Town of Hillsdale Natural Resource Inventory

FEBRUARY 2020

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Cover Photograph: One of Hillsdale's many rural views, a cornfield on Whippoorwill Road bordered by yellow coneflowers in the foreground and one of the limestone hills of the Harlem Valley in the distance. Photo © 2020 David Lewis

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NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation | Hudson River Estuary Program

Summary

The Town of Hillsdale Natural Resource Inventory (NRI) identifies, maps and describes the many natural resources found in the Town. It is intended to provide information to help guide long-term decision-making related to planning, development, and conservation that will help sustain our land and water resources for future generations.

The NRI provides maps and descriptions of the Town's biological, mineral, water, and farmland resources. It also describes features such as topography, scenic and recreation resources, and land uses in Town that contribute to the beauty and character of the Hillsdale landscape.

The first part of the NRI identifies and celebrates the diversity of natural resources in Hillsdale. The second part of the NRI describes threats that may adversely impact Hillsdale's resources along with tools that could be put to work to prevent or mitigate those impacts. The NRI also sets forth resource conservation principles that can promote sustainable uses, water conservation, maintenance of biodiversity, and mitigation of climate change effects.

To address threats such as climate change, habitat loss, degradation of water resources or the loss of farmland to development, the NRI offers conservation measures that could be adopted over time. These measures aim to protect or link large areas of broadly connected intact habitats, ensure clean, ample water supplies, reduce soil erosion, maintain the present and future viability of agriculture, and protect scenic landscapes, all of which are goals expressed in the Town's Comprehensive Plan.

There are many ways this NRI can be used to promote natural resource conservation. It can be useful in future updates to the Town's Comprehensive Plan by helping the Town develop policy recommendations for stewardship. It can aid in identifying critical natural resources and priority areas for both land use and for conservation.

The Planning Board, Zoning Board of Appeals and Conservation Advisory Council can use the NRI during site plan, special use, subdivision, or variance review processes. Those wishing to develop their property can use the NRI to gain understanding of the natural features of importance and design new land uses in ways that accommodate those resources.

Landowners, local and regional organizations, and individuals will also find the NRI useful to foster enhanced land management and stewardship. Overall, the NRI is designed to promote best use, stewardship, conservation and long-term sustainability of natural resources.

Introduction

About the Natural Resource Inventory (NRI)

This Natural Resource Inventory (NRI) identifies, describes, and illustrates important natural resources in the Town of Hillsdale. The term "natural resources" encompasses a variety of environmental features such as bedrock, soils, streams, groundwater, wetlands, habitats, plants, and animals. It also includes scenic and recreational resources that are closely tied to natural resources.

The NRI is a foundation for planning and informed decision-making in Hillsdale. The NRI is intended to help landowners, organizations, and Town officials make informed decisions about uses and conservation of land and water. It provides information, maps, and other tools to help people understand the local and regional environmental features and their connections to each other and to the community.

The NRI is a companion document to the Town of Hillsdale Comprehensive Plan and the Natural Resources Inventory for Columbia County.[1] It includes:

- Maps that show the location and extent of natural resources;
- Associated data and information about the features, character and extent of resources in Hillsdale;
- Descriptive information about the potential threats to these resources; and
- Conservation principles and recommendations.

The NRI was developed for the Town by consultants Nan Stolzenburg (Community Planning and Environmental Associates [CPEA]) and Rick Lederer-Barnes (Upstate GIS) in collaboration with the Hillsdale Conservation Advisory Council (CAC). The effort was funded by the New York State Environmental Protection Fund through a grant to the Town from the Hudson River Estuary Program of the New York State Department of Environmental Conservation (NYSDEC). Members of the CAC determined the scope of the document and worked with the consultants to develop the maps, data, and narrative.

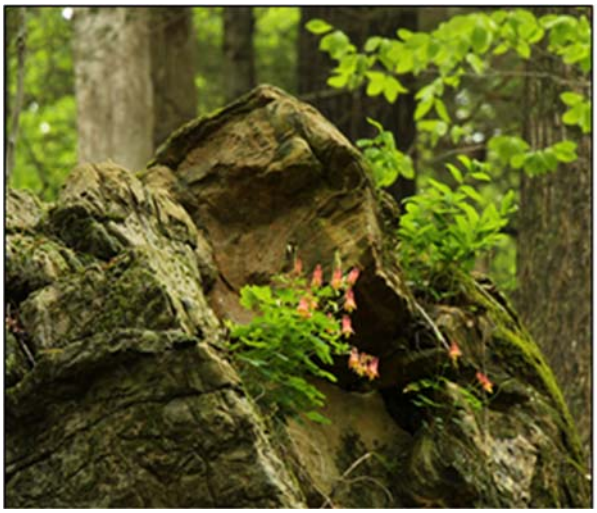
Most of the natural resource information was obtained from existing sources (published literature, map data, biologists' field notes), but some original information was gathered from interviews and field surveys conducted by the CAC especially for the NRI. Natural resource information was also obtained from the public through solicitations on the Town website, and at three events held in 2018 and 2019 - an information table at the Town flea market, and two public meetings at the Town Hall. The

[1] Stevens and Travis, 2018

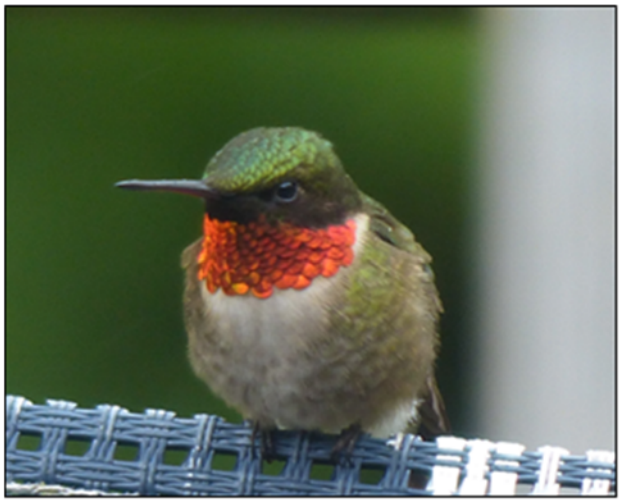
photographs throughout the NRI were contributed by CAC members and other Hillsdale residents and friends.

This NRI is designed to be used by a variety of agencies, organizations and individuals. The maps and descriptive information can be incorporated into all levels of decision-making and planning by:

- landowners who want to manage their land to protect and enhance natural resources;
- the Town Board, Planning Board, Zoning Board of Appeals, CAC, and other Town officials and committees involved in making land use policy, regulatory decisions, and conducting State Environmental Quality Reviews (SEQR);
- other municipalities for region-wide planning and intermunicipal cooperation;
- conservation organizations considering new conservation projects in the Town;
- people purchasing, selling, or developing land in Town; and



A wild columbine makes its home in the sparse soil in a crack on this limestone outcrop in the Harlem Valley. Photo © 2020 David Lewis



The ruby-throated hummingbird is the only hummingbird in the Eastern United States. It has evolved a special relationship with our only native columbine, the wild or red columbine, the range of which is almost congruent with that of the hummingbird. Photo © 2020 John Piwowarski

- the general public interested in learning more about Hillsdale.

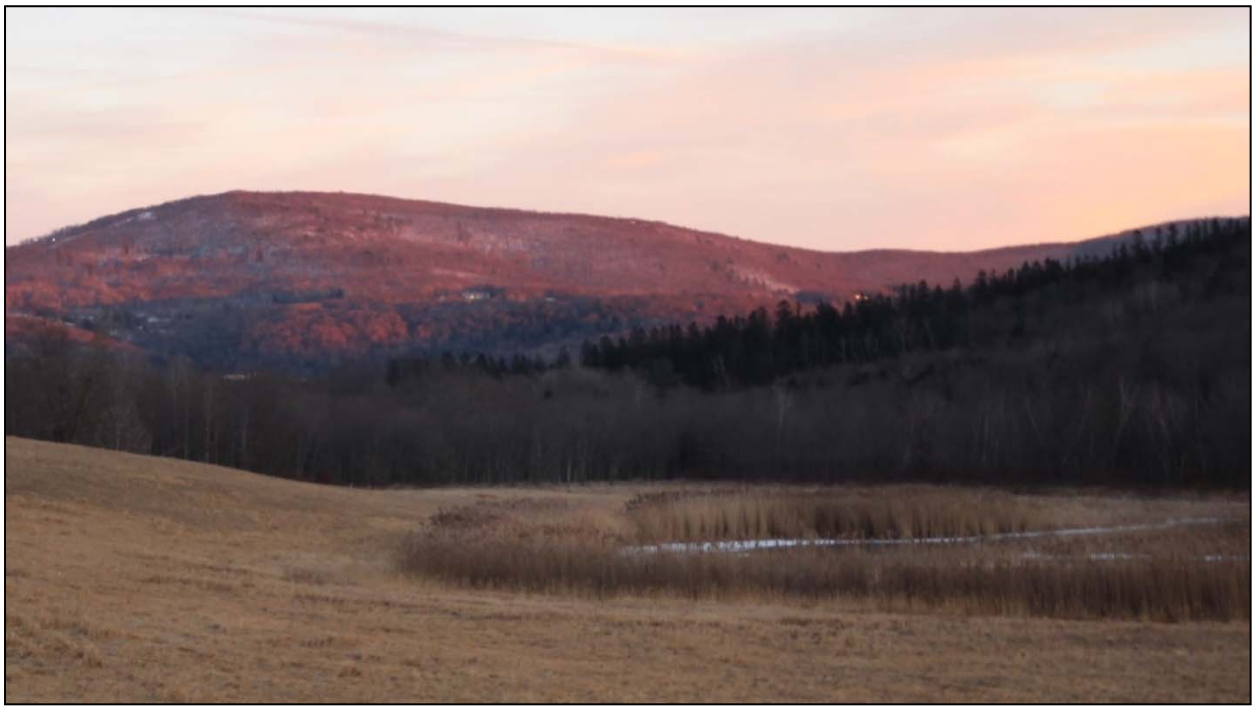
The NRI can also be used in a variety of other ways, for example, for:

- Updating the Town's Comprehensive Plan in the future and as a reference document for planning purposes;
- Updating land use regulations;
- Identifying Critical Environmental Areas;
- Helping with Planning Board reviews of proposed development projects;
- Helping the Zoning Board of Appeals with Special Use/Variance reviews; and
- Informing landowners about natural resources and conservation tools.

Physical Setting and Geology

Hillsdale is a small town located in eastern Columbia County, 15 miles east of Hudson, New York, and about 10 miles west of Great Barrington, Massachusetts. There are five hamlets within Hillsdale that are the historical population and cultural centers of the Town: Harlemville, Green River, North Hillsdale, East Hillsdale, and Hillsdale (Figure 1). The Town has a total land area of 47.9 square miles (124.0 km^2), of which 0.15 square miles , or 0.34%, is water.

Hillsdale spans three different physiographic regions, each with distinctive topographic relief, landforms, landscapes, and geology. These regions are the Southern Taconic Mountains that occupy the eastern portion of the Town; the Carbonate Belt in the Harlem Valley just west of the Taconics; and the Slate Hills west of the Harlem Valley.



The Taconics reflect a sunset glow, viewed from NYS Route 23 just west of the Hillsdale hamlet. Photo © 2020 David Lewis

Topography and Elevation

What is this? Topography is the arrangement of the hills, valleys, and other elevational surface features of the landscape. Elevation refers to the height of the land above sea level.

Why is this feature important? Topography strongly influences an area's environment, visual character, settlement patterns, land uses and recreation opportunities. For example, changes in elevation help to determine differences in microclimates and ecological functioning. Disturbances to topographic features, especially steep slope areas, can impact viewsheds, water quality of nearby streams, and wildlife use of an area.

The Taconic Ridge along the eastern edge of Town, the Harlem Valley along the Route 22 corridor, and the rolling hills and valleys westward are the major topographic features that dominate Hillsdale (Figures 1 and 2). The Taconic Mountains extend from western Vermont through Rensselaer, Columbia, and Dutchess counties (NY) and into neighboring Massachusetts and Connecticut.

Hillsdale's hills and valleys range from about 612 feet elevation above mean sea level (amsl) in the valleys to 1,673 feet elevation on White Hill along the Massachusetts border.

Other high summits include Kijk-Uit Mountain (1,530 ft), Lyon Mountain (1,398 ft), Pumpkin Hollow Hill (1,227 ft), Shepard Hill (1,627 ft), and Texas Hill (1,188 ft) (Figure 2). The lowest elevation is where the Roeliff Jansen Kill (Roe Jan) flows into Copake in the Hillsdale hamlet.

Hillsdale has four main valleys (Figure 2). In the northeast, the Green River valley cuts through the Taconic Ridge as the river flows eastward into Massachusetts and drains to the Housatonic River in Great Barrington. The Roeliff Jansen Kill flows north-to-south and creates a major valley flanking Route 22. The Roeliff Jansen Kill is a major tributary to the Hudson River. Together with its tributaries, its upper end forms the Harlem Valley which extends from North Hillsdale south through the towns of Copake, Ancram, and beyond.

To the southwest, the Taghkanic Creek and its tributaries create a third valley in the vicinity of Knapp Hollow and, in the northwest corner of Hillsdale, tributaries of the Agawamuck Creek create the fourth valley. Both the Agawamuck and Taghkanic creeks are tributaries to Claverack Creek which drains to Stockport Creek, another major Hudson River tributary. Many place names in Hillsdale relate to local topography such as Pumpkin Hollow, Shepard Hill, Shepard Hollow, and Knapp Hollow.

Key areas having the lowest elevations in Town are Knapp Hollow, Shepard Hollow, and the large wetland at the foot of Scutt Hill along Route 23.

Topography has had a major influence on land use in Hillsdale. Higher elevations had forests once exploited for charcoal, timber and pasturing animals, while valley locations were used (and continue to be used) for agriculture. Geologic conditions allowed for mining of iron and manganese and there were five mines in the vicinity of the Harlem Valley.

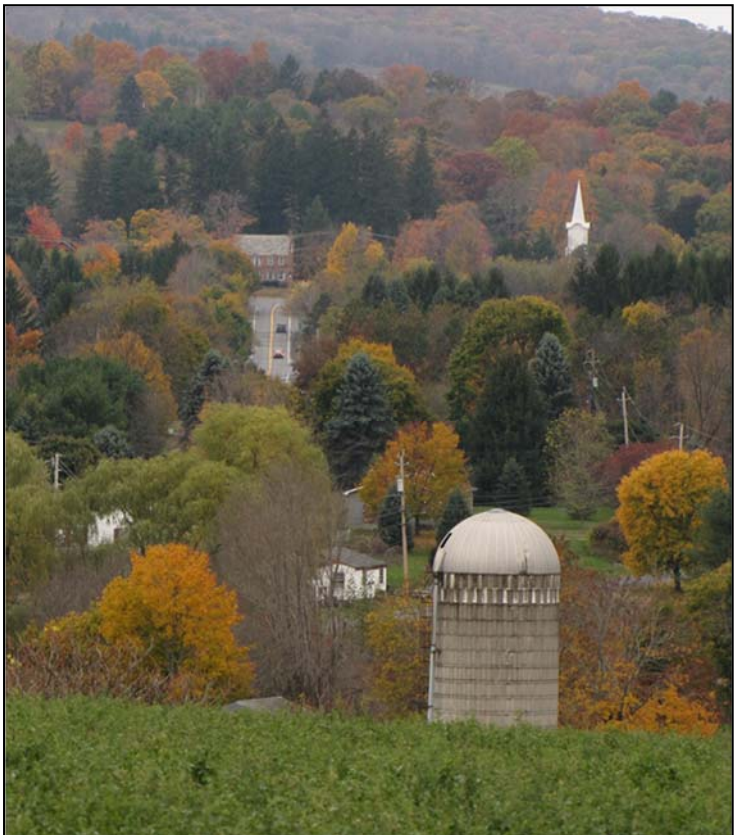
Floodplains and other areas with flat or gently sloped lands are where the best farmland occurs. Our major roads, railroad and settlements have developed in valleys and other areas of gentle terrain. Figure 3 is an aerial photograph showing the forested and open areas in Hillsdale.

Although many of the steep slopes and highest elevations in Hillsdale were cleared for charcoal-making, timber, firewood, or agriculture in the late 1700s and early 1800s, those areas were also among the first to be abandoned with the decline of sheep farming in the mid- to late 1800s.

For that reason, the re-forested hills and ridges that now dominate the Hillsdale landscape currently support some of the oldest forests in Hillsdale.

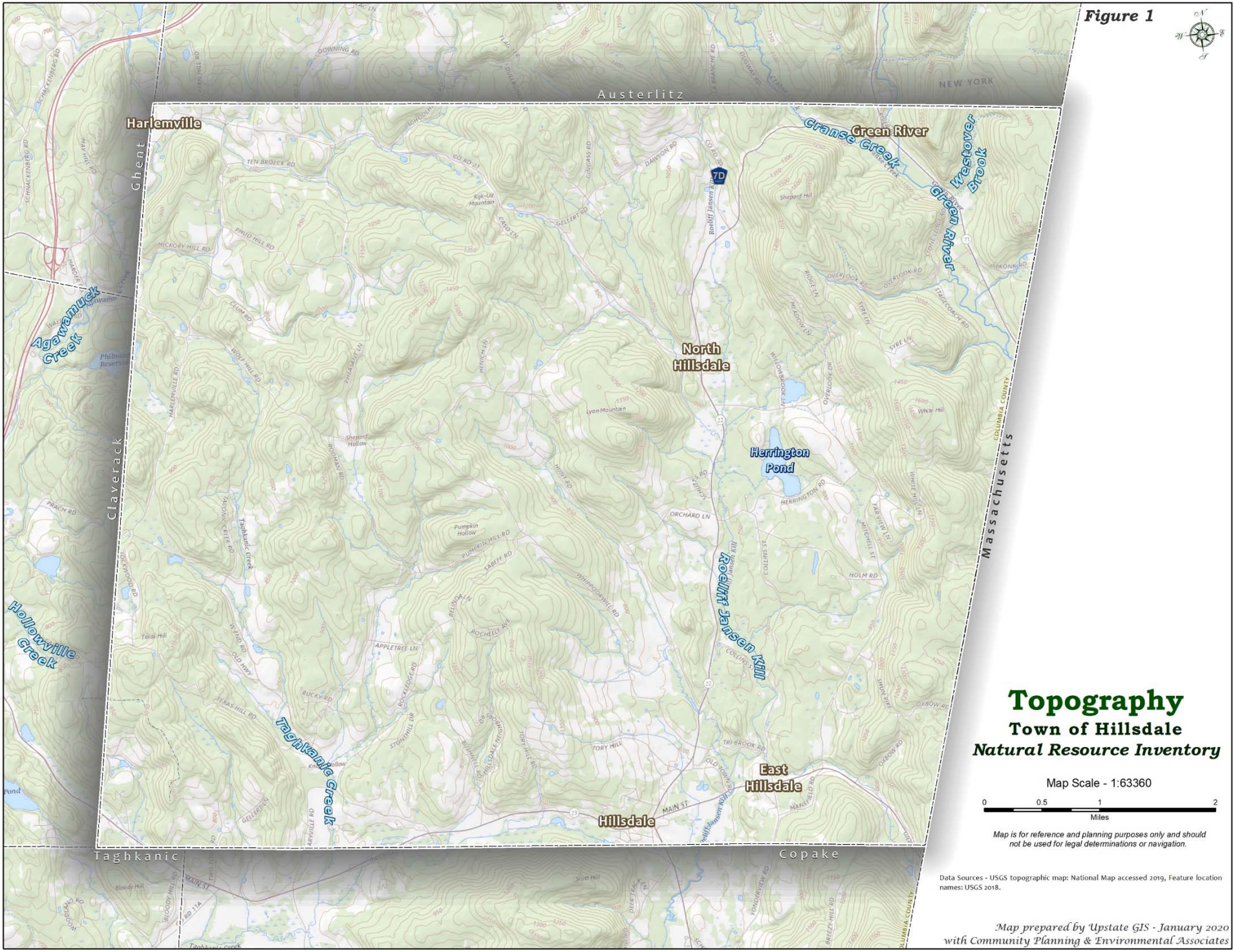
Slopes of 20% and greater occur on hills throughout the Town (Figure 4), and slopes in the Taconics can be 30% or steeper. Significant steep slope areas are located around Shepard Hill, White Hill, and Lyon Mountain.

In addition to influencing land uses, the Town's topography creates hills, ridges, valleys, slopes, floodplains, and other features that influence natural habitats. For example, wetland habitats can be in basins, on floodplains, on hillside benches, and on seepy slopes.



A fall view of the Hillsdale Crossroads with the Parla and Phoebe Foster House which dates to the late 18th century, and the steeple of the Methodist Church peeking above the trees. Photo © 2020 David Lewis

Figure 1



Topography

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

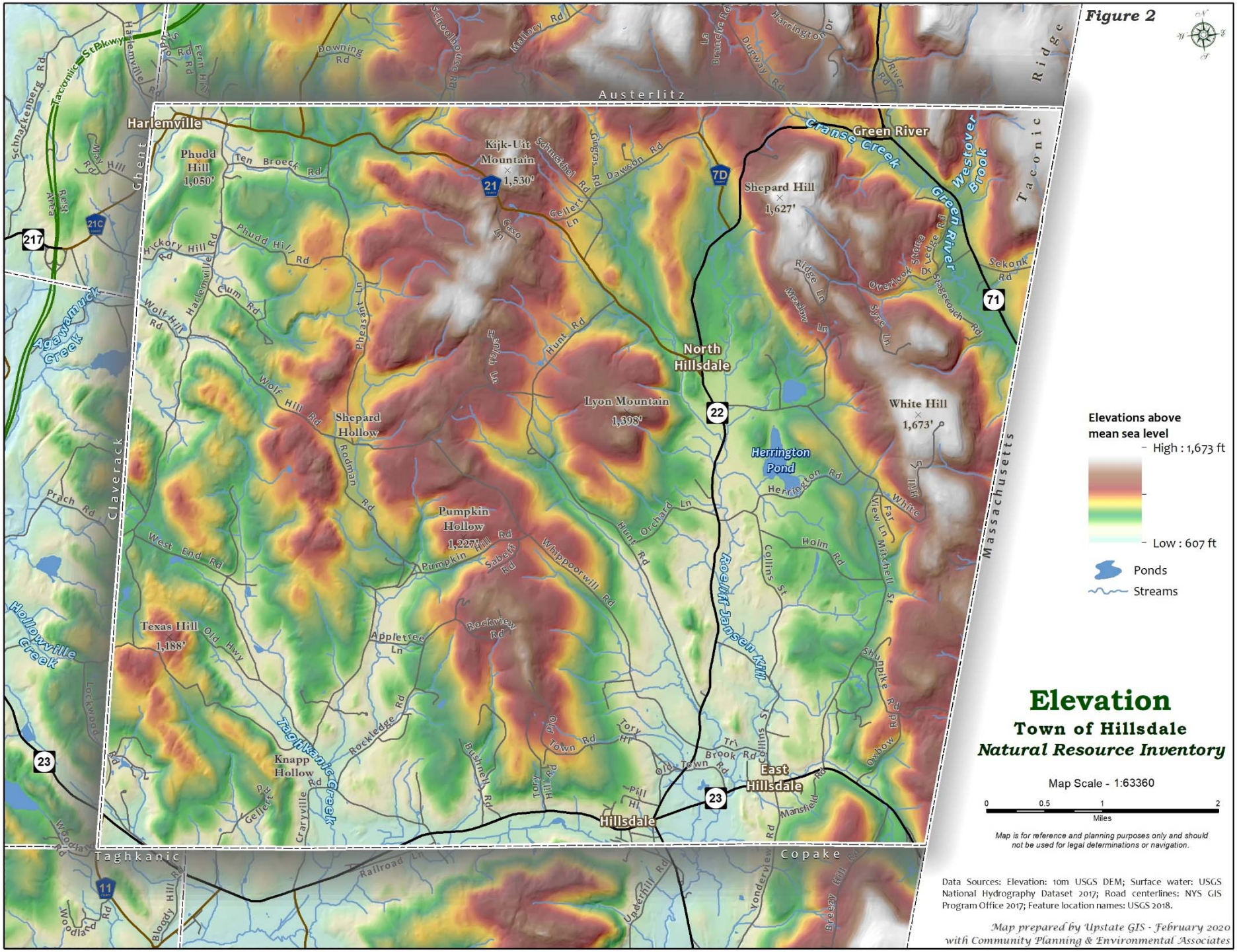
Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources - USGS topographic map: National Map accessed 2019, Feature location names: USGS 2018.

Map prepared by Upstate GIS - January 2020
with Community Planning & Environmental Associates

Figure 2



Elevations above mean sea level

High : 1,673 ft

Low : 607 ft

Ponds

Streams

Elevation

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Elevation: 10m USGS DEM; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

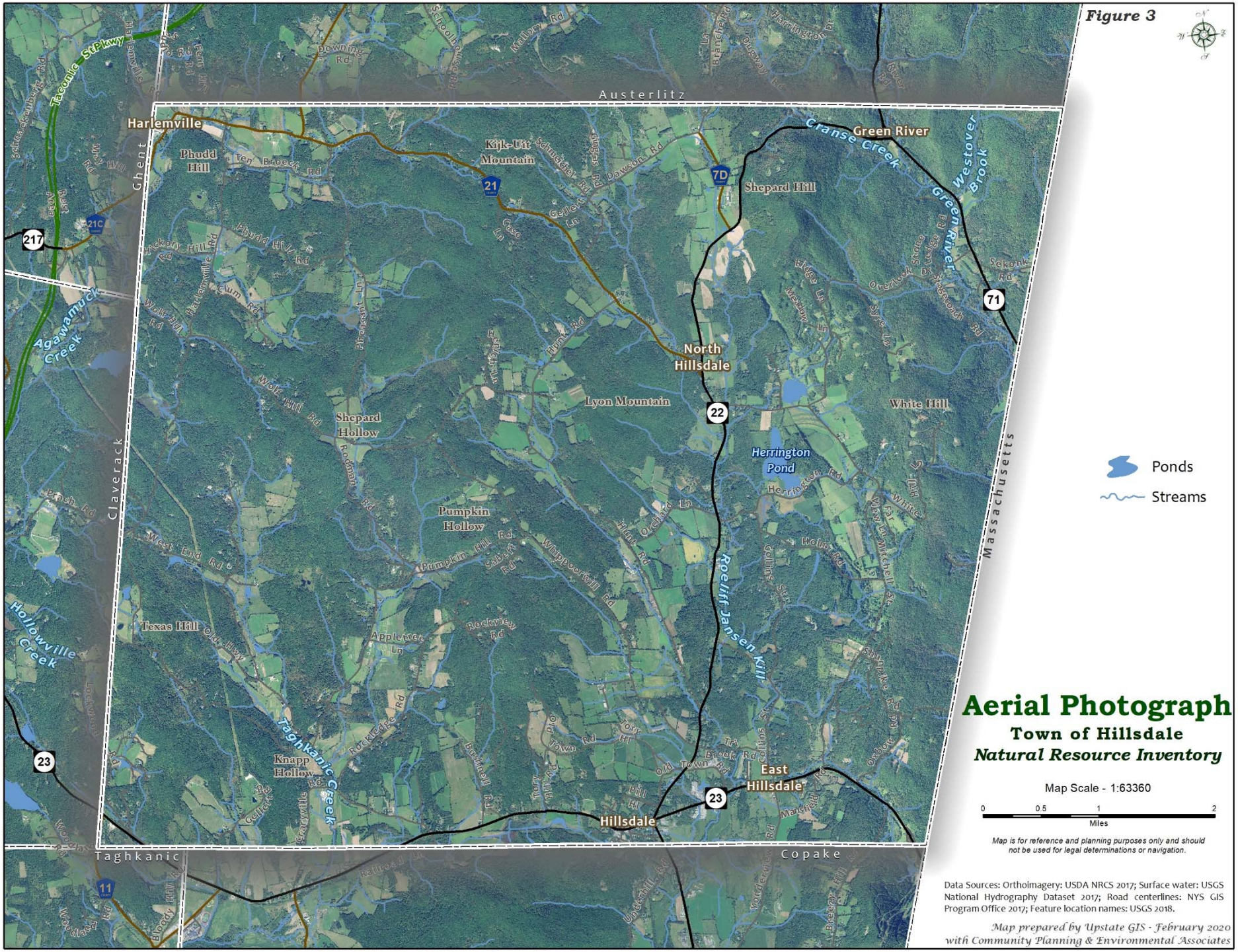


Figure 3
Austerlitz
Harlemville
Phudd Hill
Kijk-Uit Mountain
Green River
Cranse Creek
Westover Brook
Shepard Hill
Green River
Ghent
Agawamuck Creek
Claverack
North Hillsdale
Lyon Mountain
White Hill
Shepard Hollow
Herrington Pond
Massachusetts
Pumpkin Hollow
Roeliff Jansen Kill
Hollowville Creek
Texas Hill
Taghkanic Creek
Knapp Hollow
East Hillsdale
Hillsdale
Taghkanic
Copake
Ponds
Streams
Aerial Photograph
Town of Hillsdale
Natural Resource Inventory
Map Scale - 1:63360
0 0.5 1 2
Miles
Map is for reference and planning purposes only and should not be used for legal determinations or navigation.
Data Sources: Orthoimagery: USDA NRCS 2017; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.
Map prepared by Upstate GIS - February 2020
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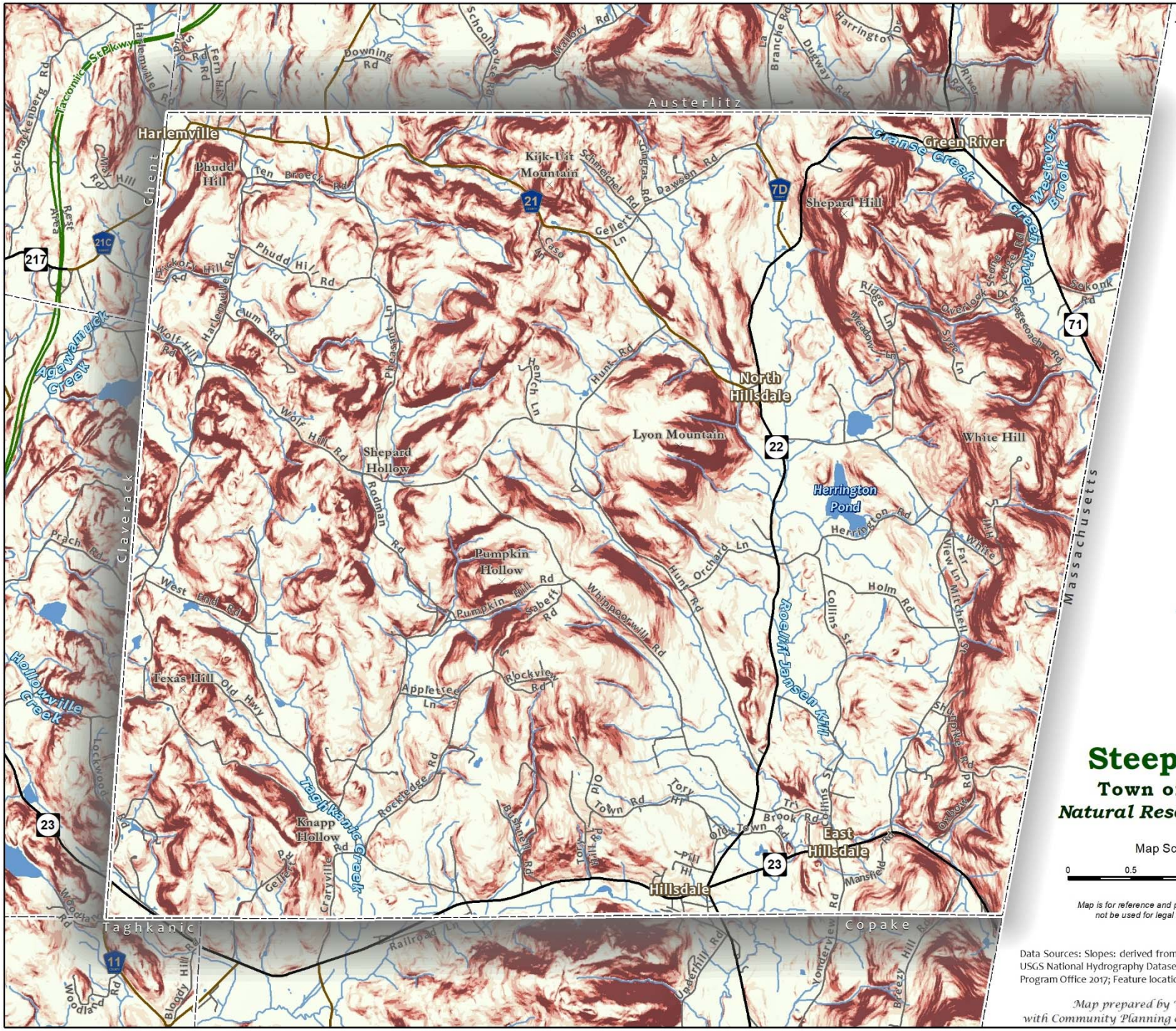
Figure 4



Steep Slopes

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Slopes: derived from 10m USGS DEM; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Geology

What is geology? Geology is the study of the Earth, the materials of which it is made, the structure of those materials, and the processes acting upon them. As used in this NRI, the term "geology" refers to the bedrock, unconsolidated mineral materials, and soils that constitute the basic physical structure of our landscapes.

Why is this feature important? Geology affects groundwater and surface water volumes and chemistry, soil conditions, habitats, and vegetation, and helps to determine how and where roads and structures can be safely built, and the accessibility and vulnerability of groundwater.

Bedrock Geology

Like topography and elevation, Hillsdale's geological character also highly influences the basic physical structure of our landscape. The Town's geology determines the nature of the rocks, the loose "unconsolidated" mineral materials, and the soils that have developed here over time. Figure 5 shows a very generalized picture of the Town's bedrock geology.

The Taconic Mountains and our Slate Hills, sometimes called the Lower Taconics, are ancient in origin, arising from great mountain-building events that occurred 450 million years ago, and then repeated about 200 million years later.

At those times, what is now Hillsdale was near the coast of ancient North America when islands or land masses offshore were thrust against the continent to create mountain ranges of alpine heights, much as the European Alps are now being created as the Italian peninsula moves into Europe.

GENERAL ROCK TYPES

Metamorphic rock Rock that has been transformed in texture and composition by heat, pressure, or chemically active solutions.

Igneous rock Rock formed from solidification of molten material deep in the Earth or from volcanic processes.

Sedimentary rock Rock formed by layered deposition of mineral and organic material.

Carbonate rock Sedimentary rock composed of carbonate minerals, chiefly calcium carbonate ($CaCo_3$) or calcium magnesium carbonate ($CaMg[Co_3]_2$).

In the course of these events, older rocks were pushed west covering younger rock formations. Subsequently those ancient mountains eroded away to become the modest mountains and hills of today.

More recent events have further molded and shaped the landscapes formed from those ancient events. During the most recent Ice Age, which ended about 10,000 years ago, the advancing and receding glaciers transported and rearranged sediments and rocks in our area, and left basins and piles of mineral debris. Since then, the movement of sediments by streams, gravity, and wind along with other geologic processes have continued to shape the land.

Over half the Town is underlain by the Walloomsac Formation, an Ordovician-age (~470-458 million years ago) metamorphic rock group composed primarily of slate, phyllite and schist.

The view from White Hill Road goes on for miles and miles in the winter. Photo © 2020 Heidi Cottini

The Taconic Mountains occupy the eastern and northeastern parts of Hillsdale. As these mountains were formed, older rocks were pushed large distances westward over both the younger Walloomsac rock formation and the Wappinger-Stockbridge carbonates. Highly metamorphosed rock called Everest Schist underlies much of the southern Taconics, including White Hill and Shepard Hill in Hillsdale. Soils are shallow in the Taconics, and bedrock is at or near the surface.[2]

West of the Taconic Mountains is the Carbonate Belt of the Harlem Valley, where the rocks of the Walloomsac Formation are largely eroded away, leaving the Wappinger-Stockbridge-Group carbonates more exposed.

Carbonate rock formations underlie the Harlem Valley and extend eastward to Mitchell Street and westward along Whippoorwill and Hunt roads to approximately 740-800 ft elevation (Figure 5). Carbonate rocks are a class of sedimentary rocks made up of carbonate minerals - in this case calcium carbonate (limestone) and calcium magnesium carbonate (dolostone).

The high pH soils that develop from the carbonate rock material support unusual plant communities and high-quality farmland soils. Steeper slopes found here tend to be on elongated bedrock hills influenced by glacial erosion.[3]

[2] Winkley, 2009

[3] Ibid.

Carbonate bedrock extends along the Roeliff Jansen Kill in the Harlem Valley in a band widening from Hillsdale through Copake into Ancram and is responsible for some of the good farmland soils and the unusual calcareous (calcium-rich) habitats of Hillsdale, such as fens and calcareous crests and ledges. These are described in the Habitats section of this NRI.

West of the Harlem Valley are the Slate Hills, underlain by argillite (derived from shale or mudstone) from the Walloomsac Formation and other metamorphic rock formations. This region is highly dissected (cut by erosion into hills and valleys), with elevations ranging from 650 feet to 1,540 feet above mean sea level. Slopes vary from nearly flat along the Taghkanic Creek valley to 20 to 45 percent on hillsides. The soils are fairly shallow, and bedrock exposures are numerous.[4]

The slate, phyllite, schist and argillite of the Taconics and the Slate Hills are of variable chemistry but are somewhat more acidic than the limestones and dolostones of the Harlem Valley. The soils that have developed from these rocks are also more acidic, and this is reflected in the ecological communities of those regions.

The Hillsdale hamlet is surrounded by fields and forest and receives regular visitors from the animal denizens of those areas, including the almost omnipresent white-tailed deer and the less common black bear. Here, a white admiral butterfly, usually an inhabitant of boreal or transition forests and forest edges, nectars on a Joe-Pye weed in a hamlet garden. Photo © 2020 David Lewis.

[4] Ibid.

ROCKS AND MINERALS

Argillite	A fine-grained compact rock derived from mudstone or shale.
Dolostone	A durable sedimentary rock composed primarily of ***dolomite*** (calcium magnesium carbonate); slightly harder than limestone, but otherwise similar in appearance, solubility, and human uses.
Limestone	A fine-grained sedimentary rock composed of calcium carbonate.
Marble	A medium-grained metamorphic rock of interlocking calcite crystals derived from limestone.
Phyllite	A fine-grained metamorphic rock intermediate in grade between slate and schist.
Schist	A medium-grained, layered metamorphic rock derived from shale.
Shale	A fine-grained thinly layered sedimentary rock derived from silt and clay.
Slate	A fine-grained metamorphic rock derived from shale.

The view from just west of the hamlet across the ponds of the Rheinstrom Hill Sanctuary to the Catskills is one of Hillsdale's most striking. Photo © 2020 Brianne Kraus

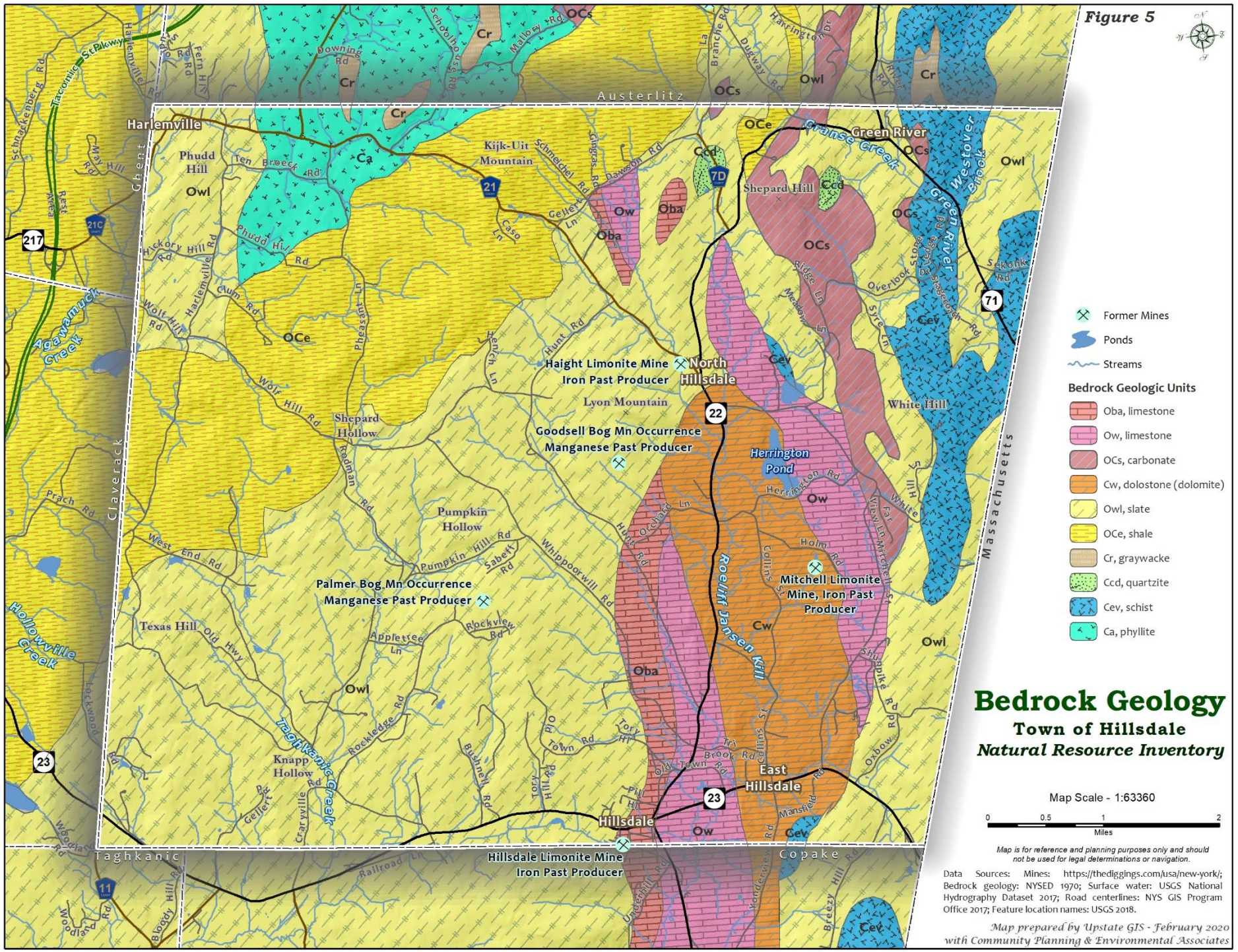


Figure 5
Austerlitz
Harlemville
Phudd Hill
Owl
Kijk-Uit Mountain
Green River
Shepard Hill
Ccd
OCs
OCe
Cev
Oba
Ow
Haight Limonite Mine
Iron Past Producer
North Hillsdale
Lyon Mountain
Goodsell Bog Mn Occurrence
Manganese Past Producer
White Hill
Herrington Pond
Shepard Hollow
Pumpkin Hollow
Palmer Bog Mn Occurrence
Manganese Past Producer
Mitchell Limonite Mine, Iron Past Producer
Cw
Texas Hill
Knapp Hollow
East Hillsdale
Hillsdale
Hillsdale Limonite Mine
Iron Past Producer
Taghkanic
Copake
Claverack
Ghent
Massachusetts
Agawamuck Creek
Hollowville Creek
Taghkanic Creek
Roeliff Jansen Kill
Gransee Creek
Green River
Westover Brook
Former Mines
Ponds
Streams
Bedrock Geologic Units
Oba, limestone
Ow, limestone
OCs, carbonate
Cw, dolostone (dolomite)
Owl, slate
OCe, shale
Cr, graywacke
Ccd, quartzite
Cev, schist
Ca, phyllite
Bedrock Geology
Town of Hillsdale
Natural Resource Inventory
Map Scale - 1:63360
0 0.5 1 2
Miles
Map is for reference and planning purposes only and should not be used for legal determinations or navigation.
Data Sources: Mines: https://thediggings.com/usa/new-york/; Bedrock geology: NYSED 1970; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.
Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Surficial Geology

Surficial geology (Figure 6) describes the loose material that has been transported and deposited on top of bedrock over time and the organic material that has developed in place. These materials have been deposited through the action of glaciers, by wind (aeolian), by moving (fluvial) or stationary water (lacustrine), or by deposits made at the base of hills by erosion and by downslope creep (colluvial). They also include the peat and muck that has developed from decaying organic material in wetlands.

While the bedrock geology of an area highly influences the physical relief of the landscape and the chemistry of water and soils, the surficial geology describes some of the visible landforms we see today as well as the sediments that lie beneath the ground surface.

The surficial geology of the Town is a natural feature that influences critical elements of the Town's environment such as the water supplies, types of habitats, and soils suitable for agriculture.

Most of the unconsolidated sediments here are remnants of the last glaciation which ended approximately 10,000 years ago. These include glacial till (unsorted material of all sizes), and glacial outwash and kame deposits (sand and gravel) left by meltwater of the receding glacier, and alluvial deposits left along streams.

The surface geology in Hillsdale is dominated by glacial till and by bedrock close to the surface (which, in fact, is mostly covered by till) (Figure 6).[5] Bedrock outcrops are most common on hillsides and summits at the higher elevations. A few locations also have kame, outwash sand and gravel, and recent alluvial deposits.

Glacial till is a relatively dense and poorly sorted mixture of boulders, gravel, sand, silt and clay. It was the principal material left by the glacial ice sheet.

A small stream tumbles down from the Taconic Ridge to Mitchell Street. Photo © 2020 Bob Kessler

[5] Caldwell et al., 1989

Glacial outwash is generally well-sorted, coarse material deposited by the glacier on flat plains or deltas. The largest accumulation of outwash is in the Roeliff Jansen Kill valley. Small areas of outwash sand and gravel are also found along the Taghkanic Creek near Craryville and along the Agawamuck near Harlemville. These deposits have a variable topography with numerous small hills and depressions. [6]

Outwash deposits hold the unconsolidated aquifers that are among the important sources of groundwater for human uses (described below in the Water Resources section). The surficial geology depicted in Figure 6 is from very coarse data, and additional occurrences of outwash elsewhere in Hillsdale are likely.

Alluvial deposits consist of stratified (i.e., sorted) post-glacial silt, sand, and boulders that are left by flowing streams. Soils formed in alluvium are usually very fertile and are often classified as prime agricultural soils (see Figure 18). Significant alluvial deposits in Hillsdale are found only in the northeastern part of Town along the Green River.

Kame deposits are irregularly shaped hills or mounds composed primarily of sand and gravel left by the receding glacier. There are ten mapped kame deposits in Hillsdale - the largest located in and around the Hillsdale and East Hillsdale hamlets, running south into Copake, and along the Green River and Cranse Creek in the northeast corner of Town. Kame and outwash deposits are the sources for sand and gravel that is widely used in construction industries.

In summary, glacial till deposits (unsorted mineral materials) cover the bedrock throughout most of the Hillsdale landscape and represent the parent material for most of our soils. The major glacial outwash (sand and gravel) deposits occur along the Roe Jan, the Agawamuck, and the Taghkanic Creek, and are associated with unconsolidated aquifers, important water sources for human uses. Kames are scattered throughout the Town, and with outwash gravels are sources of sand and gravel that have long been mined for a variety of construction uses. The only alluvial deposits mapped in Hillsdale are along the Green River, but smaller areas of alluvium are likely along other streams.

SURFICIAL DEPOSITS *(Loose material over bedrock.)*

Glacial till Mixtures of unsorted mineral materials of various textures (fine to cobble-size), deposited by melting glacial ice.

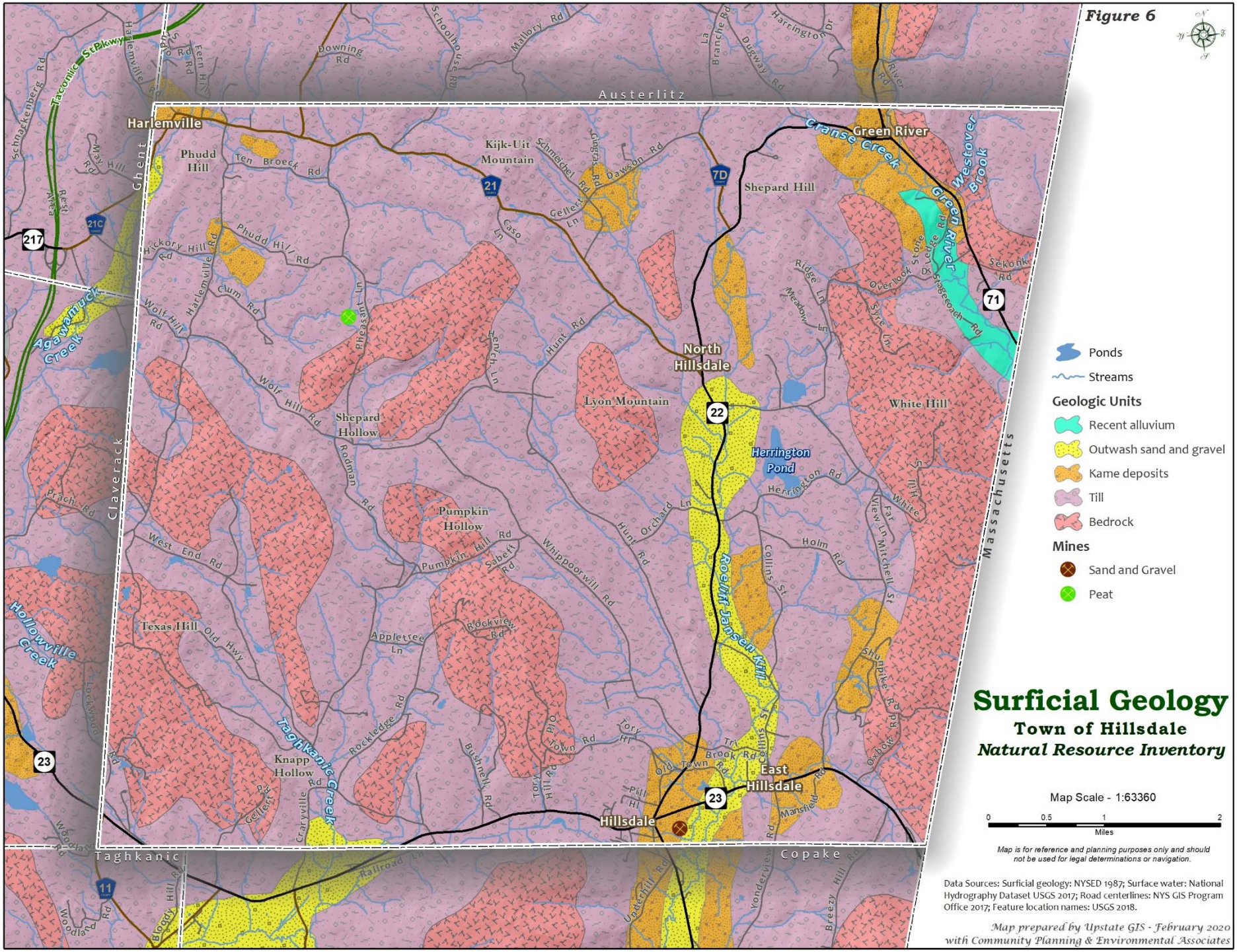
Glacial outwash Coarse mineral materials (sands and gravels) deposited by glacial meltwater streams.

Glacial lacustrine deposits Fine silts, clays, and sands that settled in glacial lakes and ponds.

Alluvium Clay, silt, sand, or gravel, sorted by texture and weight, and deposited by running water in the glacial or post-glacial period to the present.

[6] Ibid.

Figure 6



Surficial Geology

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Surficial geology: NYSED 1987; Surface water: National Hydrography Dataset USGS 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Soils

What are soils? Soils are organic or unconsolidated mineral materials that have been acted on by weathering and organic processes. Soil types are distinguished and classified according to depth, texture, color, chemistry, and wetness or dryness. Soil characteristics are much influenced by the "parent" materials of origin—that is, the bedrock, surficial deposits, or organic material from which they are formed—and by topography, climate, hydrology, vegetation, and time.

Why is this feature important? Soils are at the foundation of most ecosystems and of agriculture. Soils regulate water flow, influence the type and health of vegetation and habitats, dictate agricultural potential, affect forest growth, impact water quality, and support human structures such as buildings, septic systems and roads. Soil chemistry, texture, and drainage determine where certain habitats occur, and what kinds of plants and animals they will support.

Soil types differ from each other depending on their parent material (the mineral or organic material that they formed in), depth above bedrock, texture, and chemistry, and their wetness or dryness. All these characteristics help to determine the kinds of biological communities that become established and the kinds of agricultural crops that will thrive.

The different physiographic areas in Town have unique soil types. For example, most of the soils in Hillsdale's Taconic Ridge and Slate Hills are somewhat acidic silt loams that formed in glacial till.

Coarse-textured soils formed in glacial outwash and kame deposits. These are found mainly in the Harlem Valley and Green River corridors, but also occur in small areas in and near Harlemville and along Dawson Road.

Fine-textured alluvial silt loams are found along the floodplains of the Roe Jan and many of the other streams throughout the Town. These soils support the forests, shrublands, meadows, and marshes of those occasionally flooded areas.

Wetland soils have developed in mineral materials of all kinds, but some of the very old wetlands have organic soils composed of deep layers of peat. The calcareous (calcium-rich) soils of a fen support the unusual community of fen plants such as grass-of-Parnassus, shrubby cinquefoil, spike muhly, and bog goldenrod.

The shallow, droughty mineral soils of rocky outcrops support plants such as hairgrass, low blueberries, and hair-cap moss.

Soil type and agricultural productivity are closely linked. Soils formed in glacial till and alluvium constitute most of Hillsdale's best agricultural soils. See the Farmland Resources section below for further discussion of Prime Farmland Soils and Soils of Statewide Importance.[7]

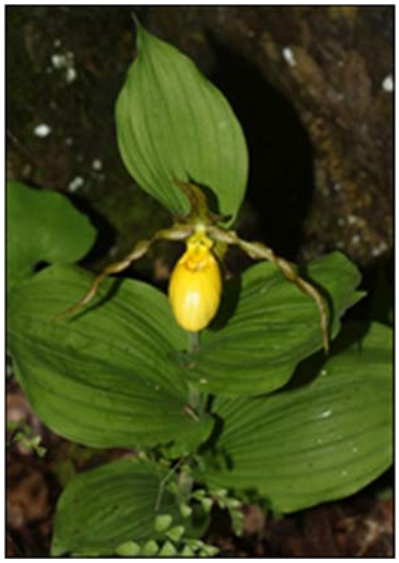
[7] NRCS, 2018

Soils and Drainage

Soil types are described in part according to their "drainage" characteristics. To a soil scientist, the term "drainage" refers simply to the wetness or dryness of the soil. It does not refer to "percolation" or how swiftly water moves through the soil. Soils range from "excessively drained" (the driest) to "well-drained" (medium moisture) to "poorly drained" and "very poorly drained" (the wettest).

Soil characteristics can be used to predict the occurrence of wetlands, rocky habitats, or pH-dependent habitat types.

Figure 7 shows that many drainage classes of soils can be found in Hillsdale, but most soils are well to moderately well-drained. The ridges and slopes are dominated by well drained or moderately well-drained soils. The somewhat excessively drained soils of the Taconic Ridge and the Slate Hills occur where bedrock is near the ground surface. Poorly and very poorly drained soils are wetland soils (called hydric soils), and occur at all elevations, even high in the Taconics, but are most extensive in the valleys along creeks and other low depressions.



This beautiful orchid, the yellow lady's slipper, is known from only one or two places in Hillsdale, both in the Harlem Valley. It favors calcareous soils in this region, but its cousin the pink lady's slipper or moccasin flower can be found nearby on acidic soils in the Taconic ridge. Photo: Conrad Vispo

Soils that are described as poorly or very poorly drained are likely to indicate wetlands. Figure 13 shows wetlands mapped by New York State and the U.S. Fish and Wildlife Service, as well as additional areas of "probable wetlands" where the mapped soils are classified as very poorly drained or poorly drained, and "possible wetlands" where soils are classified as somewhat poorly drained.

Soil wetness, drainage, slope and other physical features highly influence both natural resources and the built environment. For example, soils on slopes greater than 15% are erodible if not well-vegetated and are severely limited in their ability to absorb septic system leachate.

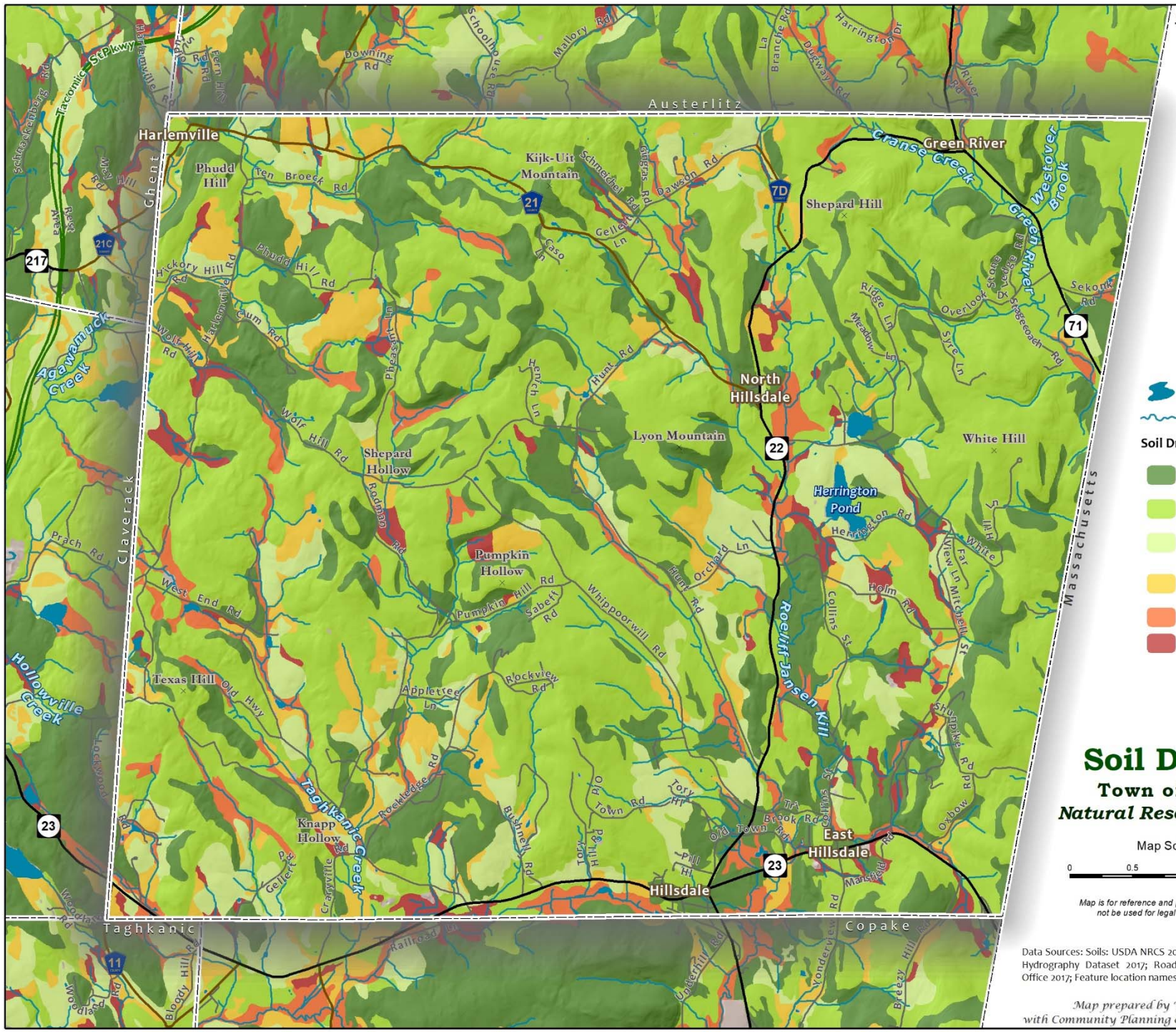
Soils have been mapped throughout the county,[8] and maps and descriptions of soils in any part of Hillsdale can be viewed on interactive maps available on the Web Soil Survey webpage of the Natural Resources Conservation Service of the U.S. Department of Agriculture.[9]

In the Biological and Farmland sections we discuss some of the soil characteristics associated with specific habitats and the soils that are most suitable for agriculture. For more information on soils, see the Mineral Resources section.

[8] Case, 1989.

[9] NRCS Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm)

Figure 7



Soil Drainage

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Soils: USDA NRCS 2017; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Air Resources

The air quality index (AQI) is a number used to characterize the quality of the air at a given location based on the levels of six pollutants: carbon monoxide, lead, nitrogen oxides, ozone, particulate matter, lead in particulates, and sulfur dioxide. A higher AQI means poorer air quality. AQI values are divided into ranges, and each range is assigned a descriptor and a color code by the U.S. Environmental Protection Agency. Standardized public health advisories are associated with each AQI range.

Any AQI below 50 is considered "good." By comparison, an index value between 101-150 is considered unhealthy for sensitive individuals and an index value greater than 200 is considered very unhealthy.

In general, air quality in Columbia County is good, and about on par with other upstate New York communities. According to the air quality data collected by the USEPA in Hudson, NY,[10] the air quality index has decreased from 44 in 1999 to about 36 in the region in 2018. Air quality has remained good or increased in quality over the years.[11]

A dairy farm in North Hillsdale commands a view of the length of the Taconic Ridge running south into Copake. Photo© 2020 David Lewis

[10] USEPA, 2020

[11] Ibid.

Water Resources

Watersheds

What is a watershed? A watershed is the entire land area that drains to a particular place such as a stream, wetland, or pond. Watersheds are divided from each other by ridges and other high points on the land surface. Every location is part of a watershed because all lands drain into one water body or another. Watersheds are further divided into sub-watersheds (or sub-basins). Each tributary of a major creek or river has its own sub-watershed. Like the streams and other waterbodies they feed, watersheds can be regional and span multiple towns, counties or states.

Why is this feature important? Understanding the extent and boundaries of watersheds and sub-basins helps us understand the sources of water for our streams, wetlands, and ponds, the direction of water movement over the land, the volumes of water reaching any location along a stream, and the fate of rainwater and snowmelt runoff from any location.

Most of Hillsdale is in the Hudson River watershed. The Hillsdale portion of that watershed is further divided into three sub-basins : the Agawamuck Creek, the Roeliff Jansen Kill, and the Taghkanic Creek (Figure 8).

The Agawamuck Creek drains the northwest corner and very western side of the Town of Hillsdale, north and west of Shepard Hollow, and south to Texas Hill. The Agawamuck rises in Austerlitz, flows briefly into Ghent, then through

Small, nameless woodland streams like this one, near Wolf Hill Road, form a crucial part of a watershed. In total length, they amount to as much as 80% of the channel length of water courses in the watershed, and they exert a critical influence on the larger downstream streams and rivers by affecting the flow of sediments and nutrients and providing habitat and migration corridors for diverse organisms. Photo © 2020 Marcy Feld

the Harlemville hamlet (in Hillsdale), and then into Claverack where it ultimately joins the Claverack Creek. The Claverack Creek is an approximately 17-mile long tributary to Stockport Creek – a major tributary to the Hudson River.

The Roeliff Jansen Kill--another major tributary to the Hudson River--drains a large part of Hillsdale. The Roeliff Jansen Kill rises just north of Hillsdale in the Town of Austerlitz. Also known as the Roe Jan, the stream flows for approximately 56 miles through Columbia and Dutchess counties before entering the Hudson River in Livingston. Most of the 212 square miles of the Roe Jan watershed lies in Columbia County.

The Taghkanic is an approximately 30-mile-long tributary to the Claverack Creek. It drains the southwest portion of Hillsdale, including Pumpkin Hollow, Shepard Hollow, and the southern area west to Texas Hill and east to the Hillsdale hamlet.

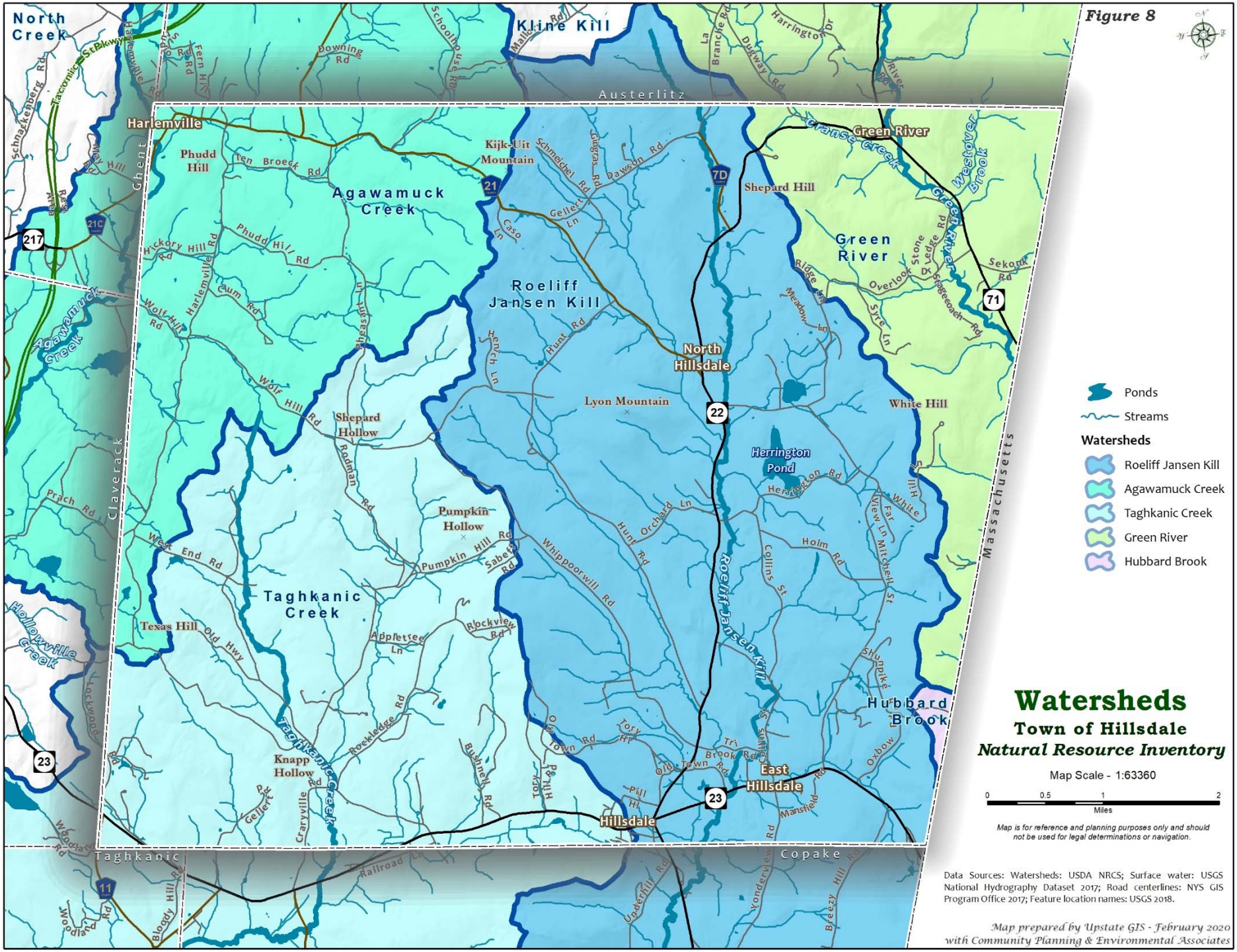
At New Forge, several miles downstream from Hillsdale, water is drawn from the Taghkanic to feed the Churchtown Reservoir, the main drinking water source for the City of Hudson. It ultimately joins Claverack Creek which flows into Stockport Creek before entering the Hudson River.

A significant area along the northeastern and eastern edges of Hillsdale is within the Green River and Hubbard Brook sub-watersheds in the Housatonic River basin. The Housatonic River is in western Massachusetts and Connecticut, and eventually empties into Long Island Sound.

Major tributaries to the Green River in Hillsdale are Westover Brook and Cranse Creek. The watershed includes the eastern slopes of Shepard Hill and White Hill, both at the border of the Roeliff Jansen Kill watershed.

A dark red skunk cabbage flower emerges from the waters of a swamp still covered by a thin layer of ice. The skunk cabbage flower is suited to this early emergence by the ability to produce heat that helps melt its way through a layer of snow or ice. The red color and fetid smell, resembling that of spoiled meat, attract flies and carrion beetles to pollinate the plant in the early season before other pollinators are active. Photo © 2020 David Lewis

Figure 8



Watersheds

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Watersheds: USDA NRCS; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Surface Water

What is surface water? Surface water includes streams, lakes, ponds, and wetlands.

Why is this feature important? Surface water resources are among the most recognizable and important natural resources in an area and play critical roles in our environment: for example, providing clean water for recreation, irrigation, and sometimes drinking; serving as habitat and wildlife travel corridors; and managing flood waters.

The major surface water bodies in Hillsdale are streams: the Green River, the Roeliff Jansen Kill (the "Roe Jan"), the Taghkanic Creek, and the Agawamuck Creek (see Figure 9). Most parts of the Town drain to one of those streams, either directly, or via the network of hundreds of smaller streams that drain the landscape. (The only exception is the few acres along Oxbow Road that are in the Hubbard Brook drainage system.)

Figure 9 shows most of the perennial streams (i.e., those with year-round flow) in Hillsdale and some of the smaller streams that run only intermittently, but many of the intermittent streams are unmapped. Users of this NRI should be alert to the presence of small streams that do not appear in the map figures in this document or in other publicly available maps.

A beaver makes its home at the pond's edge across Route 23 from Long Hill Farm. Photo © 2020 David Lewis

Intermittent streams provide valuable instream habitat and are used by many kinds of terrestrial wildlife. They also supply essential water, organisms, and organic materials to larger streams, lakes, and ponds. The presence of these smaller streams can sometimes be predicted from contour lines on a topographic map, or identified on an aerial photograph, but often they are found only from on-the-ground observations.

The major lakes in Hillsdale are Toppel Pond at the corner of Mitchell Street and Willowbrook Lane, and Herrington Pond on Herrington Road; both are privately-owned. Throughout the Town there are also many small backyard ponds created for ornament, recreation, or fire control, and farm ponds created for fire control or watering livestock. Here and there, other ponds have been created through impoundment by roads or created or enlarged by beaver dams, such as those on Rodman Road, Pheasant Lane, Mitchell Street, and at the base of Scutt Hill.

Stream Classification

In New York State, streams are classified based on "existing or expected best usage of each water or waterway segment" (see Figure 9 and explanation in sidebar below). The stream classifications range from "AA" (drinking, bathing, fishing, and fish propagation and survival) to "D" (fishing, but

waters will not support fish propagation). Each classification may be modified by a T or TS to indicate suitability for supporting trout or trout spawning. These classifications are based on limited information, and do not necessarily reflect up-to-date or site-specific habitat conditions.

Waters classified as AA, A, B, C(T) or C(TS) are considered "protected streams" in New York and are subject to certain use restrictions: disturbances to the bed or banks of these streams require a State permit.

Hillsdale has one Class A stream, but most streams are classified as Class C, suitable for fisheries and secondary contact recreation, such as canoeing and kayaking (Figure 9). Many of Hillsdale's streams have not been assessed and classified.

The only NYSDEC Class A stream in Hillsdale is a small segment of stream emanating from a wetland near the western edge of Town in the Agawamuck watershed, flowing into the Town of Claverack.

The Class C streams that are further designated as C(T) are deemed to have the good water quality and cool water temperatures suitable for trout habitat. C(TS) streams are those suitable for trout spawning. In addition to good water quality, cool temperatures, and high dissolved oxygen levels, these streams also have relatively unsilted stream bottoms suitable for trout spawning. Many of Hillsdale's streams that have been classified have a T or TS classification.

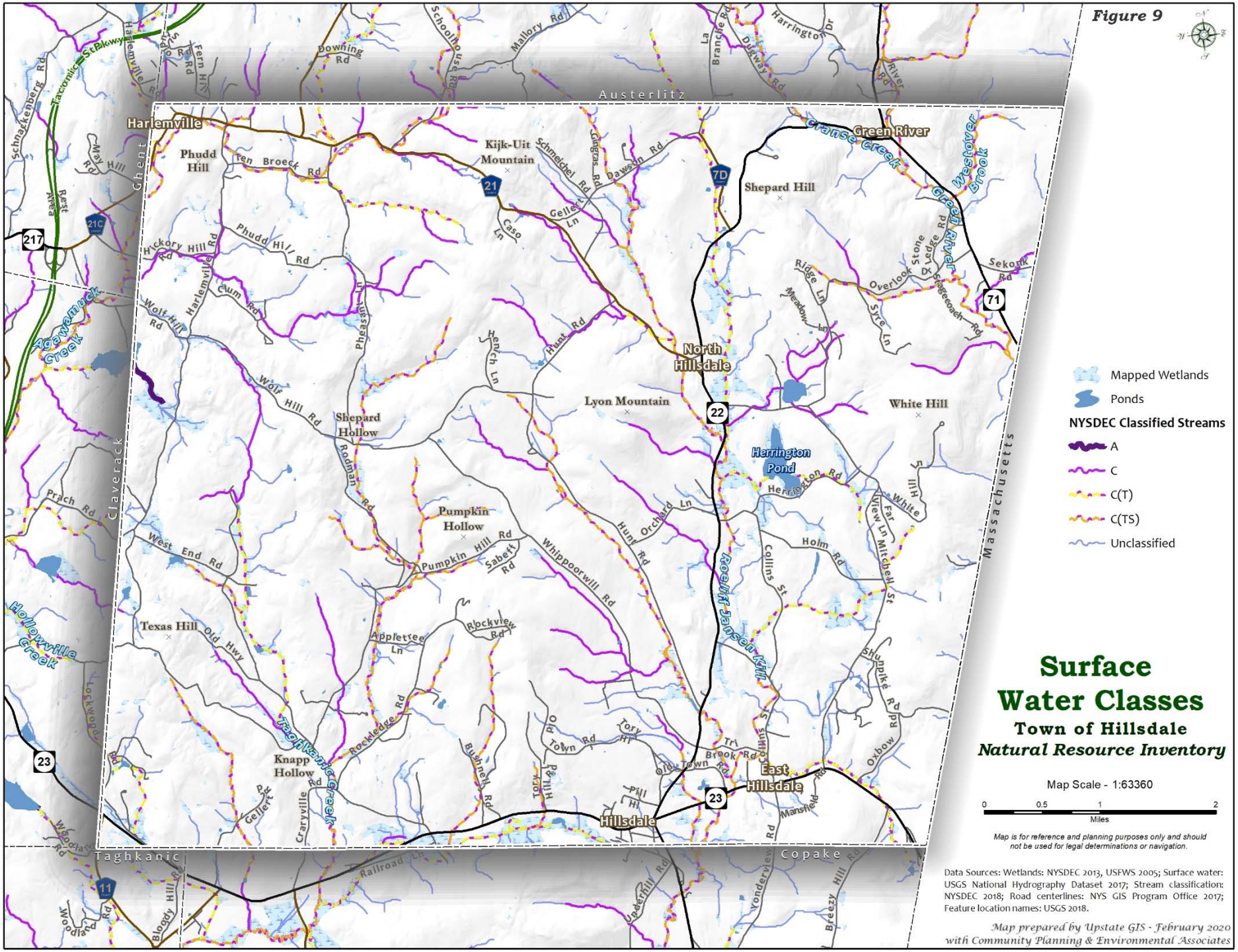
NYSDEC Waterbody Classes

Class	Best Use
AA	drinking (with disinfection), bathing, fishing
A	drinking (with disinfection and treatment), bathing, fishing
B	bathing, fishing
C	fishing (reproduction and survival)
D	fishing (survival)

Modifiers

T	sufficient dissolved oxygen to support trout
TS	suitable for trout spawning

Figure 9



Surface Water Classes

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Wetlands: NYSDEC 2013, USFWS 2005; Surface water: USGS National Hydrography Dataset 2017; Stream classification: NYSDEC 2018; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Floodplains

"Floodplains" are the entire areas along streams or other waterbodies that flood at any time. When functioning well and with natural vegetation intact, floodplains feed the stream ecosystem, help prevent erosion, recharge groundwater, slow water flow, and reduce downstream flooding. They also tend to be very productive areas, are ecologically diverse and, along with other stream-side (riparian areas), serve as important wildlife habitat and travel corridors.

"Flood zones" are the floodplain areas that flood at specific statistical intervals. A 100-year flood zone, for example, is deemed to have a 1% chance of flooding in any given year. For a homeowner with a 30-year mortgage, a house in a 100-year floodplain has a 26% chance of flooding during that mortgage period. The flood zones of most of Hillsdale's streams have not been delineated, but Figure 10 shows the 100-year flood zones mapped by the Federal Emergency Management Agency along the Green River, the Roe Jan, and the Taghkanic Creek. These flood zones are quite narrow in most places in Hillsdale, but broaden out at a few locations along the Green River and the Roe Jan.

The Shepard Hollow swamp on Rodman Road is one of Hillsdale's largest wetlands. Photo © 2020 David Lewis

FEMA has not mapped the 500-year flood zones in Hillsdale, and they do not map the flood zones of the smaller streams, even though those zones can be substantial at some locations.

Furthermore, the FEMA flood zone maps are based on historical data which includes neither the flood zones of recent large storm events—Irene, Lee, and Sandy in 2011 and 2012—nor the even larger events predicted for the coming decades. FEMA has been updating their flood zone mapping throughout New York, but Columbia County has not been included thus far, so the flood zones may not fully or accurately reflect current or future conditions.

Riparian Buffers

The New York Natural Heritage Program has delineated "riparian buffers" along many of the larger streams throughout the state, including many streams not included in the FEMA flood zone mapping. These areas encompass the estimated 50-year flood zone (based on U.S. Geological Survey stream gage data and topography) and adjacent wetlands and are considered to be the areas most important for protecting, improving, and maintaining the integrity of streams (Figure 10).[12]

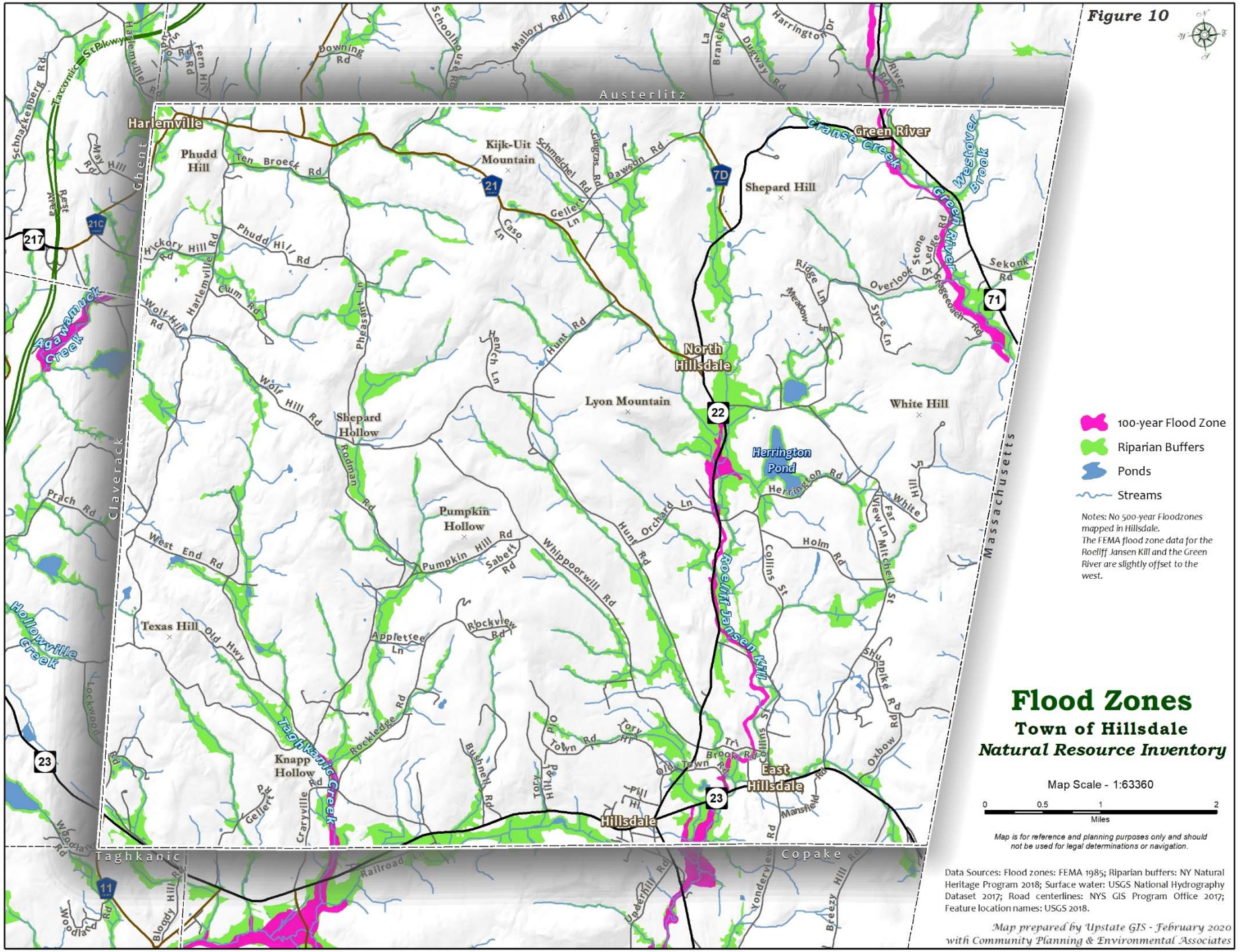
The mapped buffer zones overlap partially with the FEMA 100-yr flood zones and extend beyond the FEMA zones at some locations (e.g., to include adjacent wetlands).

Riparian areas are critically important to stream ecosystems and serve roles as habitats, flood mitigation areas, and locations that filter and clean water. They help to maintain water temperatures and contribute biological materials necessary for stream organisms. The well-being of the streams depends in large part on the condition of the riparian zones.

Some riparian buffers are quite narrow, while others are ¼- to ½-mile wide or wider, such as along the Roeliff Jansen Kill in North Hillsdale and east of the Hillsdale hamlet, and along the Taghkanic Creek tributary that runs through the Rheinstrom Hill wetland west of the hamlet.

[12] Conley et al., 2018

Figure 10



Notes: No 500-year Floodzones mapped in Hillsdale.
The FEMA flood zone data for the Roeliff Jansen Kill and the Green River are slightly offset to the west.

Flood Zones

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Flood zones: FEMA 1985; Riparian buffers: NY Natural Heritage Program 2018; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

This brook trout fingerling is cruising the stony bottom in the clear waters of the Agawamuck Creek. The prevalence of this type of clear, cold stream in Hillsdale makes many of them prime areas for trout spawning. Photo © 2020 John Piwowarski

Water Quality and Habitat Quality of Streams

Many human activities influence the health and functioning of our surface waters, including placement of stream barriers (dams and culverts), soil disturbance and clearing of vegetation, removal of natural streamside vegetation, disturbance of streambanks and pond edges, land uses such as development on steep slopes, and applications of fertilizers and pesticides to lawns and farm fields.

Water quality is also influenced by climate change. Climate change is predicted to increase the intensity and frequency of precipitation events in the future, which is likely to lead to further threats to water quality through increased flooding and increased potential for erosion/sedimentation. Climate change is also anticipated to bring reduced winter snowpack and more frequent summer droughts, both of which may affect the base flows of streams during dry periods. (See also section on Climate Change.)

Stream water quality and habitat quality are determined not only by the presence or absence of pollutants, but also by water volumes, stream bottom substrates, water depth, and other stream characteristics.

Many of our fishes need different parts of a stream for feeding, spawning, nursery areas, drought refuge, shelter from predators, and overwintering. Sometimes they need to make longer journeys for population dispersal and genetic exchange. Access to cool pools in summer, deep pools in winter, suitable substrates for spawning, shallow nursery areas inaccessible to predators, and invertebrate drift from upstream reaches for food sources can be essential to maintaining fish populations.

Similarly, invertebrates, amphibians, reptiles, and other animals also need to move freely to take advantage of various stream habitats and materials in different seasons, life history stages, and stream conditions. Instream barriers such as dams and perched culverts prevent these essential

migrations and reduce the accessibility of stream habitats.

Priority Water Bodies in New York State

NYSDEC has established water quality standards for pollutants and other factors such as dissolved oxygen and turbidity to protect specific uses, such as drinking water supply, swimming, aquatic life, or secondary recreation. Waterbodies that do not meet the standards for their "best uses" may be listed as "impaired" by NYSDEC. NYSDEC conducts a waterbody inventory program and monitors water quality and trends throughout the state. Streams are assessed for invertebrates, water and sediment chemistry, and sediment toxicity to identify the impaired streams, lakes, and ponds most in need of improvement.

Elevated nutrient levels in streams can lead to excessive growth of algae and vascular plants whose decay can deplete dissolved oxygen which is critical to fish and other aquatic life. The decay can also cause foul odors and interfere with recreational uses.

The Roeliff Jansen Kill has been found to be "slightly impacted" north of the Hillsdale hamlet due to nutrient-laden runoff from farm fields but improves downstream from that location.

The quality of the Roe Jan improves farther south, and no other water bodies inventoried so far in Hillsdale are considered by NYSDEC to be "impacted." Streams in the Taghkanic Creek watershed in Hillsdale have not been assessed in the program.

Local and Regional Stream Water Quality Efforts

Hillsdale's surface waters have been subject to several other kinds of monitoring and assessments by state and county agencies, and by volunteers.

In 2017 a team of volunteers working with the Housatonic Valley Association conducted visual surveys along the full length of the Green River to document the condition of the stream and adjacent landscape. In the Hillsdale segments they found that the stream ran swiftly and clear over sand, gravel, and cobble substrates, but was infested with "rock snot" algae. Although much of the corridor was forested, there were also adjacent residences and farm fields, some of which had little or no vegetated riparian buffer at the stream edge. Patches of the non-native Japanese knotweed were here and there, and a few instances of severe streambank erosion were noted.[13]

In a program initiated by Riverkeeper in 2016 and conducted by the Roe Jan Watershed Community (RJWC) in partnership with the Bard College Water Lab, volunteers have been collecting monthly water samples, May – October, along the length of the Roe Jan. The Water Lab has analyzed the samples for *Enterococcus* bacteria, an EPA-approved indicator of fecal contamination. As of 2019, RJWC members sample at 15 points in the Roeliff Jansen Kill, its tributaries and the Hudson nearby.

[13] HVA, 2017

Water samples are processed at the Bard Water Lab. In 2019, field data were also recorded for water temperature, pH, and conductivity.

The two uppermost sampling stations are at Collins Street in Hillsdale and at the Roe Jan Park in Copake. On the 20 sampling dates between May 2016 and October 2018, the *Enterococcus* counts exceeded the USEPA "acceptable" threshold of 61/100 ml on four days at Collins Street, and five days at the Roe Jan Park. The sources of the high bacterial counts could be runoff from agricultural fields, septic leachate from residences, runoff from roads or other paved areas, or other unknown sources.

When available, the water analysis results can be found on the Riverkeeper website (riverkeeper.org).

The Roe Jan Watershed Community also does macroinvertebrate monitoring in coordination with the New York DEC WAVE initiative (Water Assessments by Volunteer Evaluators, https://www.dec.ny.gov/chemical/92229.html).

A few of the potential or actual sources of water pollution and soil contamination throughout Hillsdale are shown in Figure 11.[14] These include petroleum bulk storage (six locations), landfills (two locations on Holm Road), a Stormwater Pollution Discharge Elimination System (SPDES) location (in the Hillsdale hamlet), and road salt storage (at the Town garage on Old Town Road). Figure 11 does not show the other widespread sources of pollution such as roads, parking lots, driveways, lawns, agricultural fields, and septic leach fields.

This bald eagle is perched on a dead tree in the Shepard Hollow swamp of Rodman Road. Bald eagles rely on fish from such surface water bodies. Photo © 2020 Heather Kitchen

Stream Barriers

Barriers such as dams or suspended culverts can also disrupt the flow and ecological integrity of streams. From headwaters to mouth, a stream is a continuous ecosystem dependent on free movement of water, nutrients, organic detritus, sediments, and animals.

Dams are an obvious impediment to these movements, but culverts, if improperly sized, designed, and installed, can also act as partial or total barriers, severely altering stream flows, and disrupting the stream ecology.

Culverts that are suspended above the stream bottom prevent the movement of organisms and materials. Undersized bridges or culverts disrupt natural flow patterns, causing upstream impoundment and increasing downstream velocities, often leading to streambed scouring and bank erosion, and damage to bridges, roads, and other infrastructure.

[14] Winkley, 2009

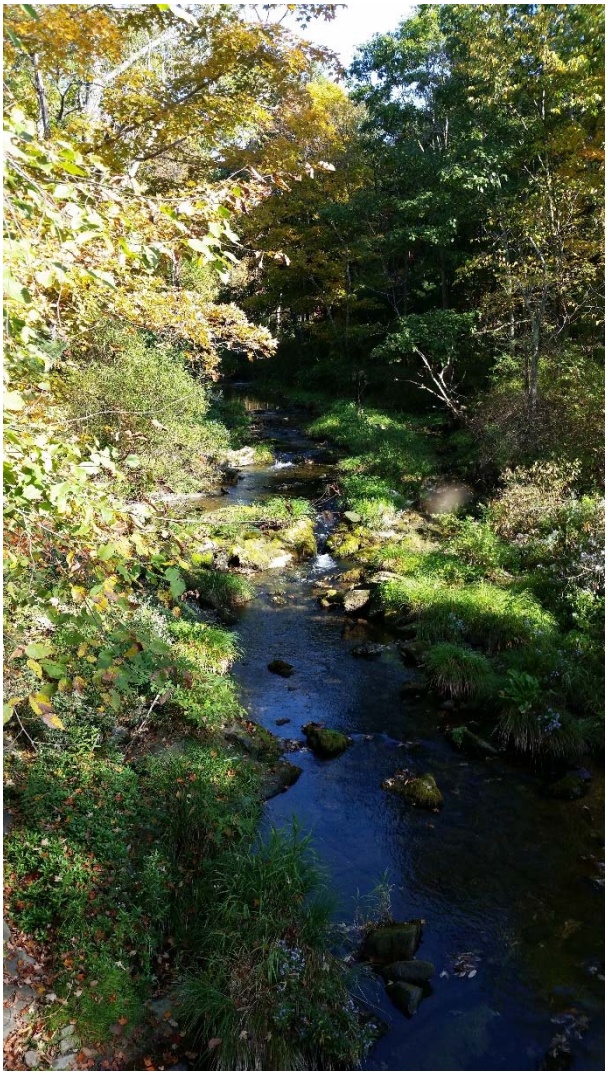
There is a growing concern about the role of road crossings such as culverts in altering habitats and disrupting stream continuity. Since most of the culverts currently in place were designed to move water under a road, little consideration has been given to the impacts of those culverts on ecosystem processes.

The Hudson River Estuary Program has been conducting surveys to identify culverts throughout the region to identify those that are too small to carry expected flood flows, or are perched above the streambed . The survey results are provided to local, county, and state agencies to help them prioritize culverts for replacement so that risk to infrastructure is reduced and stream continuity is restored.

Figure 11 shows dams (two on tributaries to the Taghkanic Creek, five along the Roeliff Jansen Kill or its tributaries, and one on Cranse Creek) and culverts assessed in the recent Estuary Program survey.[15] Many culverts have been classified as having significant or severe barriers that may impair water flow and aquatic habitats.

While most of the barriers in Hillsdale are classified as minor or insignificant, some are ranked moderate or severe. Most of the barriers are found along unnamed streams in Town.

The data for Hillsdale can be found at the North Atlantic Aquatic Connectivity Collaborative website at: http://streamcontinuity.org/naacc/data-center.



The Roeliff Jansen Kill at Collins Street Bridge. Photo © 2020 Paul Duernberger

[15] North Atlantic Aquatic Connectivity Collaborative and Trout Unlimited, 2019.

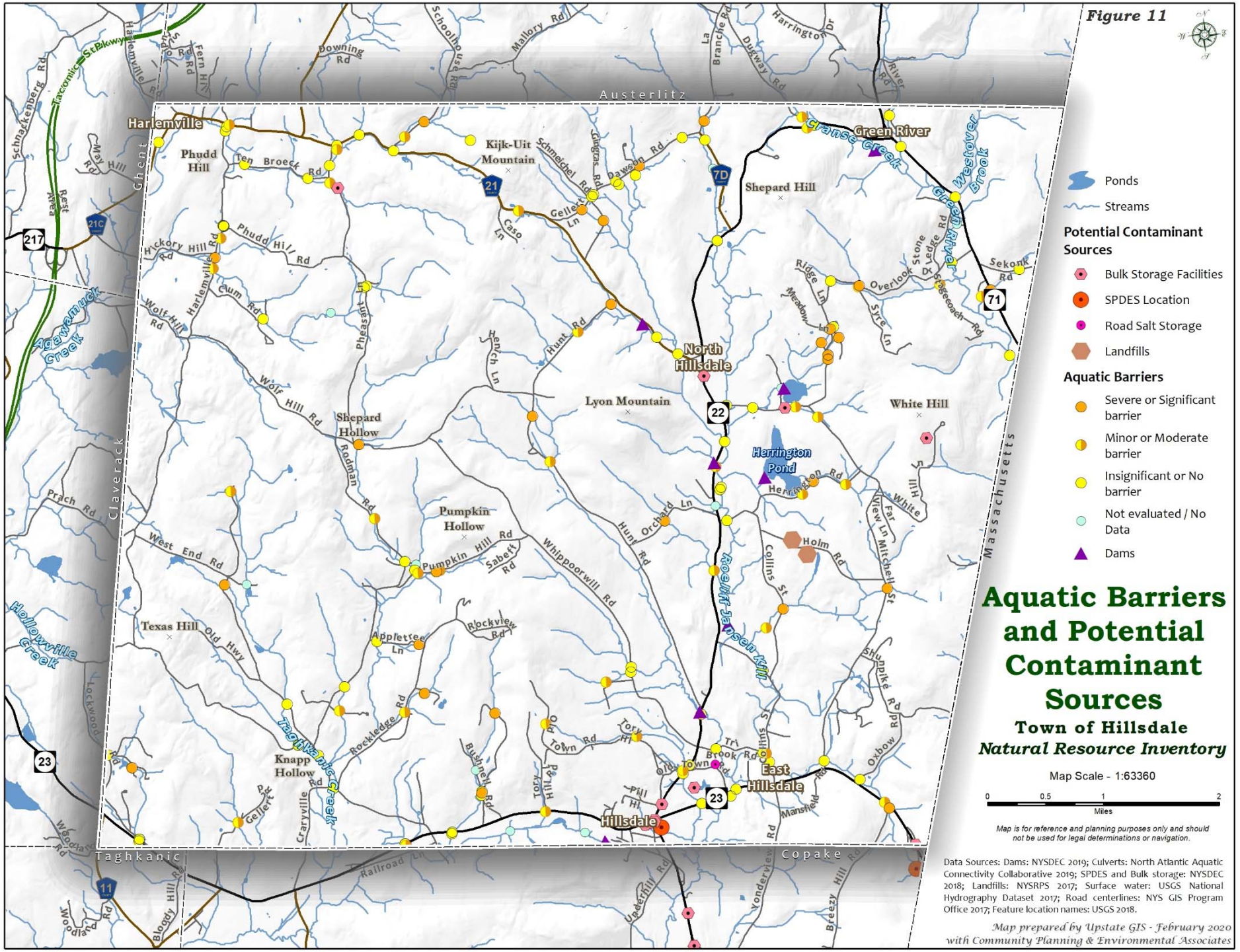


Figure 11
Ponds
Streams
Potential Contaminant Sources
Bulk Storage Facilities
SPDES Location
Road Salt Storage
Landfills
Aquatic Barriers
Severe or Significant barrier
Minor or Moderate barrier
Insignificant or No barrier
Not evaluated / No Data
Dams
Aquatic Barriers and Potential Contaminant Sources
Town of Hillsdale
Natural Resource Inventory
Map Scale - 1:63360
0 0.5 1 2
Miles
Map is for reference and planning purposes only and should not be used for legal determinations or navigation.
Data Sources: Dams: NYSDEC 2019; Culverts: North Atlantic Aquatic Connectivity Collaborative 2019; SPDES and Bulk storage: NYSDEC 2018; Landfills: NYSRPS 2017; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.
Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates
Austerlitz
Taghkanic
Copake
Massachusetts
Harlemville
Phudd Hill
Kijk-Uit Mountain
Green River
Shepard Hill
North Hillsdale
Lyon Mountain
White Hill
Herrington Pond
Shepard Hollow
Pumpkin Hollow
Texas Hill
Knapp Hollow
East Hillsdale
Hillsdale
Claverack
Ghent
Agawamuck Creek
Hollowville Creek
Taghkanic Creek
Cransee Creek
Westover Brook
Green River
Roeliff Jansen Kill

Groundwater

What is groundwater? Groundwater is water that resides beneath the ground surface in spaces between sediment particles and in rock fissures and seams.

Why is this feature important? All residents and businesses in Hillsdale rely on groundwater resources for drinking water. Groundwater is also used for crop irrigation and water for livestock. In addition to supporting the human population, groundwater feeds our streams, ponds, and wetlands, and supports many of Hillsdale's habitats, plants and animals.

Groundwater is fed and replenished by rainwater, snowmelt, and other surface water that seeps from the surface through soils and rocks to reach underground spaces. Our surface waters (streams, lakes, ponds) are fed directly by rain and snow, but most are also fed by groundwater. At times of drought when there is no stream flow from runoff, water in streams comes from groundwater sources. Most Hillsdale residents and businesses obtain their drinking water from groundwater resources.

Groundwater is available from shallow and deep sources throughout the Town, but the most easily accessible sources are in the unconsolidated sand and gravel deposits in the valleys. Figure 12 shows unconsolidated aquifers in Hillsdale.

Unconsolidated aquifers are prone to contamination from activities at the land surface because the coarse sands and gravels allow rapid vertical migration between the surface and groundwater with little filtering.[16]

Some locations in Town having limestone bedrock at or near the surface are especially vulnerable to contamination because of the many cracks and holes in the limestone that allow surface water to enter groundwater very rapidly and without any natural filtration from soils.

Aquifers can become polluted through chemical spills, leaking underground storage tanks, improperly working septic systems or polluting land uses. Unconsolidated aquifers are especially vulnerable to contamination from these and other sources.

Northern watersnakes live in many aquatic habitats including streams, lakes, ponds, bogs, and marshes. They are often seen basking on logs or rocks in ponds, as this one is doing in a pond off County Route 21. Photo © 2020 John Piwowarski

[16] Winkley, 2009

A groundwater study conducted for the Town of Hillsdale in 2009 by the New York Rural Water Association[17] offers more details on groundwater resources and should be consulted whenever groundwater is a topic for conservation or development.

Hydrogeologic Sensitivity

Figure 12 also shows areas with high "hydrogeologic sensitivity," a measure of the ease and speed with which a contaminant could migrate into a water-bearing layer underground. An area with a rating of high or very high hydrogeologic sensitivity could be especially vulnerable to contamination from, for example, nitrates and bacteria from septic systems, nutrients from fertilizer applications to lawns and farm fields, deicing salts applied to roads and driveways, and volatile organics and other contaminants from leaks and improper disposal of petroleum or other fluids.[18]

Areas in Hillsdale with high to very high hydrogeologic sensitivity are mainly those with coarse-grained soils and underlying unconsolidated or limestone/dolostone aquifers. These areas include much of the Roeliff Jansen Kill Valley, and the corridors of the Agawamuck Creek, Green River, and Taghkanic Creek. Much of the Slate Hills and Taconic Mountains regions have lower hydrogeologic sensitivity due to the lower permeability of the bedrock, the till soils, and the steeper slopes.[19]

The swamp at Shepard Hollow on Rodman Road. Photo © 2020 Marcy Feld

Groundwater Yields

According to the Hillsdale Groundwater Study, "[t]here is some variation in bedrock well yields across Hillsdale. Much of this variation is due to the type of bedrock. The carbonate (limestone) rocks of the region (including Balmville Limestone) often have significantly higher permeability due to the presence of cracks and openings that have been enlarged through dissolving of the rock material. In some instances, dissolution of the rock can lead to formation of caves, springs, sinkholes, and disappearing streams. Drillers have noted such features in Hillsdale.[20]

Lower well yields in the carbonate bedrock areas of the Harlem Valley and in the schist bedrock areas of the Taconics average 10 gallons per minute (gpm) or less. Reduced permeability makes the availability of groundwater in the Slate Hills significantly less.[21] High-yield aquifers (100+ gallons per minute (gpm)) are located along the Green River, the Roeliff Jansen Kill, and the Taghkanic Creek.

[17] Ibid.

[18] Ibid.

[19] Ibid.

[20] Ibid.

[21] Ibid.

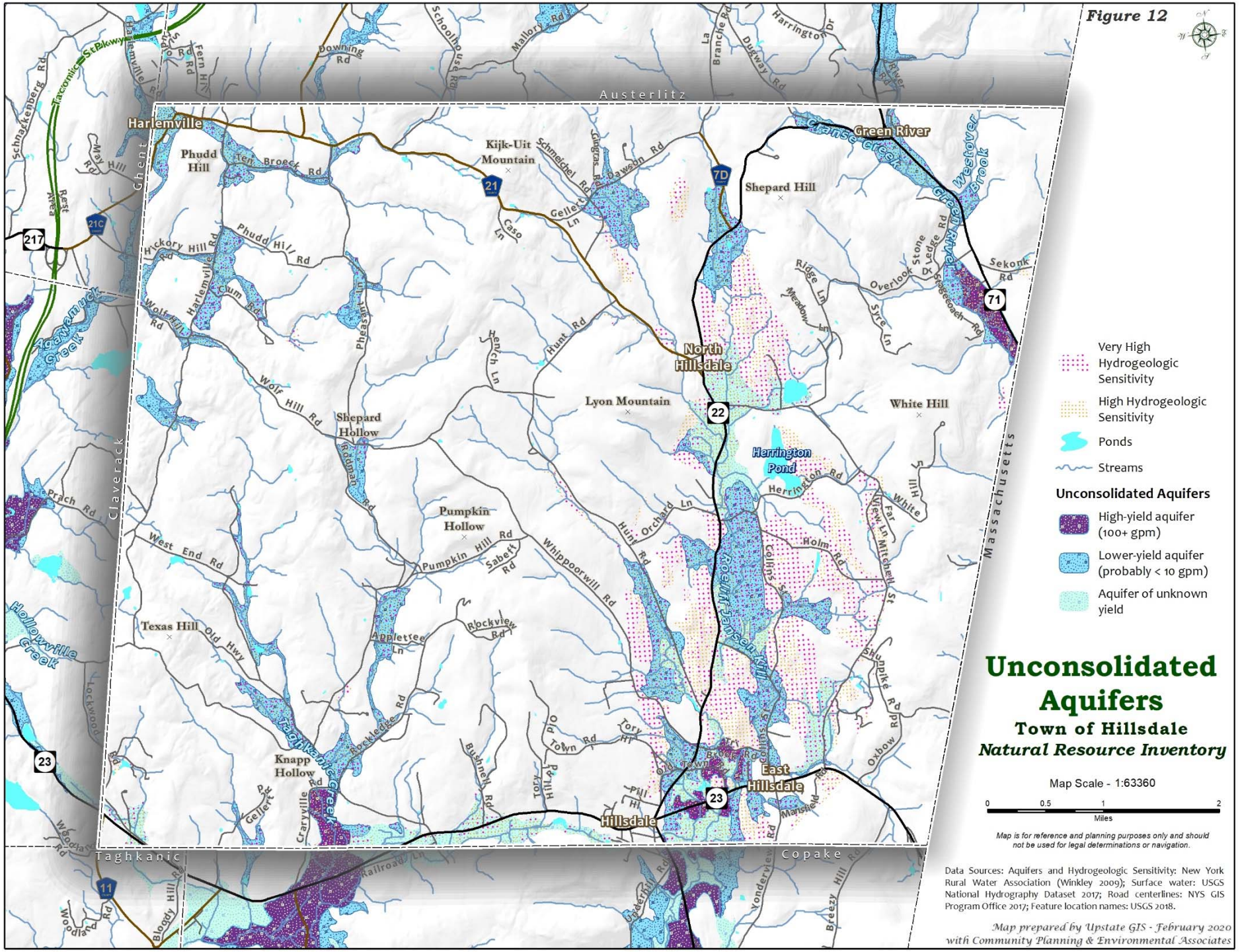


Figure 12
Austerlitz
Harlemville
Phudd Hill
Kijk-Uit Mountain
Green River
Shepard Hill
North Hillsdale
Lyon Mountain
White Hill
Herrington Pond
Shepard Hollow
Pumpkin Hollow
Texas Hill
Knapp Hollow
East Hillsdale
Hillsdale
Taghkanic
Copake
Ghent
Claverack
Massachusetts
Very High Hydrogeologic Sensitivity
High Hydrogeologic Sensitivity
Ponds
Streams
Unconsolidated Aquifers
High-yield aquifer (100+ gpm)
Lower-yield aquifer (probably < 10 gpm)
Aquifer of unknown yield
Unconsolidated Aquifers
Town of Hillsdale
Natural Resource Inventory
Map Scale - 1:63360
0 0.5 1 2
Miles
Map is for reference and planning purposes only and should not be used for legal determinations or navigation.
Data Sources: Aquifers and Hydrogeologic Sensitivity: New York Rural Water Association (Winkley 2009); Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.
Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Wetlands

What is a wetland? A wetland is a vegetated area that has saturated soils in the rooting zone of plants for a prolonged period during the growing season. Some wetlands are permanently flooded, and some have little or no standing water for most of the year. Wetlands include swamps, marshes, wet meadows, vernal pools, bogs, and similar areas.

Why is this feature important? While wetlands were once thought of as wastelands and were routinely filled in or drained, now their important ecological role is more deeply understood. Wetlands provide critical habitats for plants and animals, but also benefit the broader environment and human communities by controlling flooding, filtering water to remove pollutants, sequestering carbon, providing wildlife habitat, and providing a host of other services.

Wetlands come in many forms and sizes—large, small, forested, shrubby, herbaceous, some with permanent standing water, some with temporary, and some with little or no standing water. A wetland is a permanent feature even if the standing water or soil saturation comes and goes.

According to federal and New York State definitions, to be identified as a wetland, an area must have: (1) hydrophytic vegetation (water-loving plants), (2) hydric (wet) soils, and (3) indicators of prolonged wetness (wetland hydrology). "Hydrophytic vegetation" consists of plants adapted to the low-oxygen conditions associated with prolonged water saturation of the soils. "Hydric soils" are those that are saturated for long enough during the growing season to develop anaerobic (low-oxygen) conditions.

Wetland Regulations

Certain wetlands receive some regulatory protection from New York State and the federal government. Activities in large wetlands (≥ 12.4 acres) and a few smaller wetlands of "unusual local importance" are regulated by the New York State Freshwater Wetlands Act (Article 24 of the New York Conservation Law).

Activities in wetlands of any size that are functionally connected to "navigable waters" are regulated by the federal government under Section 404 of the Clean Water Act. Even with these regulations, many of the small and hydrologically isolated wetlands found in Hillsdale are unprotected by these laws, despite the great ecological importance of these natural features.

The wetlands map (Figure 13) depicts state regulated wetlands, federally identified wetlands (National Wetland Inventory, or NWI), and other places mapped as "probable wetlands," and "possible wetlands." The "probable wetlands" are in areas where the mapped soils (from the county soil survey) are described as "poorly drained" or very poorly drained." The "possible wetlands" are in areas where the mapped soils are described as somewhat "poorly drained."[22] Probable and

[22] Kiviat and Stevens, 2001

potential wetlands in Hillsdale are extensive and cover a significant land area.

The National Wetlands Inventory (NWI) was established by the U.S. Fish and Wildlife Service (USFWS) to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. The NWI includes a wetland classification system that is now the Federal standard for wetland classification.[23] The NWI relies on trained image analysts to identify, map, and classify wetlands and deep-water habitats from remote analysis of aerial imagery, soils, and topography, but most of the mapping has not been verified on the ground.

Both the NYS Freshwater Wetland maps and the NWI maps are known to generally underestimate wetland area. Many wetlands are larger than shown on the map, and many smaller and drier wetlands tend to be missed in the inventory process. Thus, the wetlands shown in Figure 13 are a minimum and not definitive. Many other wetlands are present in Hillsdale, both within and outside the areas mapped as "probable" and "possible" wetlands.

There are approximately 770 acres of mapped wetlands in Hillsdale that are regulated by New York State DEC (12.4 acres or larger). There are an additional 1,110 acres of NWI mapped wetland areas, outside of the mapped NYS DEC wetlands,

This juvenile green heron and an eastern painted turtle seem to be having a visit at water's edge on the wetlands of the Rheinstrom Hill Sanctuary off NYS Route 23. Photo © 2020 David Lewis

[23] Cowardin et al., 1979

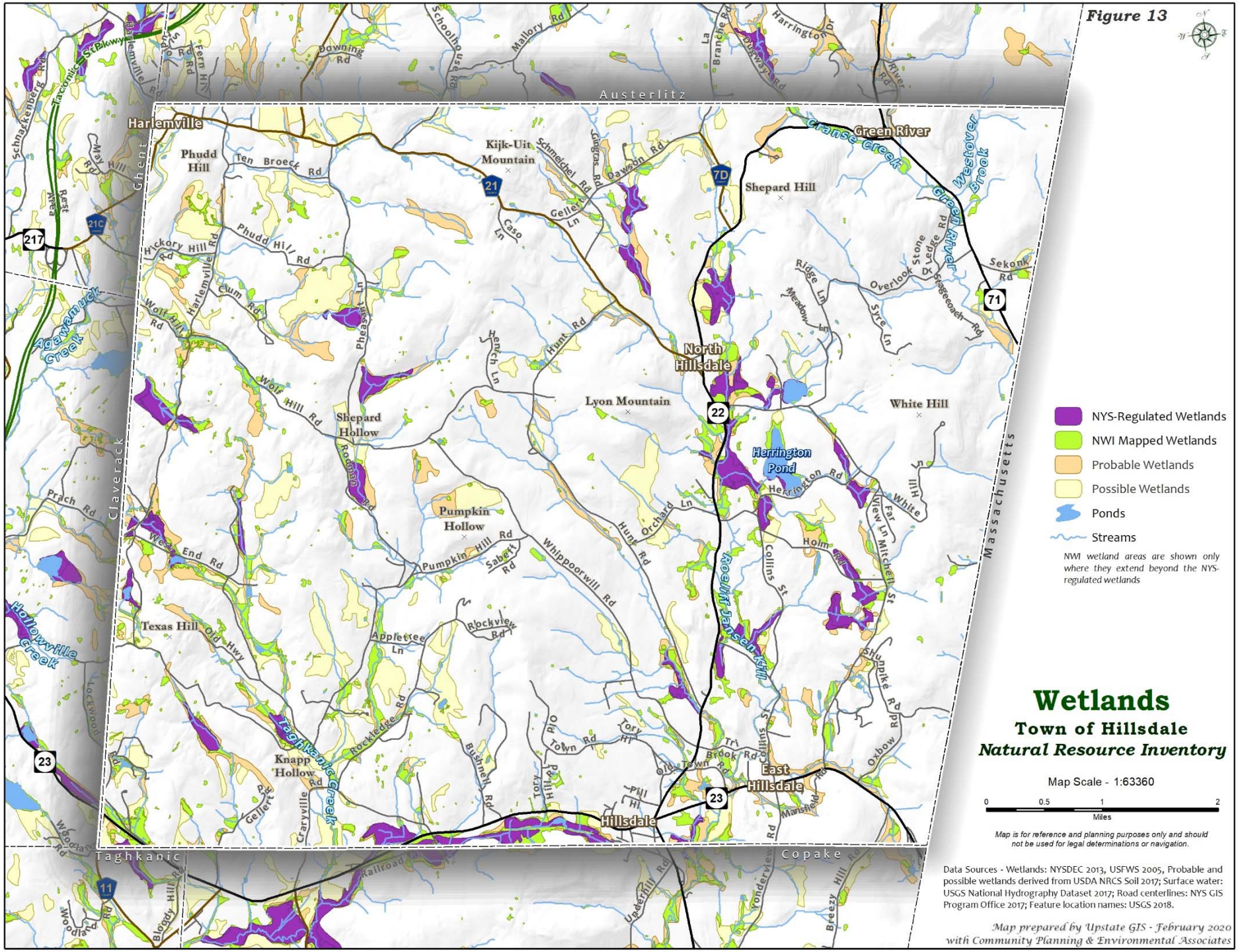
located within the Town. Additionally, over 3,000 acres are mapped as possible or probable wetlands based on poor soil drainage properties.

Wetlands, streams, floodplains, and riparian areas often overlap and interact, and thus the health and functioning of one will affect the other. As can be seen on the map, many wetlands in Hillsdale are associated with stream systems, but many others are isolated from streams, lakes, or ponds.

The largest mapped wetlands in Town can be found along the Roeliff Jansen Kill just north and south of North Hillsdale, along Holm Road, in Shepard Hollow, at the foot of Scutt Hill, and in western Hillsdale along the Taghkanic Creek. There are thousands of acres of possible or probable wetlands along other smaller tributaries, in valley areas, in isolated depressions, and on seepy hillsides. Wetland habitats of Hillsdale are further described below.

Bullfrogs like this one in a pond off County Route 21, inhabit warm, still waters. They are voracious predators of other amphibians and many other animals, including insect pests. Photo © 2020 John Piwowarski

Figure 13



Wetlands

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources - Wetlands: NYSDEC 2013, USFWS 2005, Probable and possible wetlands derived from USDA NRCS Soil 2017; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Biological Resources

Habitats

What is a "habitat"? A habitat is the place where an organism or population lives or where a biological community occurs. It is defined by both its biological (plants, animals, fungi, bacteria, etc.) and non-biological components and their interactions with each other. The non-biological components include features such as sunlight, moisture, slope, soils, soil or water chemistry, and bedrock substrates. Habitats in Hillsdale include swamps, marshes, vernal pools, other wetlands, meadows, forests, ledges, and streams in many variations.

Why is this feature important?
Habitats are essential components of the ecosystems that make the world habitable for us and the living world around us. They support the plants and animals that process and produce the oxygen we breathe and the nutrients we consume and provide a host of uncountable services that we depend on.

A healthy ecosystem has diverse native species of plants and animals. And a diversity of species can only be maintained with diverse intact habitats to support them. When a habitat becomes degraded or disappears, it can lead to local or regional extinction of the species that depend on that habitat. The sizes of habitats, their spatial relationships to each other, and their connectedness across the larger landscape all contribute to an area's health and biological diversity.

This NRI is concerned with habitats that play a significant role in ecosystems—referred to as "ecologically significant habitats." These are areas undeveloped with roads, driveways, lawns, and buildings, and include both common habitats such as upland hardwood forests, upland meadows, and shrub swamps, and less common habitats such as fens and vernal pools.

A sugar maple forest on a limestone knoll in the Harlem Valley off Route 22. The green layer on the forest floor consists mostly of maple seedlings. Photo: Conrad Vispo

Below are profiles of some of the habitats in Hillsdale: forest; crest, ledge and talus; meadow; wetlands; and streams. The information included comes from publicly available sources relevant to Hillsdale and the region, such as Ecological Communities of New

York State,[24] the Biodiversity Assessment Manual for the Hudson River Estuary Corridor,[25] the Hillsdale Habitat Summary,[26] and the Natural Resources Inventory for Columbia County,[27] as well as local observations of Hillsdale residents, especially members of the Hillsdale Conservation Advisory Council.

Most places in Hillsdale have not been surveyed by biologists, however, so detailed knowledge of the habitats, plants, and animals is incomplete.

Figure 16 gives a coarse representation of some of the ecological communities of Hillsdale habitats. The communities were identified by remote sensing by The Nature Conservancy without field verification. They include many errors and inaccuracies, but the map nonetheless provides a general picture of some of the biological diversity of the Hillsdale landscape. Descriptions of the communities shown in Figure 16 are at http://easterndivision.s3.amazonaws.com/NortheastHabitatGuides.pdf.

Cattails, here lining the shore of a large pond in the Rheinstrom Hill Sanctuary, provide important shelter for birds and food and cover for fish and for the insects they eat. Cattails also help protect the banks of a pond from erosion and slow the movement of water, trapping sediment and silt. Recent research shows that cattails can also remove polluting substances from the water surrounding their roots. Photo © 2020 David Lewis

[24] Edinger et al., 2014
[25] Kiviat and Stevens, 2001
[26] Strong, 2010.
[27] Stevens and Travis, 2018

Forests

Upland Forests

Upland (non-wetland) forests are the most extensive habitats in the Town and region. Figure 14 depicts the large forested areas in Hillsdale. Figure 16 offers additional details on specific forest types in Town. Hillsdale's forests are extremely variable in type of vegetation, ages and sizes of trees, size of forest patches, and character of the forest community.

Gaywings, or fringed polygala, is a diminutive woodland flower, usually less than four inches tall, that blooms in mid-spring. Like violets, gaywings produces both aerial flowers that are attractive to insects and are fertilized by cross-pollination, and inconspicuous flowers that grow underground and self-pollinate. Photo: Conrad Vispo

Forests of all kinds provide wildlife habitat and ecological services such as carbon storage, water management, and moderation of local air temperatures. Some also provide forest products that contribute to the area's economy. Large forests provide critical habitats for many area-sensitive species—including raptors, songbirds, reptiles, amphibians, and large mammals.

Forests cover approximately 70% of Hillsdale, and many of our forests are in large patches of regional significance due to their size and condition. Figure 14 maps the contiguous forest areas of 2000 acres and larger in Hillsdale. Note that State and County roads are shown as fragmenting features on this map, but local roads are not, even though smaller roads can have similar fragmenting effects.

One of the most significant large forest areas in Hillsdale is the 2,228-acre forested block in the eastern part of Town in the Taconic Ridge. This is part of a much larger forest extending into adjacent areas of New York and neighboring states. Other large forests are in the Slate Hills region of Hillsdale (Figure 14).

Typical plants found in Hillsdale's upland forests include maples, oaks, hickories, birches, white ash, American beech; eastern hemlock, white pine, eastern red cedar; witch-hazel, maple-leaf viburnum, serviceberries; wild sarsaparilla, Canada mayflower, trout-lily, Christmas fern, and wood ferns.

Some of the species of conservation concern of Hillsdale's forests include the eastern box turtle, eastern racer, Jefferson/blue-spotted salamander, red-shouldered hawk, black-throated blue warbler, blackburnian warbler, and worm-eating

warbler. An indication of the habitat quality of the large forests in Hillsdale is that 18 of 20 bird species representative of high-quality forests for the Atlantic Northern Forest[28] were inventoried in Hillsdale in the 2000-2005 Breeding Bird Atlas.

Large forests

While forests of any size can have significant habitat value for wildlife and can provide important other services to the human community, large forests have special value for species of plants and animals that benefit from the environmental conditions of the deep interior parts of large forests.

Forest interiors provide different conditions of light, air and soil temperatures, moisture, and air flow than forest edges—conditions that help to determine the kinds of plants, animals, and other organisms that can survive and thrive there. Forest edges tend to be warmer, brighter, drier, and windier than forest interiors.[29] They are often occupied, in part, by non-native invasive plants, which are less likely to infest the undisturbed interior.[30]

In addition, forest interiors are less exposed to many of the nest predators and brood parasites, such as blue jay, raccoon, domestic cat, and brown-headed cowbird, that plague songbird nests at forest edges. The populations of many of our "forest-interior songbirds," such as scarlet tanager, black-throated blue warbler, worm-eating warbler and Louisiana waterthrush, depend on the protective interior environments.[31]

The Louisiana waterthrush, a wood warbler, makes its home streamside in deep forest like this spot on the Agawamuck where it nests in small holes in the banks and feeds on aquatic insects and their larvae. It is suffering deep population declines, due mostly to loss of interior forest habitat and stream pollution and is classified in New York as a "Species of Greatest Conservation Need." Photo © 2020 John Piwowarski

Large forests often provide a great variety of microhabitats that serve diverse organisms and provide safe travelways for many kinds of wildlife.

Habitat "fragmentation" refers to the dividing of a contiguous habitat area into smaller patches by, for example, roads, driveways, yards, utility corridors, or other developed features. Fragmentation of forests into smaller blocks increases the area of forest edge habitat where there are higher light and noise levels, drier conditions, and where invasion by non-native plant species and by edge-adapted predators is more likely.

Fragmentation makes the (formerly) deep interior forest areas newly accessible to songbird nest predators and brood parasites whose activities are ordinarily confined to open areas and forest edges.

[28] Burger and Liner, 2005

[29] Vanwalleghem and Meentemeyer, 2009

[30] Harper et. al., 2005

[31] Mowbray, 1999; Raffa et al., 2009

Jack-in-the-pulpit is a common plant of our rich woods. Despite its common name, "Jack," individuals may be either female or male and may change from male to female, and back, depending on growing conditions. When conditions are good, a male Jack may become female, usually larger, with two leaves rather than one, and producing a clutch of bright red fruit. After a bad year however, the female individual may again become male, and produce no seed. Photo © 2020 David Lewis

Roads and other developed areas intruding into forests also act as barriers and hazards to wildlife movement.

In general, larger forest patches are better habitat for forest interior species; are better able to accommodate disturbances like floods and wind damage; and contribute more significantly to landscape resiliency and climate change adaptation. However, small patches of forest can also be valuable habitat and can serve as "stepping stones" for animal migration.[32]

Other factors besides size, such as deer browsing, pest damage, management history, and invasive species, can have a large impact on forest quality for plants and animals of conservation concern.

The forests shown in Figure 14 are classified in the following categories:

1. **"Matrix forests"** are large contiguous areas whose large size and intact condition allow for support of ecological processes and viable large-forest communities of plants and animals that cannot necessarily persist in smaller or poorer-quality forests. The Nature Conservancy (TNC) and the New York Natural Heritage Program (NYNHP) delineated these areas to identify viable examples of the dominant forest types that, if protected and allowed to regain their natural condition, would serve as refuges and source areas for plant and animal species requiring interior forest conditions or associated with the dominant forest types.[33] The only "matrix forest" area in Hillsdale is the part of the Taconic Ridge lying south of NYS Route 23 in the southeast corner of the Town. The matrix area extends south along the ridge through Copake, and east into Massachusetts and Connecticut.

2. **"Globally important forests"** (greater than 15,000 acres) are large, intact forest ecosystems that support characteristic, wide-ranging, and area-sensitive species, especially those that depend on interior forest. Their large size helps to ensure that they include a range of forest successional stages, such as those subject to recent blowdowns and fire, areas recovering from such disturbances, and mature areas that have avoided such events for long periods. These forests are likely to be large enough to support and maintain genetic diversity of plant and animals populations over

[32] Cornell University, 2010

[33] Anderson et al. 2016

several generations."[34] The "globally important forest" areas in Hillsdale are limited to the parts of the Taconic Ridge lying north of NYS Route 71 in Green River, and south of NYS Route 23 in the southeast corner of Town. Both are part of much larger forests that extend far beyond Hillsdale.

3. **"Regionally important forests"** (6,000 - 14,999 acres) are large enough to provide habitat to many area-sensitive species and can accommodate large-scale natural disturbances that maintain forest health over time. (Smaller patches are often less able to maintain the entire range of needed habitats and successional stages after large-scale disturbances.) Most of the large forests in Hillsdale fall into the "regionally important forest" category. These cover large areas of the Taconic Ridge and the Slate Hills.

4. **"Locally important forests"** (2,000 – 5,999 acres) can provide habitat for interior forest-dependent birds. (Some of the more sensitive bird species often require 2,500 to 7,500 acres of intact interior habitat.) These forests can also provide important corridors and connectivity among forest ecosystems. The only "locally important forests" identified by the TNC and NYNHP in Hillsdale are on Scutt Hill and small patches in the northwest corner where larger Austerlitz forests extend across the Town boundary into Hillsdale.

5. **"Linkage zones"** are areas that link larger forest patches, and are thus important for maintaining ecosystem health, ecological connections, and travel corridors.[35] The linkage zones in Hillsdale help to link the large forests of New York with those of New England. They include much of the large forest areas east of NYS Route 22, and a swath connecting the higher hills between Texas Hill and Kijk-Uit Mountain.

Figure 14 also shows locations of non-wetland floodplain forests—areas that may be especially important for biological diversity and for stream water quality, habitat quality, and flood attenuation. These areas are described further below.

Maidenhair ferns are usually found on rich forest soil and especially on rocky, limestone slopes. The fern is often indicative of a forest that has seen no recent disturbance. Photo © 2020 David Lewis

Forest patches less than 200 acres have lesser ecological significance at the landscape scale and were excluded from the map, but can still have very significant habitat value, and provide all the important ecological services such as water management, climate moderation, and carbon sequestration.

[34] Ibid.

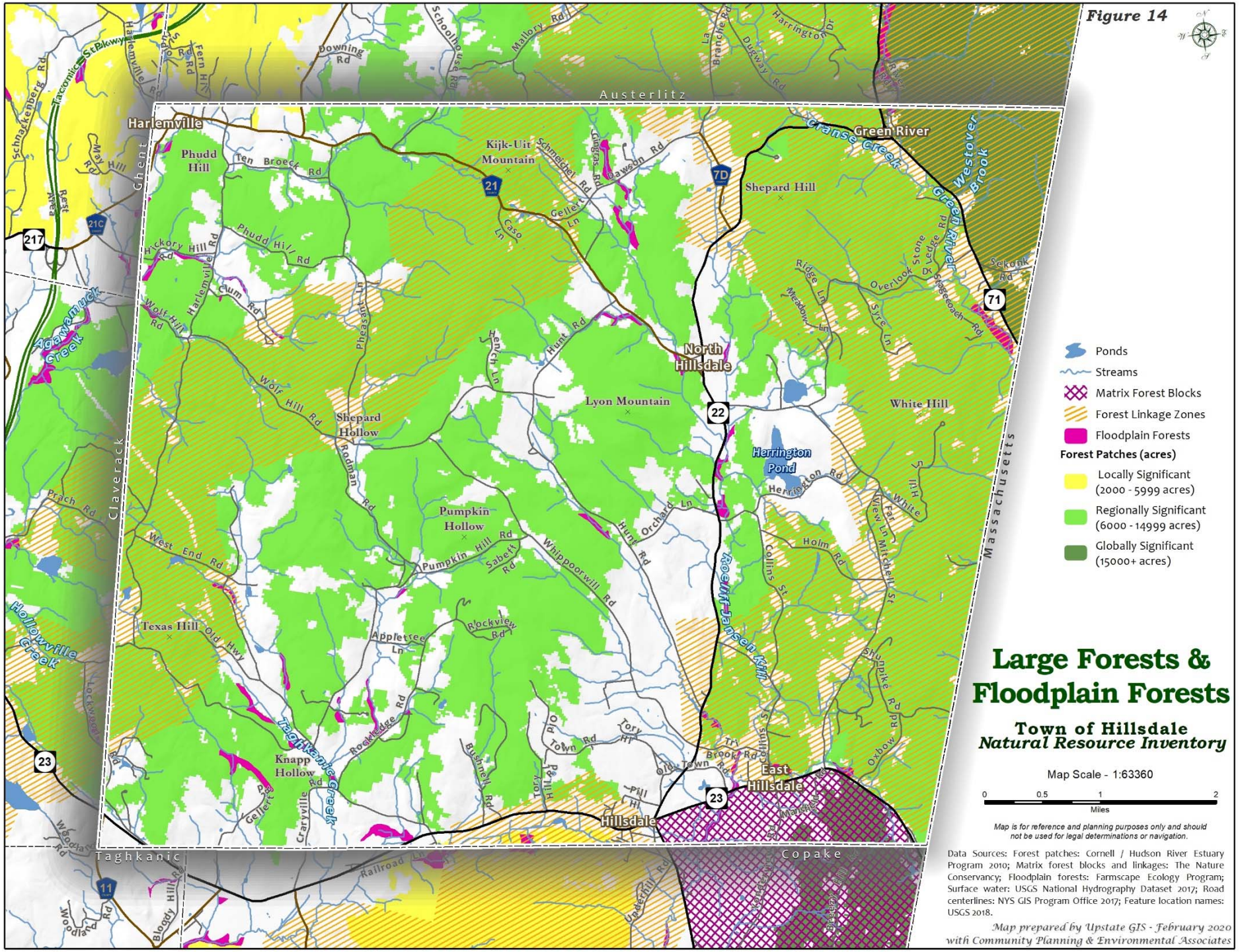
[35] Ibid.

The large forests of Hillsdale's Taconic Ridge and Kijk-Uit Mountain are part of the Taconic Ridge Significant Biodiversity Area (identified by NYSDEC; see below), which extends north and south far beyond the Town boundaries. The most significant threat to the Hudson Valley's forest ecosystems is fragmentation into smaller patches.[36]

This wood anemone, in woods off County Route 21, is a spring ephemeral that flowers in rich, moist woods in the spring and dies back by mid-summer, when the shading forest canopy develops. Photo © 2020 John Piwowarski

[36] Strong, 2010

Figure 14



Large Forests & Floodplain Forests

Town of Hillsdale
Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2
Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Forest patches: Cornell / Hudson River Estuary Program 2010; Matrix forest blocks and linkages: The Nature Conservancy; Floodplain forests: Farmscape Ecology Program; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Crest, Ledge, and Talus

Hillsdale has several areas with crest, ledge and talus habitats. These are areas of small or large bedrock outcrops, cliffs, ledges, talus (accumulation of rock fragments below a ledge), or erratics (isolated boulders). Soils in many ledgy areas are shallow (or absent), and vegetation is often stunted and sparse, but some ledgy areas are well-forested.

An extraordinary array of plants and animals of conservation concern are associated with these habitats in the Hudson Valley. Snakes such as the black racer and black rat snake use ledges with deep crevices for winter habitat, and use exposed, unshaded ledges for basking and breeding in the warm months. Slimy salamander is closely associated with forested talus. Small-footed bat (not yet observed in Hillsdale but could occur here) uses talus for summer roosting. Open, ledgy areas are used by certain butterfly species for "hilltopping" when seeking mates. Porcupine and bobcat use ledge and talus areas for denning.

Red squirrels collect and hoard food, including seeds, nuts, and mushrooms, in middens that may be large, holding food enough for a year or two, or small, holding just enough for a month. This activity affects the forest system by dispersing the seeds and spores of fungi to new areas, where they may germinate and grow if the squirrel fails to return to eat them. Photo © 2020 John Piwowarski

Porcupines in New York are largely tree dwellers, coming down primarily to forage in ground cover that provides both food and protection from predators. One result of deer overpopulation is that the forest floor vegetation is often depleted, depriving porcupines of sources of food and protection on the ground. In the trees they subsist on bark, cambium, buds, and fruit and nuts such as acorns and beechnuts. Photo © 2020 John Piwowarski

Meadows

In this NRI we use the term "meadow" for non-wetland areas dominated by herbaceous (non-woody) vegetation. Meadows of 10 acres or larger are shown on Figure 15. These include both dry upland meadows and wet meadows that have standing water or saturated soils for part of the growing season. Meadows of all sizes are habitats for a wide variety of plants and animals.

Typical plants of meadows include grasses, sedges, goldenrods, asters, common bedstraw, common buttercup, and Queen Ann's lace in upland meadows; reed canary-grass, purple loosestrife, sensitive fern, and blue flag in wet meadows; and rough-leaf goldenrod, blue vervain, and sweetflag in calcareous (calcium-rich) wet meadows.

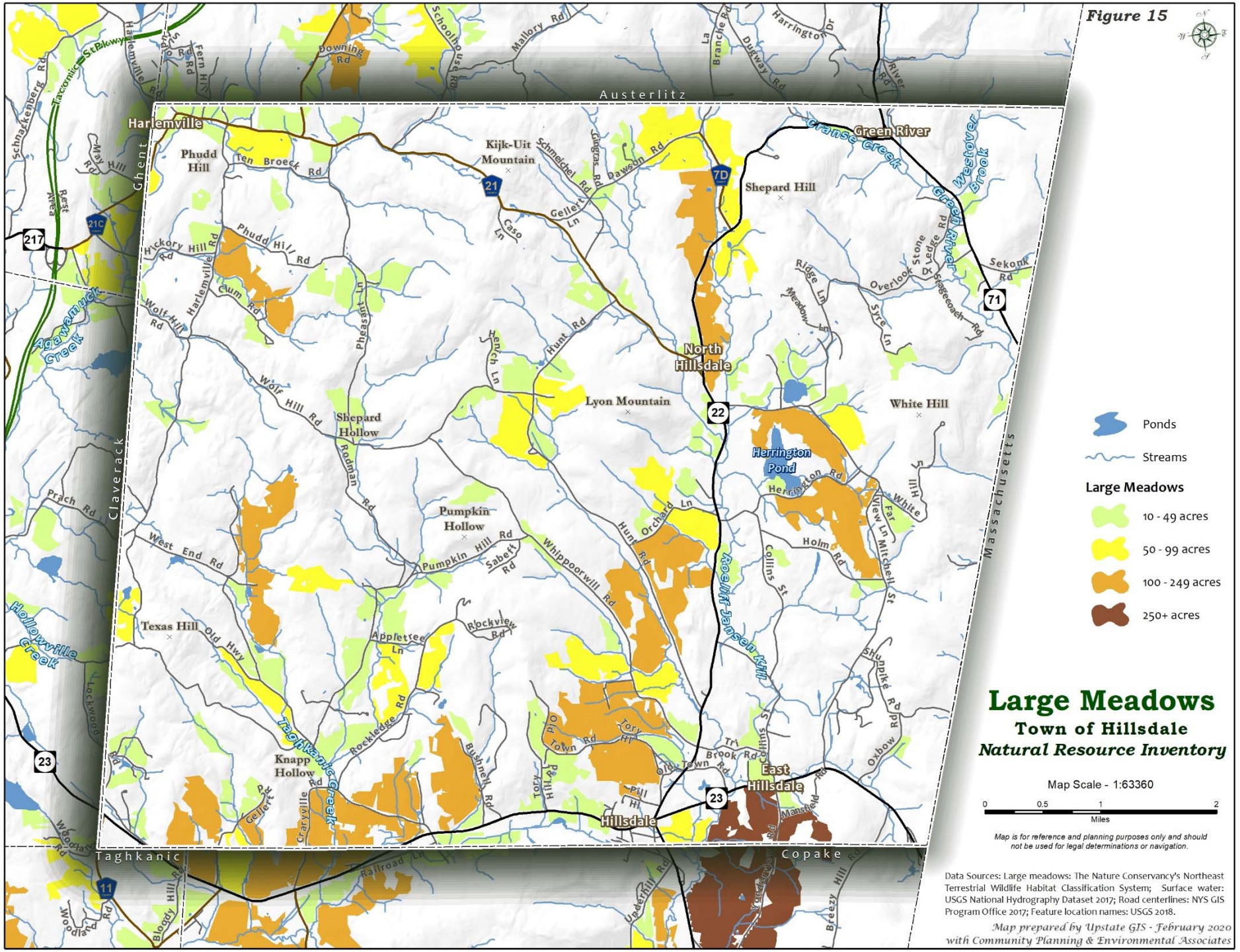
Many species of invertebrates (insects, spiders, mollusks, earthworms), reptiles, amphibians, birds, and mammals rely on the open habitats of meadows. The quantity and quality of meadowland in Hillsdale changes over time as agricultural practices change.

A shamrock orb-weaver spider (*Araneus trifolium*) in a field at Rheinstrom Hill Sanctuary. The orb weavers are named for their circular web, from which they hang upside down waiting for prey. They consume many small insects and other spiders, including members of their own species. Photo © 2020 David Lewis

An eastern bluebird in its usual habitat in a tree on the edge of an open field, here in the Rheinstrom Hill Sanctuary. The bluebird is the New York State Bird. Its numbers decreased substantially in the mid- to late 20th century due to loss of habitat and competition from introduced species such as the starling, but they have been rebounding more recently. Nonetheless, where flocks of a hundred or more birds were common before their decline, they are usually seen in small groups today. Photo © 2020 David Lewis

Species of conservation concern that use meadows include butterflies such as bronze copper, dusted skipper, and Leonard's skipper; wood, spotted, and box turtles; ribbon snake, and smooth green snake. American woodcock use meadows for courtship displays in spring; American kestrel, kingbird, and many other birds forage over meadows, as do dragonflies, damselflies, and bats. Small mammals (mice, voles) are often abundant in meadows, which provide rich hunting grounds for predators such as foxes, eastern coyote, and raptors.

Figure 15



Large Meadows

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Large meadows: The Nature Conservancy's Northeast Terrestrial Wildlife Habitat Classification System; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Large meadows, i.e., those of 10+ acres, have special value for grassland breeding birds that need the deep interior meadow habitats for protection from predators. Birds that depend on grasslands for nesting include, for example, grasshopper sparrow, savannah sparrow, vesper sparrow, bobolink, and eastern meadowlark.[37]

These are ground-nesting birds that need meadows of 10, 25, 50, or 100 acres or more, with appropriate kinds of vegetation and management, to sustain local populations. Grassland breeding bird populations have been declining dramatically in the Northeast due to loss of suitable habitat with intensification of agriculture, abandonment of farmland and transition of meadows to shrubland and forest, and conversion of meadows to developed uses. Conservation of large meadows is of great conservation concern.

Figure 15 shows large meadows in Hillsdale categorized according to size. Very few are larger than 250 acres. The largest meadow complex is south of East Hillsdale. About 2,060 acres of meadows are in the 10- to 49-acre range; 1,200 acres are in the 50- to 99-acre range; 2,200 acres are 100-249 acres; and approximately 1,800 acres are larger than 250 acres. Most meadows are found in the stream valleys, with a large concentration in the Roeliff Jansen Kill valley.

This lovely one-flowered cancer root, found in a field off County Route 21, is one of our unusual plants that has no leaves or perennial stems, no chlorophyll, and relies for nutrients on its parasitic relationship with a number of other common plants including goldenrods, asters, saxifrages and sedums. Photo © 2020 John Piwowarski

[37] Hudsonia, 2008

Farmscape Habitats

The view from Orchard Lane across fields and the Harlem Valley, with only the peaks of the blue silos from a farm below marking the valley, and the Taconic Ridge beyond. Ski trails of Catamount are visible in the upper right. Photo © 2020 David Lewis

Farmscape habitats of special importance in Hillsdale include farm ponds, hayfields, pastures, and wet and dry meadows, including old fields. Depending on the kinds and intensity of land uses, these managed and formerly managed lands can provide valuable habitats that contribute to the general biodiversity of Hillsdale.

Active and recently-abandoned farmland—including crop fields, hayfields, pastures, old fields, shrublands, and orchards—are prominent features of Hillsdale's landscapes. Some of the ecological values of farmland are discussed above (Meadows and Ponds sections), including its importance for butterflies, bees, dragonflies and damselflies, breeding birds, small mammals, raptors, foxes, eastern coyote, and many other kinds of wildlife.

Farm operations also benefit in many ways from interactions with intact ecosystems that, for example, provide clean water for livestock, pollinators for crops, other beneficial insects for controlling insect pests, and soil organisms for breaking down organic matter, processing nutrients, and improving tilth and moisture retention.

Hillsdale's farmscape includes some unmanaged meadows. These tend to develop diverse plant communities of grasses, forbs (broad-leaved non-woody plants), and shrubs, and support an array of wildlife, including invertebrates, reptiles, mammals, and birds.

These meadows are used for nesting by turtles, often have large populations of small mammals (e.g., meadow vole) and can be important hunting grounds for raptors, foxes, and eastern coyote. Bees, butterflies, and other pollinators rely on flowering plants for food throughout the growing season.

Unmowed meadows with diverse plants and different bloom times, as well as unmanaged hedgerows and forest edges that are part of the overall farmscape, provide habitat for foraging, nesting, pupating, and overwintering insect pollinators.

Many farm practices can improve habitats for rare and vulnerable wildlife and native plants, while maintaining or improving farm productivity and efficiency. Some of these practices relate to mowing and grazing schedules, patterns, and techniques to improve habitat for butterflies, nesting birds, and nesting turtles, for example; some relate to land management for water and soil conservation; some to management of field borders to improve pollination, reduce pest problems, and support wildlife; and some to least-toxic or non-toxic pest management techniques.

The Hawthorne Valley Farmscape Ecology Program (FEP) promotes "a place-based cultural and ecological exploration of how farming influences nature conservation and how wild nature, in turn, influences agricultural production."[38] The FEP has conducted extensive biological studies in farmland and forests throughout Columbia County since 2003, providing much local information relevant to this NRI.

The well-studied fields of Hawthorne Valley Farm in the Harlemville hamlet of Hillsdale and Ghent harbor some regionally rare plants including the clammy cuphea, field and whorled milkworts, ragged-fringed orchid, squarrose sedge, seedbox, yellow stargrass, and New Jersey tea.

Several animal species of conservation interest have been documented including the spotted turtle, wood frog, spotted salamander, Jefferson salamander, eastern ribbon snake, smooth greensnake, clay-colored sparrow, meadowlark, bobolink, longnose sucker, Leonard's skipper, and bronze copper. Bobcat and fisher are regularly seen at Hawthorne Valley Farm and probably occur in many of the forested areas throughout the Town.

Other farmed areas have been documented as habitat for spotted salamanders and wood frogs at the Bridlewood Farm (where Jefferson salamander eggs were also seen) and the Sills farm on NYS Route 22. A pond on the Sills farm is the only recorded location for the eastern red damselfly in Columbia County. Other farms in the Town are also likely to support a high diversity of native plants and animals.

Species of meadowhawk dragonflies are the most common dragonflies flying in the late summer and fall. Dragonflies and damselflies in general play key roles in both aquatic and terrestrial environments. The adults feed on a variety of prey including nuisance species such as mosquitoes and biting flies, and nymphs play important roles as predators. In turn, the nymphs are an essential food resource for fish and amphibians, and adults are consumed by birds, bats, and spiders. Photo © 2020 David Lewis

[38] Vispo et al., 2016; FEP, Undated

Wetlands

The cinnamon-colored fronds that produce spores of the cinnamon fern emerge just as the fiddleheads of the fern are starting to unfurl. Here in a red maple swamp in the Rheinstrom Hill Sanctuary, they are surrounded by skunk-cabbage. Photo © 2020 David Lewis

Wetlands (shown on Figures 9, 13 and 16) are transitional lands between terrestrial and aquatic systems. Wetlands are vegetated areas with soils that are saturated for a prolonged period during the growing season. Some wetland habitats are predominantly forested or shrubby, while others have emergent plants such as cattails and sedges, or floating aquatic plants, such as pond-lilies or bog mat vegetation, such as sphagnum mosses. Some wetlands have standing water for much of the year, and some are only seasonally wet.

Often called "nurseries of life," wetlands provide habitat for thousands of species of aquatic and terrestrial plants and animals, not only pond-lilies, turtles, frogs, and snakes, but also waterfowl, fish, and mammals. Migrating birds use wetlands and open waterbodies to rest and feed, and many species of waterfowl, wading birds, and songbirds use wetlands as nesting and nursery sites

Wetlands provide numerous other services of immeasurable value to the human community. They absorb surface runoff from rainwater and snowmelt and allow it to slowly infiltrate the soils, thus reducing the amount of water reaching streams during runoff events. The cumulative action of small and large wetlands in the landscape greatly reduces the volumes and velocity of floodwaters. Wetland soils serve as long-term repositories of carbon if left undisturbed.

Wetlands also process excess nutrients, intercept sediment, and process other pollutants before they reach other waterbodies. Some wetlands are

also great spots for fishing, canoeing, and birdwatching.[39]

Different kinds of wetlands are distinguished from each other by their hydroperiods and types of vegetation.

- **Swamps** are wetlands dominated by woody vegetation.
- **Marshes** are wetlands that have standing water for much of the growing season and are dominated by herbaceous (non-woody) vegetation. Marshes often are found near deeper water bodies such as lakes or ponds or in close association with other wetlands such as wet meadows or swamps.
- A **wet meadow** is also dominated by non-woody vegetation, but it lacks standing water for much of the year. Wet meadows are inundated for periods of time longer than an upland meadow, but shorter than a marsh.
- A **fen** is a low shrub- and herb- dominated wetland fed by calcareous groundwater seepage. Fens almost always occur in areas with limestone bedrock. They are identified by their low, often sparse, vegetation and distinctive plant community, with species such as shrubby cinquefoil, grass-of-Parnassus, and porcupine sedge.

Wetland Habitats in Hillsdale

The following wetland habitats can be found in Hillsdale:

Hardwood Swamp – "Swamp" is the ecologists' term for a wetland dominated by woody vegetation (i.e., trees or shrubs). Swamps can occur at any elevation—on floodplains, in lowland basins, on seepy slopes, or on benches, saddles, or swales at high elevations. Swamps may occur on organic or mineral soils. Our oldest and wettest swamps have developed deep layers of peat.

A hardwood swamp is a forested wetland dominated by hardwood trees such as red maple, green ash, slippery elm, and swamp white oak, and shrubs such as winterberry holly, nannyberry, northern arrowwood, highbush blueberry, and shrubby willows. Swamps on the more alkaline soils of the Harlem Valley may have black ash, American larch, and poison-sumac.

Hardwood swamps are extremely variable in their appearance and plant communities. Some have long-duration standing water in pools between woody hummocks, and others have little or no standing water at all for much of the growing season. Some have lush herbaceous vegetation of ferns, graminoids (grasses, sedges, rushes), and forbs, and others have only sparse ground-layer vegetation.

Swamps provide important habitat for a wide variety of birds, mammals, amphibians, reptiles, and invertebrates, especially swamps that are contiguous with other wetland types or embedded within large areas of upland forest. Hardwood and shrub swamps along the floodplains of clear, low-gradient streams can be an important component of wood turtle habitat. Other turtles such as spotted turtle and eastern box turtle frequently use swamps for summer foraging, drought refuge, and travel corridors.

[39] USEPA, 2018

Pools within swamps are used by several pool-breeding amphibian species and are the primary breeding habitat of blue-spotted salamander. Four-toed salamander uses swamps with rocks or abundant, moss-covered, downed wood or woody hummocks. Eastern ribbon snake forages for frogs in swamps. Red-shouldered hawk, barred owl, great blue heron, wood duck, American black duck, red-headed woodpecker, Canada warbler, and white-eyed vireo nest in hardwood swamps.

Shrub swamps - In Hillsdale, shrub swamps have shrub species similar to those of hardwood swamps, and often occur adjacent to or interspersed with forested swamps or marshes. Less common shrubs are swamp azalea, black huckleberry, and buttonbush. There may be scattered individuals of red maple or green ash, but shrubs constitute most of the canopy. Like forested swamps, shrub swamps have variable hydroperiods, structure, and vegetation. Although many of the wildlife species of forested swamps also use shrub swamps, the open canopy invites a different array of nesting birds and other animals, often overlapping with the wildlife of marshes (see below).

Marsh – A "marsh" is a wetland with standing water for much of the growing season, and dominated by herbaceous (i.e., non-woody) vegetation. Freshwater marshes occur in closed or open basins that are generally flat and shallow. They are associated with lakes, ponds, slow-moving streams, and/or impoundments or ditches. Some typical plants of marshes in Hillsdale are cattail, pickerelweed, bur-reed, and yellow pond-lily. Scattered trees and shrubs may be present but represent less than 25% cover. The substrate is typically muck over mineral soil, but older marshes may have deep layers of peat. Marshes are used by many kinds of wildlife, including fish, turtles,

While adult eastern painted turtles feed mainly on plants but eat some small animals, hatchlings are mainly carnivorous and develop a taste for plants only later in life. Painted turtles must eat in the water because their tongue does not move freely and they have no teeth, so they cannot manipulate food easily on land. Photo © 2020 John Piwowarski

snakes, amphibians, waterfowl, wading birds, songbirds, and mammals. Invertebrates of marshes are often diverse and abundant, using the emergent and submerged vegetation, the water column, and the substrate. Dragonflies and damselflies forage over the marsh.

Wet Meadow – A "wet meadow" is a wetland dominated by herbaceous (i.e., non-woody) vegetation, but with little or no standing water for much of the growing season. Wet meadows occur in agricultural fields, in floodplains, in utility corridors, and at the edges of marshes and other wetlands. Some typical species of Hillsdale's wet meadows are reed canary-grass, soft rush, bulrushes, sedges, sweet flag, sensitive fern, and purple loosestrife. The plant species can be very diverse and very variable from one meadow to the next. Wet meadows are used by many of the same animal species as upland meadows and marshes. Frogs, toads, turtles, and snakes often forage in wet meadows, and birds and dragonflies forage for insects over wet meadows. Red-winged blackbird

and marsh wren nest in sturdy wet meadow vegetation.

Fen – A fen is a rare, low shrub- and herb-dominated wetland that is fed by calcareous groundwater seepage. Fens occur in areas influenced by carbonate bedrock (e.g., limestone and marble), and are identified by their low, often sparse vegetation and their distinctive plant community, with species such as shrubby cinquefoil, grass-of-Parnassus, and porcupine sedge. Tussocky vegetation and small seepage rivulets are often present, and some fens have substantial areas of bare mineral soil or organic muck.[40] Fens are an uncommon habitat in Hillsdale, and today in Columbia County occur only in the eastern-most towns. Hillsdale's fens have not been recently surveyed for rare species, but elsewhere in the Hudson Valley fens are known to support the bog turtle (endangered in NY) and several state-listed rare plant species.

The eastern newt occupies ponds and forests in Hillsdale. Newts hatch from eggs as aquatic larvae, spend 3 or 4 months in water, then emerge on land as juvenile red efts. In two or more years, the eft develops the strong tail seen on the adult pictured here and returns to the pond to breed and to remain for the rest of its life. Photo © 2020 John Piwowarski

The Farmscape Ecology Program documented a small calcareous fen at the base of the Taconic Range east of Mitchell Street in the southeastern corner of the Town of Hillsdale. Among the characteristic and rare fen vegetation, it also had a population of the uncommon orchid shining ladies'-tresses and fringed gentian.[41] A few other fens have been documented by Hudsonia elsewhere in Hillsdale's Harlem Valley.

Intermittent Woodland Pool – An intermittent woodland pool is a "vernal pool" in a forested setting. This is a small wetland with standing water during winter and spring that dries up by mid- to late summer during a normal year and is partially or entirely surrounded by upland forest. Both the seasonal drying and the surrounding forest are critical components of the intermittent woodland pool ecology. These wetlands typically support diverse and abundant invertebrates—some with special adaptations to the intermittent hydroperiod—and amphibian diversity equal to or higher than that of much larger wetlands.[42] Microcrustacea, fingernail clams, a variety of insects, salamanders, frogs, and turtles are typical permanent or temporary users.

Intermittent woodland pools usually have a fringe of large trees at the pool edge and hummocks may be present. Many of these wetlands have little vegetation, but some have sedge tussocks, duckweeds, emergent forbs, mosses, floating filamentous algae, and scattered shrub or small trees. Because of the seasonal drying, these habitats do not support fish, which are avid predators of amphibian eggs and larvae.

[40] Hudsonia, 2008

[41] Strong, 2010

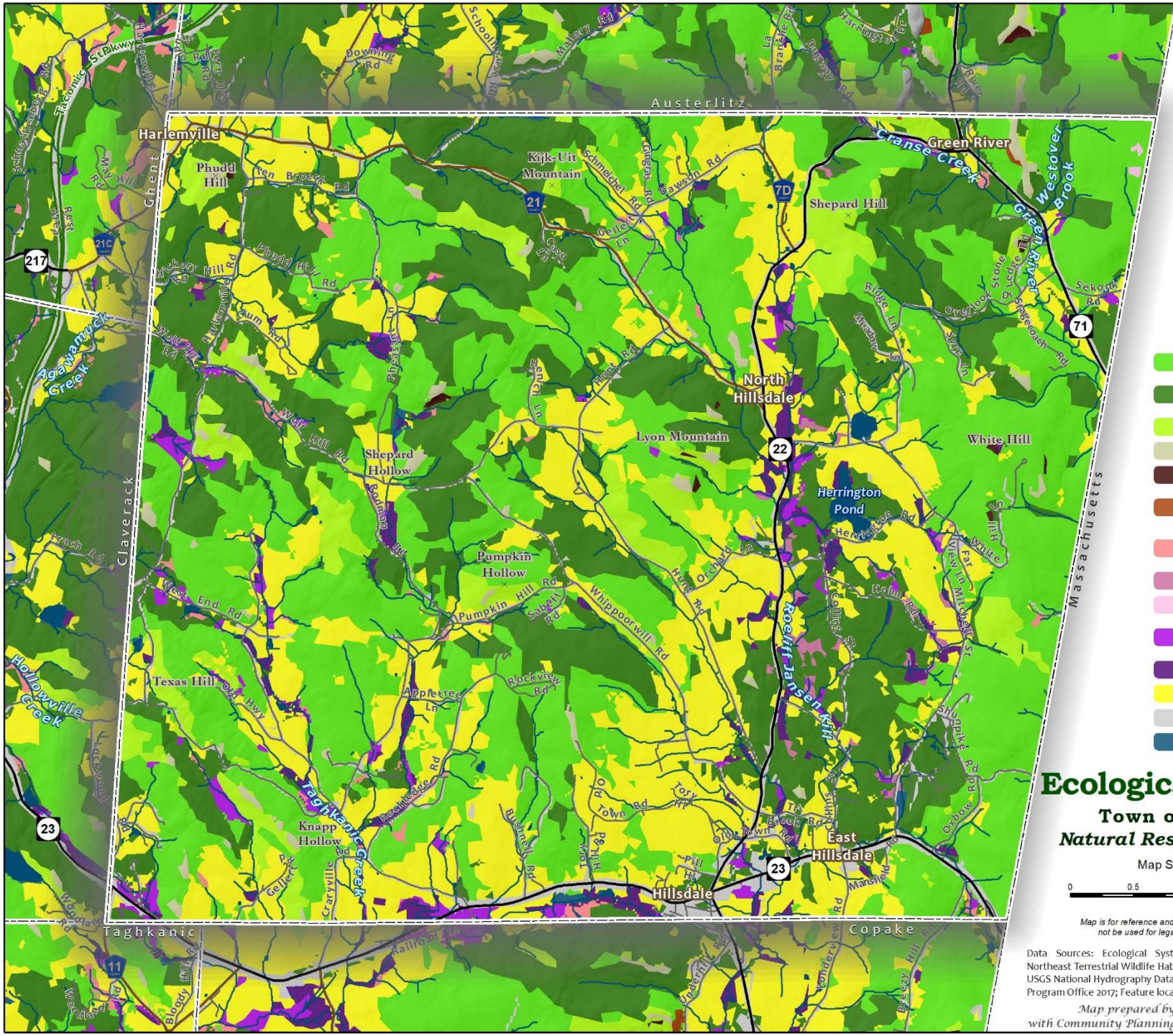
[42] Semlitsch and Bodie, 1998; Semlitsch, 2000

The fish-free environment makes intermittent woodland pools the critical breeding habitat for a special group of amphibians that do not reproduce successfully with fish predation. In Hillsdale these are spotted salamander, Jefferson salamander (NYS Special Concern), and wood frog. Marbled salamander (a NYS Species of Greatest Conservation Need) also uses this habitat elsewhere in the county but is not yet known to occur in Hillsdale. Although these salamanders use the woodland pools for breeding, they spend most of the year in the surrounding upland forest—an essential component of their habitat complex.

Spring/Seep – These are locations where groundwater discharges to the ground surface, either at a single point (spring) or diffusely (seep). Some flow continuously while others flow intermittently. The habitats supported at springs and seeps are determined in part by the amount and duration of water and the chemistry of the soils and bedrock through which the groundwater flows before emerging. Springs and seeps help maintain cool temperatures of many streams, ponds, and wetlands, an important habitat attribute for some fish, amphibians, insects, and other aquatic species. Springs and seeps with more permanent flow also serve as important water sources for animals during droughts and during cold winters when other sources are frozen.

A great blue heron parent heads off, apparently in search for food for its young, which it will feed by regurgitation. Photo© 2020 John Piwowarski

Figure 16



- Hardwood Forest
- Hemlock-hardwood Forest
- Oak-Pine Forest
- Pine-Oak Woodland
- Acidic Ledge and Talus
- Circumneutral Ledge and Talus
- Acidic Hardwood Swamp
- Rich Hardwood Swamp
- Rich Mixed Swamp
- Wet Meadow / Shrub Swamp
- Marsh
- Agricultural
- Developed
- Open Water

Ecological Systems

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Ecological Systems: The Nature Conservancy's Northeast Terrestrial Wildlife Habitat Classification System; Streams: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Streams

Stream habitats include not only the stream channel itself, but also streambanks, floodplains, non-floodplain areas along the bank and adjacent wetlands. This entire corridor along the stream is called the "riparian zone." All these components contribute to the types and quality of habitats in the stream channel itself.

The stream channel offers a variety of different habitats along its length, based on the flow of water, depth of water, and channel substrate. Each pool, riffle, or long run of flowing water offers its own array of microhabitats. Pools with slower moving water may have silty substrates and support submerged vegetation; swift water areas may have a gravelly substrate that some fish species require for spawning; and riffles have rocks and churn that serves to oxygenate the water, which improves the habitat for many sensitive aquatic species.

Rocks, pools, backwater areas, and overhung banks all provide microhabitats important to stream organisms. The vegetation of streambanks and their floodplains helps to determine the stability of the stream channel, the stream water temperature, the kinds of streamside habitats, and the quality of organic material available to feed the stream food web.

Streams may flow year-round or intermittently. Perennial streams flow continuously in years with normal precipitation. They provide essential water sources for wildlife throughout the year and are critical habitat for many plant, vertebrate, and invertebrate species. Intermittent streams may flow for a few days or weeks or months, but ordinarily dry up at some time during the year. They also provide important habitat and nutrient cycling services themselves, and are vital sources of water, nutrients, organisms, and structural material that feed perennial streams, lakes, ponds, and wetlands.[43]

The Roeliff Jansen Kill flowing south from the bridge at Collins Street, muffled in snow. Photo © 2020 Paul Duernberger

[43] Hudsonia, 2008

Many kinds of wildlife rely on streams and riparian corridors, including American mink, muskrat, bats, birds, turtles, salamanders, and dragonflies, damselflies, and many other invertebrates.

While all streams have habitat value, the coldwater streams are especially important to native coldwater fish such as brook trout and slimy sculpin, and the non-native brown trout and rainbow trout. [44]

Coldwater streams have flowing waters with maximum daily temperatures over a seven-day period generally not exceeding 68 degrees Fahrenheit (20 degrees Celsius). Those with other ecological features—fast-flowing, clean, well-oxygenated—can support year-round trout populations.

Figure 9 shows the streams classified by NYSDEC as C(T)—suitable for trout habitat—and C(TS)—suitable for trout spawning. All the mainstems and many of the tributaries of the Taghkanic Creek and Roeliff Jansen Kill include these sensitive habitats.

Brook trout from the New York State Department of Environmental Conservation website

(https://www.dec.ny.gov/animals/94572.html)

[44] Cohen, 2017

Plants

Trout-lilies, here in woods off County Route 21, got their name from the mottled leaves that recall the skin of brook trout. They are true spring ephemerals, small plants that hurry to flower before the forest canopy shades them and then quickly disappear until next year. Photo © 2020 John Piwowarski

Plants of Hillsdale, including trees, shrubs, forbs, graminoids, mosses, liverworts, lichens, and algae, are diverse and occupy all the varied habitats of the Town. There is no comprehensive list of plants for the Town, but Rogers McVaugh[45] included descriptions and lists of some Hillsdale sites in his *Flora of Columbia County* (1957), and the Hawthorne Valley Farmscape Ecology Program and Hudsonia have surveyed plants at a few other sites. Most places in the Town, however, have never been surveyed by biologists for plants or animals.

The presence and abundance of any plant species at any location depend on conditions of moisture, temperature, light, soil or rock texture, the chemistry of the substrate (soil, water, rock), relationships with other plants, and other factors.

Some plants, including many of our tree species, depend on the intermediary services of fungi to obtain essential nutrients, and will not thrive where the fungi are absent. Some plants are parasitic on other plants, such as beechdrops on American beech, squawroot on oak, and one-flowered cancer root on goldenrods and sunflowers.

Native plants and plant communities of all kinds are important contributors to local ecosystems, but rare and uncommon species of plants and animals are of particular conservation concern because they are in the greatest danger of disappearing from our landscapes. Some are rare because they occur only in rare habitats; some are rare because they are at or near the edge of their distribution range and are living close to the limits of their environmental tolerances; some are in populations that have become isolated from their main populations, and have limited resilience due to a small population size or a depleted gene pool. Some are in habitats that have been stressed by pollution, overgrazing by deer or livestock, extreme weather events, or the many effects of the warming climate. The effects of past land uses, such as grazing or tilling, and the effects of past catastrophic events (hurricanes, tornadoes, floods, wildfire, diseases) can sometimes be detected in plant communities of today.

Rare species can show up anywhere, but the most likely places to find them are in habitats that are

[45] McVaugh, 1959

themselves rare or uncommon. In Hillsdale, those would be places such as fens, calcareous ledges, calcareous upland or wet meadows, or limestone forests in the Harlem Valley, acidic ledges on the Taconic Ridge, or acidic or alkaline bogs. These and other habitats should be surveyed as needed on a case-by-case basis wherever proposed new land uses pose potential risks to rare species. Known historical and present-day occurrences of state-listed rare plants in Hillsdale are given in Table 1. Other rarities are also likely here and may turn up in future surveys.

Table 1. Rare plants observed in Hillsdale. Observations are from the Farmscape Ecology Program or Hudsonia Ltd. (G. Stevens pers. comm.), or from Rogers McVaugh (1957).

Common Name	Scientific Name	Statewide Rank[1]	Habitat
Culver's-root	*Veronicastrum virginicum*	T, S2	oldfield
forked rush	*Juncus dichotomus*	S2	calcareous shrub swamp
hairy angelica[2]	*Angelica venenosa*	R, S3	dry woods
lesser bladderwort	*Utricularia minor*	R, S3	calcareous marsh
ovate spikerush	*Eleocharis ovata*	E, S1S2	marsh, pond edge
prickly coontail	*Ceratophyllum echinatum*	R, S3	calcareous pond
slender knotweed	*Polygonum tenue*	R, S3	oldfield, shaly or sandy knoll
sundial lupine[2]	*Lupinus perennis* ssp. *perennis*	R, S3	shaly hillside
swamp-pink[2]	*Arethusa bulbosa*	T, S2	bog

[1] Statewide ranks:
NYS ranks: E = Endangered; T = Threatened; R = Rare (Environmental Conservation Law 6CRR-NY 193.3)

NYNHP ranks: S1 = critically imperiled; S2 = imperiled; S3 = vulnerable. A double rank (e.g., S1S2) is applied to those species for which more field surveys are required to reconcile recent observations and historical records.

[2] Historical observation only by Rogers McVaugh in the 1930s.

The wild flora of Hillsdale includes a mix of native species and non-natives that have been introduced in the last 350+ years, mostly from other parts of North America or from Eurasia. Many of the non-native grasses of pastures and hayfields were brought here by early settlers to promote European-style agriculture, and many other plants were brought as ornamentals and have since spread into forests, shrublands, meadows, wetlands, and roadsides. Some plants were brought here unintentionally on ships or other vehicles, with imported goods, or in travelers' luggage.

Many non-native plants are apparently harmless in their new environments, occurring as single individuals or in small stands that do not readily spread. But some reproduce and spread rapidly,

and threaten native plants and communities directly through competition, or indirectly by altering soil chemistry, soil microbiota, nutrient cycling, vegetation structure, or plant community composition.[46] These are the "non-native invasive plants" that are of great concern to ecologists and conservationists.

Appendix Table B-4 lists many of the non-native invasive plants that occur in Columbia County, their status in the region, and their typical habitat(s). Removing these plants from landscaped areas reduces their chances of spreading into nearby habitats and disrupting native biological communities.

The Capital-Mohawk Partnership for Regional Invasive Species Management (Cap-Mo PRISM) acts as a clearinghouse for information on non-native invasive species in Columbia County and other counties to the north and west, and provides information and services for education, early detection, and control of non-native invasive plants and animals.

A thicket of Japanese knotweed. Citation: Tom Heutte, USDA Forest Service, from https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd529922.pdf

[46] Travis and Kiviat, 2016

Wildlife

Hillsdale's wildlife takes advantage of the great variety of habitats and conditions here—meadows, forests, ledges, wetlands, streams, high and low elevations, shady and cool or exposed and warm, moist or droughty, and acidic or alkaline. Each animal species is associated with a particular habitat or complex of habitats that fulfills its particular life history needs for food, breeding, shelter, resting, and overwintering.

Many kinds of wildlife require two or more different kinds of habitats along with safe ways to move between them. A spotted salamander, for example, needs upland forest habitat with intact forest floors for foraging and shelter in the warm months and through the winter, needs vernal pools for breeding and nursery habitat, and needs safe travelways between pools and forests. The great blue heron uses dead or dying trees for nesting, usually in standing water to reduce the threat of predators, and a variety of marsh, wet meadow, pond, and stream habitats for foraging. A bobcat needs a (usually) forested area remote from human activity for denning and nursery habitat, and a variety of other forest, meadow, and wetland habitats for hunting.

There have been no comprehensive surveys of wildlife in Hillsdale. Several NYS-sponsored statewide surveys have documented breeding birds, fishes, reptiles, amphibians, dragonflies, and damselflies, but even those were snapshots of certain areas at certain times and did not cover large areas of the Town. Many of the other reliable reports are anecdotal from the field notes of biologists and naturalists, or from incidental collections submitted to the New York State Museum.

Many kinds of wildlife—such as moths, ants, beetles, bees, and spiders—have received little attention from biologists in the region, despite their great importance to intact ecosystems. Fortunately, the Hawthorne Valley Farmscape Ecology Program has been examining some of these groups and developing preliminary lists for Columbia County. See (https://hvfarmscape.org/biodiversity-columbia-county).

In subsections below and in the appendix are lists of some of the wildlife species known to occur in Hillsdale, and some general discussions of habitats and ecology.

The large eastern tiger swallowtail is one of our most noticeable butterflies. Here it nectars on New York ironweed. Photo © 2020 David Lewis

Invertebrates

The term "invertebrates" refers to all the animals that lack a vertebral column, and includes such animals as insects, crustaceans, earthworms, millipedes, mollusks, and many other groups. These animals play indispensable roles in our ecosystems, acting as decomposers, soil builders,

pollinators, distributors of seeds, grazers, predators, and prey.

We notice some of them because of their beauty (butterflies, fireflies), some because of their apparent usefulness to human endeavors (earthworms, bees), and some because they are pests (carpenter ants, cabbage worms, mosquitoes), but many others carry out their important work while all but invisible to us. Below are descriptions of just a few types of invertebrates, barely scratching the surface of this immense and essential group.

Bees

Of all our pollinating insects, bees are the most important pollinators for wild and domestic plants. They collect both nectar and pollen as food and, unlike most of our other pollinators (butterflies, moths, beetles, wasps, flies) have physical structures especially evolved for transporting pollen.[47]

New York State is home to an estimated 416 wild bee species. Of these, 21 species are introduced (including the honeybee) and 395 are considered native. Many of our native bee species are active earlier and later in the day, earlier and later in the season, and in wetter and colder conditions than the non-native honeybee,[48] and so can reach plants that would be missed by honeybees.

Native bees collect nectar and pollen from a variety of plant species, but a few specialize on a particular species, genus, or family of plants for their pollen sources. For example, squash bees specialize on pollen from squashes, pumpkins, and cucumbers; a species of *Macropis* bumble bee specializes on loosestrifes (*Lysimachia*); and the pickerel bee specializes on pickerelweed.

Some native bees are more efficient pollinators than honeybees for certain plants with tightly held pollen, such as tomatoes, potatoes, and blueberries. They can use a special "buzz-pollination" technique, vibrating their flight muscles at a certain frequency to induce the flowers to release their pollen. The pollen is largely inaccessible to honeybees and other pollinating insects that lack the buzz-pollination capability.

Populations of many native bee species in North America have been declining due, apparently, to causes such as habitat loss, pesticides, pathogens, pollution, invasive species, and climate change.[49] Bees are especially sensitive to pesticides (fungicides, herbicides, insecticides, rodenticides) and other toxins which they can absorb through their exoskeleton and also consume in contaminated nectar or pollen. Many of our native bee species nest underground, so are vulnerable both to above-ground pesticide applications and to soil fumigants.[50]

Native bees need areas with nesting habitat as well as nectar- and pollen-producing plants. Ground-nesting bees need bare or sparsely vegetated, friable soils for their tunnels and brood cells. Other bees nest in hollow stems of woody plants or in channels created by beetles or other animals in standing trees or downed wood.[51]

[47] Mader et al., 2011

[48] Ibid.

[49] Potts et al., 2016

[50] Mader et al., 2011

[51] Ibid.

Maintaining landscapes with diverse open and forested habitats that are free of toxic contaminants may be the best way to help sustain our populations of native bees, honeybees, and other insects that we rely on for pollination and a host of other services.

Dragonflies and Damselflies

Dragonflies and damselflies ("odonates") play key roles in ecosystems and are sometimes used as indicators of habitat quality and the health of aquatic ecosystems. They are predators in both their nymph and adult stages, and are themselves important prey of fish, amphibians, birds, bats, and other organisms. They are sensitive to the water chemistry, temperatures, and flows in their stream, pond, or wetland environments, as well as the kinds of vegetation, and the kinds of aquatic predators present.

Odonates are aquatic in the larval (nymph) stage, and some are more sensitive than others to conditions of water temperature, water clarity, or dissolved oxygen levels. Some species are closely tied to particular habitats such as acidic bogs, seeps, or rocky streams, and others use a wider range of habitats. The adults of some species hunt mainly over wetlands, ponds, and streams, and other species hunt over upland meadows or along forest edges.

From a 2005-2009 state-sponsored odonate survey conducted throughout the state,[52] and other observations by the Farmscape Ecology Program, 101 odonate species are known to occur in Columbia County (Appendix Table B-1). Many of these were documented in or are likely to occur in Hillsdale. At least 20% of all North American odonates are considered to be at risk of extinction, and the loss and degradation of wetland and stream habitats seem to be the major causes.[53]

A great spangled fritillary butterfly, nectaring on wild bergamot in a field at Rheinstrom Hill Sanctuary. This is the largest and most common fritillary in our area, and while it is still fairly common, its numbers have declined significantly in the last half-century. Photo © 2020 David Lewis

Butterflies and Moths

Butterflies and moths help to pollinate plants, serve as important prey to other organisms—including other insects, spiders, reptiles, amphibians, mammals, and birds—and, as caterpillars, consume large amounts of vegetation. Some species of butterflies and moths are closely tied to particular habitats or plant species, and many are very sensitive to environmental contaminants, such as pesticides.

Adults of butterflies and moths feed primarily on nectar, and the larvae (caterpillars) feed on plant tissue. (An exception is the carnivorous larva of the harvester butterfly, which feeds on aphids.) The larvae of many species are generalists—feeding on a great variety of plants—but some are much more specialized, consuming only particular species or

[52] White et al., 2010

[53] White et al., 2014

genera or families of plants. For example, the caterpillars of many of the skippers feed on grasses or sedges; those of the spicebush swallowtail feed on spicebush; and those of the meadow fritillary feed on violets. Some other host plants for butterfly larvae are asters (gray comma), gooseberries and currants (eastern comma), docks (bronze copper), and eastern red cedar (juniper hairstreak). Cresses, clovers, nettles, willows, oaks, and hickories are also hosts for many other butterfly species of the county.

Appendix Table B-2 lists the butterflies known to occur in Columbia County and their known host plants. Good sources of larval food plants and nectar sources are key components of butterfly and moth habitat. The hundreds of moth species known to occur in Columbia County are not listed here, but a preliminary list is in the Natural Resources Inventory for Columbia County, New York, and an illustrated list is being developed by the Farmscape Ecology Program at https://hvfarmscape.org/moths.

In addition to food sources, butterflies and moths also need safe places for egg-deposition, pupation, and overwintering. Most species overwinter here as eggs, pupae, or adults;[54] only a few migrate. Pupation usually occurs in tall herbaceous vegetation, shrubs, trees, or woody debris, so leaving untidy patches of undisturbed soils and vegetation in fields or at field edges will help to maintain appropriate microhabitats. The few butterflies and moths that overwinter as adults find shelter in tree cavities, under loose bark, under logs, rocks, or in similar features. Thus, unmowed meadows and unmanaged meadow and forest edges can provide valuable wintering habitat for pupae and adults of butterflies and moths.

Mollusks

Mollusks include clams, mussels, snails, slugs, and many other animals. They occur in all kinds of upland, wetland, and aquatic habitats, where they consume algae and organic debris from the surfaces of rocks, plants, water, and soil, and serve as food sources for other animals—e.g., crayfishes, fishes, amphibians, turtles, waterfowl, and mammals. Many aquatic mollusks are sensitive to low levels of dissolved oxygen and even small amounts of pollutants, and so are good indicators of water quality.

Most land snails (including shelled snails and slugs) live in the leaf litter of forests, organic debris (thatch) of old fields, and in wetlands, but some also use gardens, agricultural fields, and lawns. They feed on live and dead herbaceous material, bark, rotting wood, fungi, and algae, and are eaten by invertebrate predators, as well as salamanders, turtles, small mammals, and birds.[55]

Most of our land snails are native to the region, but a few non-natives have become pests to farmers and gardeners. Many of the aquatic mollusks (of non-tidal habitats) and land snails listed in the *Natural Resources Inventory for Columbia County, New York* could occur in the habitats of Hillsdale.[56]

[54] Cech and Tudor, 2005

[55] Hotopp et al., 2018

[56] Stevens and Travis, 2018

Fishes

The fishes of Hillsdale occupy our swift-running hillside streams and our more sluggish and meandering lowland streams, as well as lakes and ponds. Some species even use intermittent streams—those that dry up annually—for certain parts of their life cycles. The fish populations found in any habitat will vary depending on habitat characteristics such as water velocity, water temperature, turbidity, dissolved oxygen levels, and substrate qualities.

Species such as bridle shiner and fathead minnow inhabit slow-moving streams or ponds, and are somewhat tolerant of polluted waters, but others such as brook trout and slimy sculpin need faster-flowing, clean, cool, well-oxygenated streams. Table 2 lists the fish species known to occur or likely to occur in Hillsdale streams.

To support recreational fishing, NYSDEC stocks brown trout annually in many Columbia County streams and ponds but has done no stocking in or near Hillsdale in recent years. Recreational fishermen occasionally stock other non-native game fishes in ponds that escape into streams where they, along with brown trout, compete with brook trout and other natives for habitat and food resources.

Streams that support wild-reproducing brook trout and other organisms requiring clean, well-oxygenated, coldwater habitats are a declining resource in the Hudson Valley due to water pollution, stream-bed siltation, removal of forest canopies in the stream corridors, altered stream flows, and other consequences of human activities. But Hillsdale still has many high-quality streams that have been classified by NYSDEC as "trout streams" or "trout spawning streams"(Figure 9).

Figure 17 shows zones along selected streams and lakes that have been designated by the NYNHP as Areas of Known Importance for sensitive coldwater stream habitats. Those mapped areas include wild brook trout locations identified in NYSDEC fish surveys since 1980, and zones along associated stream and waterbody segments that are most likely to affect the stream habitat quality. (The map does not account for stream habitat fragmentation that might be caused by dams and inadequate culverts preventing trout from occupying some of these areas.)

The identification and mapping of these coldwater stream habitat areas is intended to promote conservation and stewardship to help maintain or restore high quality streams that may support wild native brook trout and other sensitive stream organisms. The map does <u>not</u> indicate areas with public fishing rights, however, and many of these mapped areas are unsuitable for recreational trout fishing due to small fish populations and small fish sizes.

Table 2. Fishes known or likely to occur in Hillsdale (Robert E. Schmidt, pers. comm.).

Common name	Scientific name	Native (Yes/No)	CC Status[1]	Statewide Status[2]	Streams	Ponds/ Lakes
bluegill	*Lepomis macrochirus*	N	U		x	x
brook trout	*Salvelinus fontinalis*	Y	U	SGCN	x	x
brown bullhead	*Ameiurus nebulosus*	Y	U		x	x
brown trout	*Salmo trutta*	N	C		x	x
chain pickerel	*Esox niger*	Y	U		x	x
common carp	*Cyprinus carpio*	N	U		x	x
common shiner	*Luxilus cornutus*	Y	C		x	x
creek chub	*Semotilus atromaculatus*	Y	C		x	x
eastern blacknose dace	*Rhinichthys atratulus*	Y	C		x	x
fallfish	*Semotilus corporalis*	Y	C		x	x
fathead minnow	*Pimephales promelas*	N	U		x	x
golden shiner	*Notemigonus crysoleucas*	Y	C		x	x
grass carp	*Ctenopharyngodon idella*	N	U			x
largemouth bass	*Micropterus salmoides*	N	U		x	x
pumpkinseed	*Lepomis gibbosus*	Y	U		x	x
redfin pickerel	*Esox americanus americanus*	Y	U		x	
tessellated darter	*Etheostoma olmstedi*	Y	C		x	x
white sucker	*Catostomus commersonii*	Y	C		x	x
yellow perch	*Perca flavescens*	Y	U		x	x

[1] Columbia County (CC) status: C = common; U = uncommon.

[2] NY State Rank: SGCN = Species of Greatest Conservation Need

Amphibians and Reptiles

Amphibians and reptiles occur in all parts of the Hillsdale landscape, including intermittent and perennial streams, wetlands of all kinds, upland meadows, shrublands, forests, and exposed ledges and talus. Table 3 lists all the amphibian and reptile species known to or likely to occur in Hillsdale, and the kinds of habitat where they are likely to occur.

For example, the red-backed salamander is found in upland forests, the slimy salamander is found in upland forested talus, and the northern dusky and the two-lined salamander are closely associated with forested streams and seeps. Jefferson salamander, spotted salamander, and wood frog are in the special group of vernal pool-breeding amphibians that use vernal pools for breeding and nursery habitat in spring and the surrounding upland forest the rest of the year. Similarly, the gray treefrog and spring peeper need wetlands and ponds for breeding but are otherwise terrestrial.

Common garter snake and DeKay's brown snake use all kinds of upland habitats (and some wetlands), including yards and gardens. Black rat snake and black racer also use many upland habitats during the warm months. They overwinter in deep rock crevices or rock talus, or sometimes other sheltered areas including the basements of buildings. Ring-necked snake is mainly found in or near upland forests. Smooth green snake uses wet meadows more than other habitats. The northern watersnake is our only aquatic snake (although other snakes are fine swimmers); it uses many kinds of wetlands, ponds, and streams, and rarely moves far from wet areas. The eastern ribbon snake is the other snake most closely associated with wetlands. No venomous snakes are known to occur in Hillsdale, although that could change with the warming climate.

Common garter snakes inhabit woods, as well as a wide variety of other habitats, including meadows, marshes, and suburban or urban areas with plenty of cover. Photo © 2020 John Piwowarski

Table 3. Amphibians and reptiles known to or likely to occur in Hillsdale. Occurrence data are from the New York State Reptile and Amphibian Atlas (https://www.dec.ny.gov/animals/7140.html) and the New York Natural Heritage Program.

Common name	Scientific name	Habitat	Statewide Status[1]
SALAMANDERS			
blue-spotted salamander	*Ambystoma laterale*	swamp, vernal pool, upland forest	SC
eastern newt	*Notophthalmus viridescens*	perennial pond, other wetland, upland forest	
eastern red-backed salamander	*Plethodon cinereus*	upland forest	
four-toed salamander[2]	*Hemidactylium scutatum*	swamp, upland forest	SGCN[HP]
Jefferson salamander	*Ambystoma jeffersonianum*	vernal pool, upland forest	SC
northern dusky salamander	*Desmognathus fuscus*	cool stream	
northern slimy salamander[2]	*Plethodon glutinosus*	talus, upland forest	
northern two-lined salamander	*Eurycea bislineata*	small forested stream	
spotted salamander	*Ambystoma maculatum*	vernal pool, upland forest	
TOADS & FROGS			
American toad	*Anaxyrus americanus*	everywhere	
bullfrog	*Rana catesbeiana*	pond, marsh	
gray treefrog	*Hyla versicolor*	shallow pool, upland forest	
green frog	*Rana clamitans*	pond, marsh	
northern leopard frog[2]	*Rana pipiens*	pond, marsh, meadow	
pickerel frog	*Rana palustris*	meadow, forest, wetland	
spring peeper	*Pseudacris crucifer*	upland forest, wetland	
wood frog	*Rana sylvatica*	vernal pool, upland forest	
TURTLES			
eastern box turtle[2]	*Terrapene carolina*	upland forest, meadow	SC
painted turtle	*Chrysemys picta*	pond, marsh, stream	
snapping turtle	*Chelydra serpentina*	pond, lake, wetland, meadow	SGCN
common musk turtle[3]	*Sternotherus odoratus*	stream, marsh, pond	SGCN[HP]
spotted turtle[2]	*Clemmys guttata*	wetland, upland forest	SC
wood turtle[2]	*Glyptemys insculpta*	perennial stream, upland forest, meadow	SC
SNAKES			
common garter snake	*Thamnophis sirtalis*	everywhere	
Dekay's brown snake	*Storeria dekayi*	forest, meadow, wetland, yard	
eastern rat snake[2]	*Elaphe alleghaniensis*	forest, ledge, talus	SGCN
eastern ribbon snake[2]	*Thamnophis sauritus*	open wetland	SGCN
milksnake	*Lampropeltis triangulum*	meadow, forest, barnyard	
northern water snake	*Nerodia sipedon*	pond, lake, wetland, stream	

Common name	Scientific name	Habitat	Statewide Status[1]
Table 3. (cont.)			
SNAKES (cont.)			
red-bellied snake[2]	*Storeria occipitomaculata*	forest, meadow, wetland, yard	
ring-necked snake	*Diadophis punctatus*	forest, forest opening	
smooth greensnake[3]	*Liochlorophis vernalis*	wet meadow, other wetland, open forest	SGCN

[1] New York State ranks:
E = Endangered; T = Threatened; SC = Special Concern (Environmental Conservation Law 6NYCRR Part 182.[g])
SGCN = Species of Greatest Conservation Need
SGCN^{HP} = Highest Priority Species of Greatest Conservation Need (http://www.dec.ny.gov/animals/9406.html)
(The SGCN rank also applies to all species ranked as E or T.)
[2] Not documented in Hillsdale but occurs in nearby towns and is likely to occur here.
[3] Not documented in Hillsdale or adjacent towns but could occur here.

The most common turtles in Hillsdale are painted and snapping turtles. These species use a wide range of wetland and pond habitats and nest in unshaded upland areas near those wetlands. Painted turtles are often seen basking on logs, rocks, or shorelines, and both species are often seen crossing roads during their nesting migrations in the spring or early summer. Other turtles are less conspicuous, and more specialized in their habitat needs. All but the painted turtle are listed as NYS Species of Greatest Conservation Need.

The wood turtle spends much of its time, including winter, in and near lowland perennial streams but may travel 800 ft or more from those streams for foraging, resting, and nesting. The spotted turtle uses a variety of wetland and upland habitats. It overwinters in wetland; nests in unshaded wetland or upland habitats in the spring; and spends long periods in upland habitats in summer, resting and moving between wetland habitats for foraging. The box turtle is largely terrestrial, spending most of its life in upland forests, shrubland, and meadows, but it uses wetlands or ponds occasionally in the summer, especially during heat waves or droughts.

Wild turkeys nest on the ground in moderately dense understory of forests, or occasionally fields, which provide ground cover for their nests while providing visibility of the surrounding areas. Large continuous areas of such cover provide the eggs and nestlings with some protection from predators, including raccoons, opossums, skunks, foxes, birds, woodchucks, rodents, bobcats, and snakes. Photo © 2020 Bob Kessler

Birds

Breeding birds of Hillsdale include waterfowl, shorebirds, wading birds, raptors, songbirds, and others. Most bird species are associated with particular kinds of habitats, so knowing the types and characteristics of habitats helps to predict the kinds of birds that are likely to nest, roost, or hunt there. Some nest alongside streams, ponds, and

wetlands (spotted sandpiper), some need marshy areas next to permanent open water (pied-billed grebe), some need the interior areas of large meadows (eastern meadowlark, bobolink) or large forests (worm-eating warbler). Some use hedgerows, forest edges, or shrublands (brown thrasher, blue-winged warbler), and some are closely allied with beaver ponds (great blue heron). Some species do well in human-settled landscapes, where they take advantage of lawns, gardens, shade trees, hedgerows, pastures, crop fields, or even buildings and bridges, and others need to nest in places that are distant from human activity.

Large forests are especially important for some of our migratory songbirds, such as black-throated blue warbler, scarlet tanager, and ovenbird. They require the conditions of deep interior forest areas where they are somewhat protected from the nest predators and brood parasites that frequent open areas and forest edges.

Large meadows are similarly important for grassland breeding birds, such as bobolink, grasshopper sparrow, and vesper sparrow, that nest in the deep interiors of large meadows where they have some protection from the predators that frequent meadow edges.

Shrubland-nesting birds include species such as common yellowthroat, chestnut-sided warbler, prairie warbler, blue-winged warbler, and brown thrasher. Loss of shrubland due to declining agriculture may be responsible in part for the declining populations of many shrubland birds.

Breeding birds of Hillsdale are listed in Appendix Table B-3. The persistence of Hillsdale's bird populations depends on the maintenance of suitable nesting and foraging habitat. Populations can be harmed by fragmentation of large meadows

A house wren perched in a field just off County Route 21. House wrens inhabit brushy woodlands, hedgerows, and gardens throughout North America. They nest in cavities, including nooks and crannies in houses, farm buildings or, as here, wren houses. Photo © 2020 John Piwowarski

or large forests, loss of suitable habitat due to natural succession or to land development, pesticides that contaminate invertebrate or plant food sources, water pollution, human-subsidized predators, and climate change.

Mammals

Like other animals, Hillsdale's mammal species are associated with particular habitats that serve their life history needs. Bobcat, black bear, eastern coyote, gray fox, and red fox use many kinds of forested and open, wetland and upland habitats for hunting and foraging, but often retreat to places remote from human activity for denning. Striped skunk and raccoon also use many habitats for foraging; they usually den in forests but also use human structures at times.

American beaver, muskrat, river otter, and mink spend most of their time in or near streams, ponds, lakes, and marshes. Fisher is mainly an animal of forests but is sometimes seen in open habitats in

pursuit of prey and forage. Long-tailed weasel hunts in a variety of open, shrubby, and forested habitats, including farmyards, wherever they can find abundant rodents.

Woodchuck sometimes has a summer burrow in a meadow and a winter burrow in nearby forest where it is more protected from the elements. Meadow vole inhabits meadows, especially those with a generous layer of thatch.

Many mammal species, such as gray squirrel, striped chipmunk, white-tailed deer, and raccoon, are well-adapted to human-settled landscapes, where they take advantage of our crop fields, lawns, gardens, and buildings. Table 4 lists the mammals known to or likely to occur in Hillsdale.

No bats are known to winter in Hillsdale, but several species use open and forested habitats for summer roosting, nursery areas, and foraging. They typically hunt over meadows, marshes, and stream corridors with abundant flying insects.

Of the nine bat species that are known to occur or could occur in Hillsdale, all but two are listed as NYS Species of Greatest Conservation Need (SGCN). Many of the bat species that winter in caves have been devastated by white-nose syndrome (WNS), a fungal disease that has spread rapidly through eastern caves since 2006. New York populations of Indiana bat, eastern pipistrelle, northern long-eared bat, and little brown bat, for example, have suffered over 90% mortality from WNS.

Maintaining high-quality habitat for summer roosting and foraging and minimizing the use of pesticides (which kill and contaminate the insect prey of bats) will help to support bats and minimize additional stresses while their populations are struggling to survive the WNS.

The New England cottontail is New York's only native cottontail east of the Hudson River. Once common in eastern New York and New England, it is now very rare. (It looks similar to the non-native eastern cottontail which is much more common.) Hillsdale is within the historical range of the New England cottontail, and it could still occur here but has not been found in recent years.

Unlike the eastern cottontail which uses a great variety of meadow, shrubland, hedgerow, and forest edge habitats, the New England cottontail is closely tied to dense shrub thickets that provide extra protection from predators. Upland shrublands with dense shrub thickets are rare in the Town but managing shrublands to promote these special habitats could help to bring our native cottontail back to its former home.

White-tailed deer are considered a "keystone" species in forests of the Northeast whose presence, abundance, and behavior strongly influence forest structure and plant species composition. Deer have been here since before the arrival of the first humans and were an essential source of food, clothing, shelter, and tools for Native Americans. In the century and a half after European settlement of the region the combination of forest clearing and over-hunting drove deer to extinction in most Hudson Valley counties. Extirpation of top predators, increasing farmland abandonment, a ban on deer hunting in the early 1900s, and subsequent limits on hunting take and hunting seasons led to a gradual increase

in the local population, which reached explosive levels by the late 20th century.[57]

The large numbers of deer today create nuisances for gardeners, economic losses for farmers, hazards for motorists, ecological problems in forests, and health hazards for people due to the role of deer in the life cycle of the black-legged tick which transmits Lyme disease to humans and other mammals.

Back in the 19th century we eliminated the top predators of deer—timber wolf and eastern cougar— so today with the decline of recreational hunting in recent decades and the abundant food resources in our crop fields and gardens, there is little to check the growth of the deer population. When populations are high, their selective browsing and seed predation prevents the regeneration of many forest tree, shrub, and wildflower species, and encourages infestations of non-native plants.

Litter disturbance, soil compaction, and changes in soil chemistry from over-use by deer can further promote non-natives. In these ways, deer can drastically alter the plant communities of forests, eliminate the shrub and ground-layer vegetation, and eliminate nest sites, cover, and food sources for a large array of wildlife.[58]

Although the current situation is severely out of balance, white-tailed deer are nonetheless an indigenous and valuable component of northeastern ecosystems, so the challenge is to find ways to reduce their local population to the modest level that fits the carrying capacity of the land.

This fawn is part of the white-tailed deer population explosion. The deer population is probably greater than ever in history, due to factors such as extirpation of major predators, abundant food sources, decline of deer hunting, and expansion of human-settled areas where deer are somewhat shielded from hunters and predators. Their numbers are so great that the deer are altering the patterns of forest succession and of the dominant tree species. Photo © 2020 John Piwowarski

[57] Travis and Stevens, 2018

[58] Waller and Alverson, 1997; Sullivan et al., 2016

Table 4. Mammals of Columbia County that occur or may occur in Hillsdale. Occurrence data are from Whitaker (in prep), and G. Stevens (pers. comm.).

Common name	Scientific name	Statewide Status[1]
MARSUPIALS		
Virginia opossum	*Didelphis virginiana*	
INSECT-EATERS		
masked shrew	*Sorex cinereus*	
northern short-tailed shrew	*Blarina brevicauda*	
smoky shrew	*Sorex fumeus*	
eastern mole	*Scalopus aquaticus*	
hairy-tailed mole	*Parascalops breweri*	
star-nosed mole	*Condylura cristata*	
BATS		
big brown bat	*Eptesicus fuscus*	
eastern red bat	*Lasiurus borealis*	SGCN
eastern small-footed bat[2]	*Myotis leibii*	SC, SGCN
hoary bat	*Lasiurus cinereus*	SGCN
Indiana bat[2]	*Myotis sodalis*	E, SGCN^{HP}
little brown bat	*Myotis lucifugus*	SGCN^{HP}
northern long-eared bat	*Myotis septentrionalis*	T, SGCN^{fHP}
silver-haired bat	*Lasionycteris noctivagans*	SGCN
tri-colored bat	*Perimyotis subflavus*	SGCN^{HP}
CARNIVORES		
black bear	*Ursus americanus*	
raccoon	*Procyon lotor*	
ermine	*Mustela erminea*	
fisher	*Martes pennanti*	
long-tailed weasel	*Mustela frenata*	
mink	*Mustela vison*	
river otter	*Lutra canadensis*	
striped skunk	*Mephitis mephitis*	
eastern coyote	*Canis latrans*	
gray fox	*Urocyon cinereoargenteus*	
red fox	*Vulpes vulpes*	
bobcat	*Lynx rufus*	
RODENTS		
woodchuck	*Marmota monax*	
northern flying squirrel[2]	*Glaucomys sabrinus*	
southern flying squirrel	*Glaucomys volans*	
eastern gray squirrel	*Sciurus carolinensis*	
red squirrel	*Tamiasciurus hudsonicus*	
eastern chipmunk	*Tamias striatus*	

Common name	Scientific name	Statewide Status[1]
Table 4. (cont.)		
RODENTS (cont.)		
American beaver	*Castor canadensis*	
deer mouse	*Peromyscus maniculatus gracilis*	
white-footed mouse	*Peromyscus leucopus*	
southern bog lemming[2]	*Synaptomys cooperi*	
meadow vole	*Microtus pennsylvanicus*	
southern red-backed vole	*Clethrionomys gapperi*	
woodland vole[2]	*Microtus pinetorum*	
muskrat	*Ondatra zibethicus*	
Norway rat	*Rattus norvegicus*	
black rat	*Rattus rattus*	
house mouse	*Mus musculus*	
meadow jumping mouse	*Zapus hudsonius*	
woodland jumping mouse	*Napaeozapus insignis*	
common porcupine	*Erethizon dorsatum*	
HARES & RABBITS		
eastern cottontail	*Sylvilagus floridanus*	
New England cottontail	*Sylvilagus transitionalis*	SC, SGCN^{HP}
HOOFED MAMMALS		
white-tailed deer	*Odocoileus virginianus*	

[1] Statewide rarity ranks are explained in Appendix C:
E = Endangered; T = Threatened; SC = Special Concern
SGCN = Species of Greatest Conservation Need
SGCN^{HP} = Highest Priority Species of Greatest Conservation Need
S1, S2, S3 = NYNHP ranks

[2] Occurrence in Columbia County is uncertain.

Opossums are usually nocturnal and are seldom seen in the daytime under a bird feeder, as here, near Route 21. They are omnivorous and will eat whatever they can find, including vertebrates, invertebrates, plant materials, and bird seed in the winter. They are preyed upon by a wide range of other creatures, including owls, domestic dogs, coyotes, red foxes, raccoons, bobcats and large snakes, among others. Photo © 2020 John Piwowarski

Important Areas for Biodiversity

What is biodiversity? Biological diversity, or biodiversity, refers to the variety of all life on Earth, and includes the variety among animals, plants, fungi, and microorganisms, their genes, and the communities, habitats, landscapes, and ecosystems where they occur.

Why is biodiversity important? Diverse habitats, ecological communities, and native species are fundamental to the ecosystem functions that we rely on for soil building, clean water, breathable air, food, control of insect pests and diseases, and uncountable other services. Native biological diversity helps to ensure the sustainability of ecosystems in the face of extreme weather, catastrophic events (such as fires, floods, droughts), diseases, and other hazards of life on Earth.

Habitats and landscapes important to biodiversity occur all over Hillsdale, and include the many kinds of forest, meadow, wetland, and stream habitats described above.

"The entire Hudson River estuary corridor, which includes most parts of the Hudson Valley, is considered a significant biodiversity area within the context of New York State and the New England and mid-Atlantic portions of the U.S. Within the State of New York, it forms a regional matrix that nurtures and sustains the Hudson River estuary." [59]

In 2006 NYSDEC published the Wildlife and Habitat Conservation Framework[60] which describes key habitats in the Hudson River estuary corridor and identifies strategies for protecting those habitats. The document delineated twenty-three "Significant Biodiversity Areas" (SBAs) throughout the ten counties of the Hudson River estuary corridor. One of these SBAs lies partially in Hillsdale. The NY Natural Heritage Program and the Farmscape Ecology Program have identified a few other areas with special value for local and regional biodiversity. Figure 17 shows these areas in Hillsdale:

- Taconic Mountains Significant Biodiversity Area;
- Sensitive coldwater stream habitats and NYS-classified trout streams; and
- Ancient and recently reforested floodplain forest.

Each of these is briefly described below.

The SBAs are by no means the only significant areas for biodiversity in the region but have been recognized for especially high concentrations of important, unusual, and vulnerable ecological features that contribute significantly to the broader Hudson River Valley regional biodiversity.

[59] Penhollow et al., 2006

[60] Ibid.

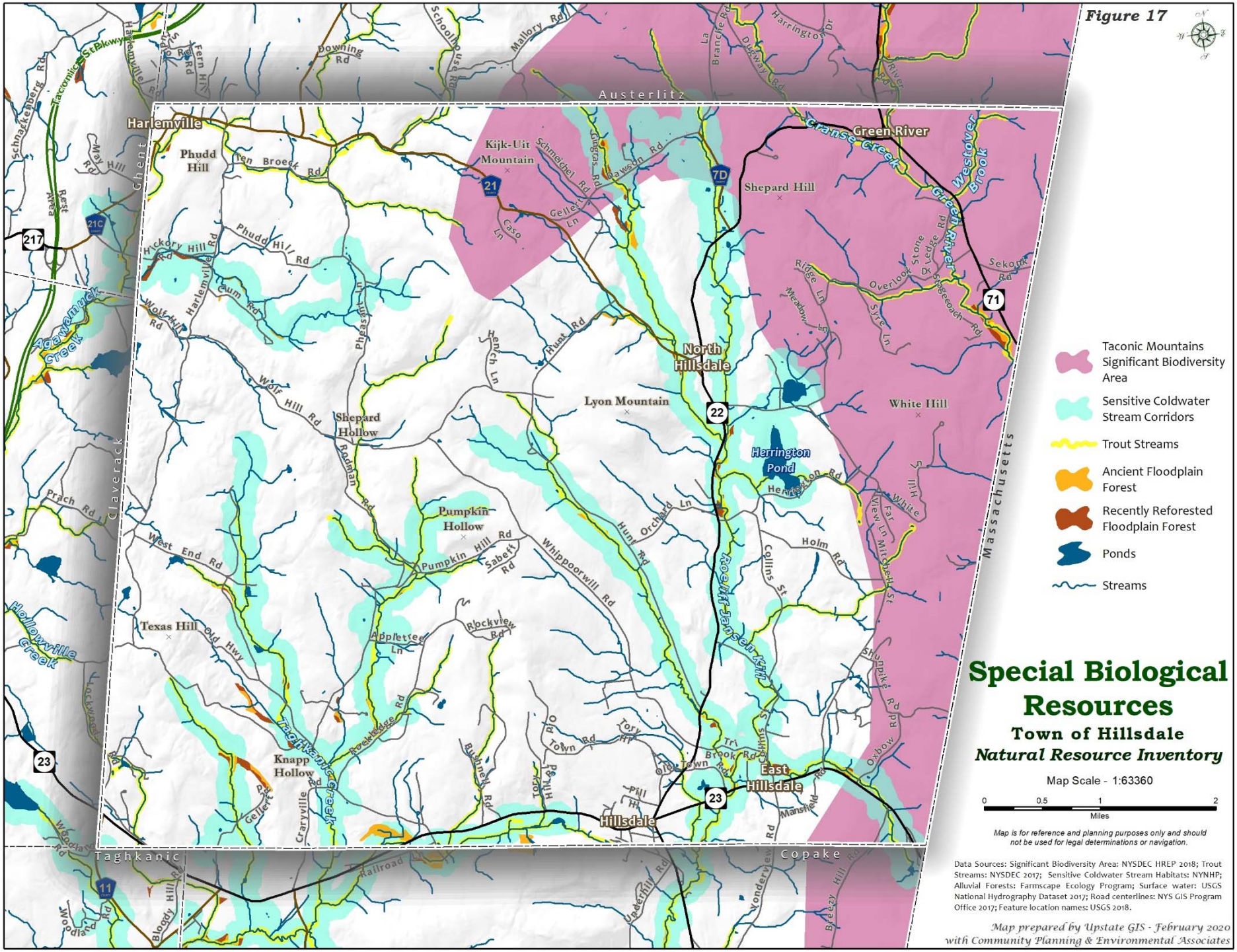


Figure 17

Special Biological Resources

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Significant Biodiversity Area: NYSDEC HREP 2018; Trout Streams: NYSDEC 2017; Sensitive Coldwater Stream Habitats: NYNHP; Alluvial Forests: Farmscape Ecology Program; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

A view of the Taconics from Orchard Lane. Photo © 2020 Paul Duernberger

Taconic Mountains Significant Biodiversity Area

The Taconic Ridge extends nearly 60 miles along the eastern edge of New York State and, in Hillsdale, it straddles the eastern border with Massachusetts. It is recognized for the large areas of contiguous, high quality, northern hardwood forest that serve as a principal watershed and recharge area for numerous rich fens, other wetlands, streams, and associated rare plant and animal species.[61]

The topographic complexity of the Taconics contributes to the high diversity of ecological communities, which include, for example, cool ravines, high-elevation ledges and rocky streams, and cool hemlock forests on north-facing slopes. The neutral to acidic bedrock of the Taconics (schists, slate, phyllite) contrasts with the alkaline bedrock of the adjacent Harlem Valley, and may make the communities of the Taconics more sensitive to acidic precipitation and other pollutants from atmospheric deposition.

The forests of the Taconic Ridge are considered among the highest quality northern hardwood forest communities in the Hudson Valley region.[62]

The value of the Taconic Region's natural assets extends beyond New York. It is considered a multi-state "priority landscape area" in the Forest Action Plans of New York, Massachusetts, Vermont, and Connecticut for its high ecological integrity, low fragmentation, and important connections between extensive forests of the Northern and Central Appalachians.[63] This designation raises the eligibility of forest conservation-related projects in the area for federal funding sources, including land

[61] Penhollow et al., 2006
[62] Ibid., 2006
[63] Strong, 2010

conservation initiatives, trails and recreation projects, and landowner stewardship outreach.

The proximity of floodplains and steep hillsides with (partly calcareous) rocky outcrops provides an exceptionally rich area for at least fifteen regional rarities, including false mermaid weed, blue cohosh, Dutchman's breeches, and leatherwood.

Sensitive Coldwater Stream Habitats and Trout Streams

The New York Natural Heritage Program (NYNHP) has designated zones that are especially important for organisms of coldwater streams (Figure 17). The mapped areas include stream segments identified in NYSDEC fish surveys since 1980 and those streamside areas most likely to affect the quality of the stream habitat. (The map does not account for habitat fragmentation that might be caused by dams and culverts.)

Coldwater stream habitats are in decline across the Northeast due to impacts of land uses and the fragmentation of free-flowing streams by dams and culverts. Native coldwater fishes such as brook trout are harmed by thermal pollution, sedimentation, and introduced exotic species such as smallmouth bass and non-native trout, which are better adapted to warmer water temperatures.

The sensitive coldwater stream habitats shown in Figure 17 represent areas important to maintaining native wild brook trout populations in Hillsdale. This is often among the first species to disappear from polluted waters.

Floodplain Forest

Both wetland forests (swamps) and non-wetland forests occur in floodplains of small and large streams. Some of these areas flood frequently—e.g., annually or every few years—and some flood only in the largest flood events, but all are important contributors to stream habitats, water quality, and bank stability. The plant communities of floodplain forests share some species of both forested swamps and non-floodplain upland forests and include some plants that have special affinities for floodplains, such as eastern sycamore, eastern cottonwood, northern hackberry, and ostrich fern.

Floodplain forests provide shade that helps maintain cool stream water temperatures; contribute organic matter that supports the stream food web and habitat structure; provide habitat and movement corridors for wildlife; and help to absorb and dampen floodwaters. These forests are used by many kinds of resident and transient wildlife.

Downy woodpeckers nest in dead trees about the diameter of the one in this picture, taking one to three weeks to excavate a nesting cavity large enough to hold the eggs and an incubating bird. These cavities may later serve as homes to other cavity-nesting birds, such as the eastern bluebird. Photo © 2020 John Piwowarski

The floodplain of the Roeliff Jansen Kill broadens as the stream approaches NYS Route 23. Photo © 2020 David Lewis

The Farmscape Ecology Program (FEP) conducted a study of the non-wetland floodplain forests in Columbia and Dutchess counties,[64] and found that floodplain forests have very diverse communities of plants and animals. Those floodplain forests that may never have been cleared (named "ancient" forests by FEP) are rare and had a significantly higher diversity of native herbaceous plants and lower densities of non-native invasive shrubs than recently reforested floodplains.

They concluded that the ancient floodplain forests are ecologically unusual, potentially irreplaceable, and deserve high priority for conservation, especially the larger examples of such forests. Some communities of these forests are described in the Habitats section, above. (Forested swamps in floodplains were excluded from the FEP study.)

The FEP grouped the floodplain forests of Columbia County into five forest types according to their dominant tree species:

Sugar Maple Floodplain Forests were "ancient" forests on relatively stable terraces where they might get flooded on average less than once a year.

Elm – Sugar Maple – Bitternut Floodplain Forests and Elm – Ash – Black Cherry Floodplain Forests were lower in the floodplain where, on average, they may receive at least one flood each year which might last for several days. The Elm – Sugar Maple – Bitternut forests might, over time and with increasing distance from the creek and decreasing disturbance, succeed into Sugar Maple–dominated forests.

Black Locust –Sycamore – Cottonwood Floodplain Forests were recent forests in the most dynamic locations within the floodplain, where they colonized mineral soil that had been deposited in major events of creek bed re-working.

Green Ash – Silver Maple Floodplain Forests largely occupied the relatively quiet backwater parts of the floodplain and, barring major re-working of the creek bed, seemed to be quite stable, largely self-perpetuating communities.[65]

Forested floodplains are uncommon in Hillsdale, and "ancient" floodplain forests are rare. The few occurrences found by the Farmscape Ecology Program are along the Green River, in the Taghkanic Creek drainage and on a couple of tributaries to the Roe Jan (Figure 14).

[64] Knab-Vispo and Vispo, 2010

[65] Ibid.

Mineral Resources

What is this? Mineral resources are those in the bedrock and surficial deposits.

Why is this feature important? The structural and chemical characteristics of bedrock and surficial materials influence the chemistry of groundwater and surface water and the texture and fertility of soils, and thus the suitability of soils for supporting natural habitats and for agriculture. Hillsdale's bedrock has been mined for iron and manganese, and glacial outwash and kame deposits have been mined for sand and gravel.

The only significant mining in Hillsdale's history was for iron ore and manganese in the 1800's.[66] Figure 5 (Bedrock Geology) shows locations of five former—"past producer"—mines, based on data obtained from the Mineral Resources Data System, maintained by USGS and accessed at https://thediggings.com/usa/new-york.

Two of these mines were at Lyon Mountain: the Haight Limonite Mine (iron) and the Goodsell Bog Occurrence (manganese). The Palmer Bog Occurrence was a manganese mine south of Pumpkin Hollow. Another producer of iron was the Mitchell Limonite Mine, located near the eastern border of the Town. A fifth mine, the Hillsdale Limonite Mine (iron) was on the southern border of Town, at the border with Copake.

Sand and gravel have been mined commercially in the past and have long been mined by farmers for onsite use. Hillsdale has had no large commercial sand and gravel mines in recent decades. As depicted on the Surficial Geology map (Figure 6), a former sand and gravel mine was in the Hillsdale hamlet near the intersection of Routes 22 and 23, and a former peat mine was on Pheasant Lane, in the northwest corner of Town. Peat was used as a filtering agent in industrial processes, as a soil amendment, and perhaps for fuel.

Mined land permits issued during 2015 by the NYSDEC (latest data available online) show no mining permits issued in the Town of Hillsdale.

[66] Stott, 2007; Hudson Gazette, 1900

Soils

Soils are an essential resource for the habitats they support, and for the plants and animals that rely on them directly or indirectly for food or shelter. Soils support the rich communities of macroinvertebrates and microorganisms and are the critical substrate for most of the vegetation in the landscape. They help to manage the movement of water overland and through the soils. They influence the chemistry of surface water and groundwater, help to cleanse water of contaminants, and are responsible for immense amounts of carbon storage. Soils are also essential for most kinds of animal- and plant-based agriculture.

When soils are lost to erosion or are polluted or damaged in other ways, they cannot be easily replaced. Most of our soils have taken thousands of years to develop from the mineral material deposited by glaciers in the last ice age, or deposited along floodplains, or from the accumulated organic material in certain wetlands. Conservation of soils will help us retain the soil structure and biology developed over those millennia that support much of what we value in the natural, agricultural, and developed landscapes of Hillsdale.

Soils are the largest reservoirs of carbon in most ecosystems. Carbon is stored both in the soil mineral material and the living and dead organic matter—the decomposing plants, animals, and microbes.[67] Where soils remain substantially undisturbed, the carbon can remain sequestered for thousands of years. Disturbance of the soils, as from erosion or excavation, drying, removal of vegetation, or plowing, can lead to rapid releases of the stored carbon to the atmosphere, contributing to the greenhouse gases responsible for global warming.

Conventional agricultural cultivation regularly stirs up and exposes soils resulting in large losses of soil carbon to the atmosphere,[68] while no-till or minimum tillage practices tend to increase both the carbon storage and the soil fertility.

Carbon storage can generally be increased by shifting to perennial crops and by using tillage systems that minimize soil disturbance and rely on cover crops, nitrogen fixation, and incorporating organic matter into the soils.[69]

Wetland soils ("hydric soils") are those classified as "very poorly drained" or "poorly drained" and in some instances as "somewhat poorly drained." Wetland soils remain saturated in their upper layers long enough during the growing season to develop anaerobic conditions, and hence to support wetland-adapted ("hydrophytic") plants.

Some wetland soils are saturated or inundated year-round, and some may be saturated for only a few weeks in the spring. Those that typically dry out for significant periods usually have little or no peat development at the surface. Wetlands that have been very wet for thousands of years,

[67] Mitsch, 2016

[68] Johnson, 1992

[69] Johnson, 1992; Byrne et al., 2018

however, have accumulated peat to great depths. The soils of the wetland on Pheasant Lane that was mined for peat, for example, are mapped as Catden muck, with peat over 6.5 ft deep.

The *Soil Survey of Columbia County, New York* includes maps and descriptions of soil types throughout the county. The soils have been identified by soil scientists through remote sensing (mainly analysis of topographic and geology maps and aerial photos), and field observations. Many of the mapped soil units have not been visited by a soil scientist, however, and the scale of mapping did not allow for great detail. Any map unit (polygon) for a soil type may contain up to two acres of other soil types. Thus, the hydric soils of many small wetlands, for example, are not mapped, and those areas are instead included within non-hydric soil units. For this reason, the soil maps are not suitable for detailed site-specific land use planning, but nonetheless provide a wealth of information on the general character of the soils at any site. Soil maps and descriptions (and updated soil names) for any Columbia County location can also be viewed in interactive maps online at https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx .

Farmland Soils

Prime Farmland Soils

Prime Farmland (Figure 18), as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or developed land or waterbodies. Prime Farmland Soils have the soil quality, growing season, and moisture supply needed to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied.

In general, Prime Farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality.

Dairy cows in North Hillsdale, with the Taconic Ridge in the distance. Photo © 2020 David Lewis

Prime Farmland Soils are permeable to water and air. They are not excessively erodible or saturated with water for long periods, and either are not

frequently flooded during the growing season or are protected from flooding. Slopes range mainly from 0 to 6 percent. More detailed information about the criteria for Prime Farmland is available from the Natural Resources Conservation service at https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcseprd1338623.html.

Prime Farmland Soils are of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's Prime Farmland Soils.

Of the total 30,675 acres in Hillsdale, approximately 2,267 acres are Prime Farmland Soils. Prime Farmland Soils are concentrated in the stream corridors of the Green River and the Roeliff Jansen Kill, with pockets located along the Taghkanic Creek and in other locations mostly in valleys and stream corridors.

Some areas in Hillsdale have soils classified as "Prime Farmland if Drained." These are soils that meet all the Prime Farmland criteria except for depth to seasonal high-water table. Somewhat poorly drained soils are designated as Prime Farmland if Drained if they meet all criteria for Prime Farmland other than depth to water table.[70]

There are approximately 1,544 acres of "Prime Farmland Soils if Drained" (not shown in Figure 18), concentrated in the southwestern portion of Hillsdale along Taghkanic Creek tributaries and their valleys.

Because these soils often support wetlands, however, draining for agricultural is strongly discouraged. In fact, under the federal "Swampbuster" program, federal farm program benefits are withheld from any person who plants an agricultural commodity on a wetland that was converted by drainage, dredging, leveling, or any other means, or who converts a wetland for the purpose of or to make agricultural commodity production possible. More detailed information about the Swampbuster program is available at https://www.epa.gov/cwa-404/cwa-section-404-and-swampbuster-wetlands-agricultural-lands.

Tedding on a hayfield at Dawson Road and County Route 7. Photo © 2020 David Lewis

Farmland Soils of Statewide Importance

In some areas, land that does not meet the criteria for Prime Farmland is considered to be "Farmland of Statewide Importance" for the production of

[70] NRCS Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm)

food, feed, fiber, forage, and oilseed crops. There are approximately 5,036 acres of Farmland Soils of Statewide Importance in Hillsdale.

Generally, this includes soils that nearly meet the requirements for Prime Farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods.

Some areas may produce yields as high as those of Prime Farmland if conditions are favorable.

Although most of Hillsdale's land was farmed in the 1800s—even very poor soils were pastured for sheep—most of the actively farmed land today is on Prime or Statewide Important soils.

Beekeeping on Whippoorwill Road. Photo © 2020 David Lewis

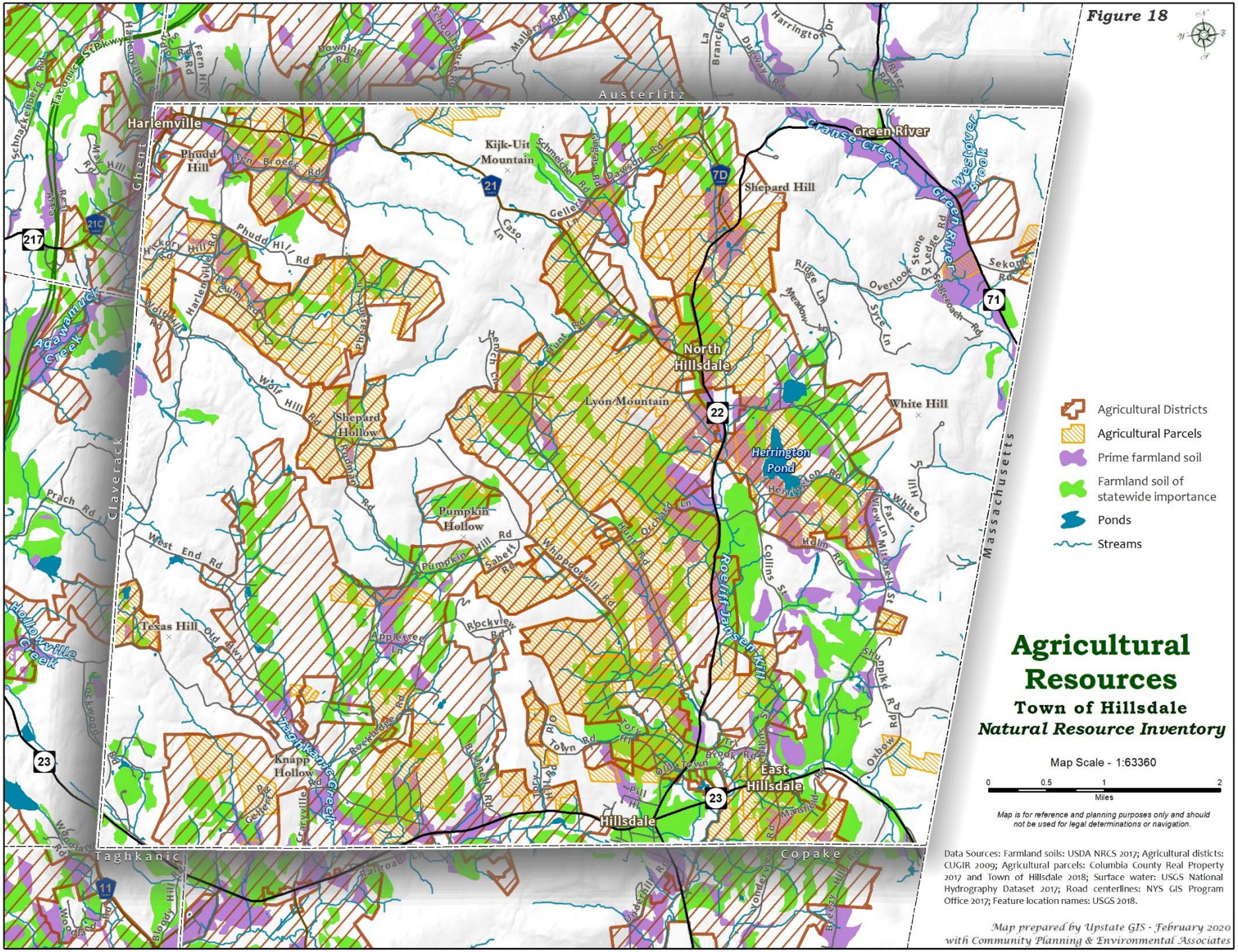


Figure 18
Austerlitz
Harlemville
Phudd Hill
Kijk-Uit Mountain
Green River
Cranse Creek
Westover Brook
Shepard Hill
Green River
North Hillsdale
Lyon Mountain
White Hill
Herrington Pond
Shepard Hollow
Pumpkin Hollow
Texas Hill
Knapp Hollow
Hillsdale
East Hillsdale
Taghkanic
Copake
Claverack
Massachusetts
Agawamuck Creek
Hollowville Creek
Taghkanic Creek
Green River
Agricultural Districts
Agricultural Parcels
Prime farmland soil
Farmland soil of statewide importance
Ponds
Streams
Agricultural Resources
Town of Hillsdale
Natural Resource Inventory
Map Scale - 1:63360
0 0.5 1 2
Miles
Map is for reference and planning purposes only and should not be used for legal determinations or navigation.
Data Sources: Farmland soils: USDA NRCS 2017; Agricultural disticts: CUGIR 2009; Agricultural parcels: Columbia County Real Property 2017 and Town of Hillsdale 2018; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.
Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Climate Conditions

Temperature

Summer daytime temperatures in Hillsdale usually range in the upper 70s° F to the mid-80s° F, although most summers have a few days in the 60s° F or in the 90s° F. The first frost usually arrives in early to mid-October, and the last frost occurs in early to mid-May, but the first and last frost dates can vary significantly from year to year and between low and high elevations. The typical minimum temperatures in winter are in the range of -10 to -15° F, putting Hillsdale in the USDA Hardiness Zone 5b (https://planthardiness.ars.usda.gov/PHZMWeb/).

According to U.S. Climate Data[71] from the nearest weather station in Copake, the average high temperature in Hillsdale is 59.3° F, the average low is 35.8° F and the average temperature is 47.55° F. These "climate normals" data do not indicate the typical highest high temperatures or the typical lowest low temperatures, but only the averages of all the daily highs and lows over a 30-year period. Thus, they may be useful for detecting overall climate trends, but not for describing our experience of seasonal or daily weather.

The City of Hudson, located west of Hillsdale on the western edge of Columbia County, has the longest continuous weather records in the County. Since 1950 the average temperature in Hudson has risen from approximately 49° F to 51° F. The presumed average in Hillsdale is slightly lower, however, as the eastern side of the county consistently has lower average temperatures than the Hudson River side of the county. Hillsdale, specifically, has average temperatures 3 to 4 degrees lower than Hudson according to a report prepared by the Hawthorne Valley Farmscape Ecology Program.[72]

Hillsdale has two local, unofficial weather stations in the Weather Underground Network. These are operated privately but the data are made available to the public at (https://www.Wunderground.com). ("Wunderground" is owned and operated by The Weather Company LLC, part of the IBM corporation.)

The network data are for personal, non-commercial use only. Standard weather data (temperature, humidity, precipitation, etc.) is collected and 24-hour forecasts are provided. Current weather maps are available including local radar charts. Monthly and yearly data are also available in chart format.

Hillsdale is included in the Columbia County "Code Red" Emergency Notification System for severe weather warnings and other natural disasters.

[71] NOAA, 2018

[72] Vispo, 2008

Precipitation

There are no distinctly dry or wet seasons in Hillsdale on a regular annual basis. Average monthly precipitation in summer is about four inches. The greatest potential for floods is typically in the early spring when rainstorms combine with rapid snowmelt to produce large volumes of runoff. Recent large storms (Irene, Lee, and Sandy), however, have produced record-setting downpours in the late summer and fall.

Severe droughts are rare, but minor droughts are common, and can deplete well water supplies, cause moisture stress for crops and natural vegetation, and increase the possibility of wildfires.

In the past, New York State and Columbia County have had abundant snowfall, with more-or-less continuous snow cover from about mid-December to mid-March, and maximum depths in February. According to the 2018 U.S. Climate Data for Copake, average snowfall is about 49 inches per year, and average precipitation is 43 inches. Nor'easter storms occur in most winters, and snow yields of 12-24 inches or more from such storms are not uncommon. [73]

Snowfall patterns have been changing noticeably over the last 20 years, however, when many winters have seen limited snow cover and prolonged periods of bare ground.

An ice storm coated the Hillsdale landscape in the winter of 2004. Here ice-covered trees are viewed from White Hill looking west across the town. Photo © 2020 Bob Kessler

[73] NCDC, Undated.

Severe Weather Events

While Hillsdale, and Columbia County as a whole, are relatively protected from extreme weather events, they do happen. The storms that reach the Atlantic coast as hurricanes have usually downgraded to tropical storms by the time they have travelled this far inland. Nonetheless, the high winds, large rainfall volumes, and flooding of tropical storms can cause severe damage to structures, roads, and farmland. The most recent severe weather events were Tropical Storms Irene and Lee (2011) and Sandy (2012).

One of the most notable of past storms is the September 1938 hurricane. While New England saw the brunt of the storm, Hillsdale experienced dangerous flooding as a result of rainfall of two inches per hour.

With the Town's proximity to the Taconic Mountains, it can experience heavier snowfall than the landscape to the west due to the upslope snow effect. As a weather system approaches from the west, the mountains cause the air to rise, cool and condense, resulting in additional precipitation, which in the winter often falls as snow.

There have been a dozen tornados recorded in Columbia County between 1950 and 2014, but only one—in 1995—has swept through Hillsdale in that period. See information at http://www.tornadohistoryproject.com/tornado/New-York/Columbia/map

While thunderstorms are common in spring, summer, and fall, Hillsdale has a much lower frequency of lightning strikes than much of the rest of the County.[74]

Wood ducks use ponds like this for feeding and nursery areas, and nest in existing cavities in trees within a mile of such open water. Photo © 2020 John Piwowarski

[74] NOAA, 2018

Climate Change Predictions and Climate Resilience

In 2011 the New York State Energy Research and Development Authority (NYSERDA) published a report[75] describing climate change in New York, both what has occurred to date, and projecting future changes.

According to the report, the average temperature statewide has increased by 2.4° F since 1970, and the average winter temperature has increased by more than 4.4° F over that period. The area of New York east of the Hudson River is predicted to see average temperatures increase by an additional 4.5 to 6.2 degrees by 2050. By 2100, the increase in the annual average air temperature is projected to be 6.1 to 11.4 degrees higher in the Hudson Valley region. At the same time, the number of days below freezing is expected to decrease from the 155 days that we experience now to 84-109 days in the 2080s.

Climate change affects more than temperature, however.[76] Projections show significant impacts on precipitation, heat waves, sea level rise, and flooding. For example, annual precipitation in the Hudson Valley is projected to increase 2-7% in the 2020s, 4-12% in the 2050s and 5-15% in the 2080s. The number of days with more than one inch of precipitation is projected to increase from 10 days now to 15-17 days by the 2080s. Similarly, the number of days with more than two inches of precipitation may rise from 1 day per year now, to 4-5 days in the 2080s.

Climate projections indicate there will be more flooding events and higher flood heights. The height of 100-year flood events in coastal New York could rise from a baseline of 15 feet now to flood heights of 16.5 to 18.3 feet by the 2080s.

Resilience to Climate Change

Adapting to and recovering from the effects of global warming will require many changes to our treatment of land and resources. Some examples are redesigning roads, bridges, and culverts to accommodate higher flood flows; moving buildings and infrastructure out of floodplains; upgrading stormwater management features; redesigning and adapting buildings for more efficient cooling; adjusting agricultural crops, livestock, and farming practices to more severe heat waves, prolonged droughts, and larger damaging storms; managing land to support pollinators and other insects that are stressed by the changing conditions; and preserving and restoring forests for their manifold services to humans and ecosystems, to name just a few. Luckily, many of the actions that promote climate resilience will also help to conserve natural resources.

In a response to the ominous climate change predictions, The Nature Conservancy (TNC) published a study in 2014[77] projecting how natural systems may react to changing climate conditions. The study looked at over 70 data sets to identify

[75] Horton et al., 2011; Rosenzweig et al., 2011

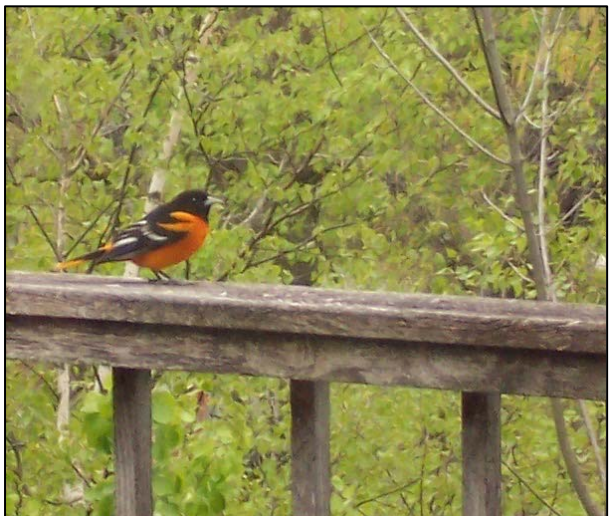
[76] NYS HREP, Undated

[77] Anderson et al., 2012

locations where the natural habitat areas may be best able to adapt to climate change.

The study found that the number of plant and animal species at localities in eastern states is correlated with the number of geology types, the amount of limestone, the latitude, and the range of elevations. Conserving places that possess this geophysical diversity will help to protect diverse species and natural processes as environmental conditions change with the warming climate.[78]

Figure 19 shows the TNC resiliency scores for Hillsdale, indicating the parts of the landscape with greater and lesser potential for species to adapt as the climate changes. The darker greens indicate areas with higher estimated resilience, and browns indicate areas more vulnerable to the effects of climate change.[79] (The map data was produced from modeling based on coarse physiographic data, without field-verification of on-the-ground conditions.)



A Baltimore oriole visits a yard on White Hill. They use open woodlands or wood edges where they forage for insects or eat fruit or nectar. Their main insect prey are caterpillars, and they are the primary predators of caterpillars of pest species such as the forest tent moth and gypsy moth. Photo © 2020 Janet Lincoln

The small areas that rank "far above average" are in the Green River valley, around Shepard Hill and White Hill, at Lyon Mountain and North Hillsdale, at Shepard Hollow, in the vicinity of Wolf Hill and Harlemville roads, and in the vicinity of Phudd Hill in Harlemville. Much of the forested area of Hillsdale is ranked as "slightly above average" or better, and the open meadows are ranked "average" or below for climate resiliency.

The warming climate is forcing many species to migrate to cooler microclimates, higher elevations, or higher latitudes as their former habitats become unsuitable. The most effective way to accommodate these movements and range shifts is to maintain intact (undeveloped and largely undisturbed) and well-connected areas with complex physiography. Conserving connected habitats in a range of geological and topographical settings—such as schist and slate hills, ravines, limestone valleys, and stream corridors—may be the best approach to supporting the life needs and movement corridors of diverse plants and animals in the changing environment.

This approach will help to protect "natural strongholds" where direct effects of climate change are moderated by topography and connected natural cover, where species can find areas of suitable moisture, temperature, food, and shelter even while the composition and structure of communities is changing.[80]

These undeveloped areas with complex topography and connected land cover are likely to

[78] Ibid.
[79] Ibid.
[80] Ibid.

be most resilient to the effects of climate change and are areas where conservation action is most likely to be successful at protecting native biological diversity and ecosystems. Conserving these areas will also help to safeguard other natural benefits, such as clean and ample water and clean air, that we all depend on.[81]

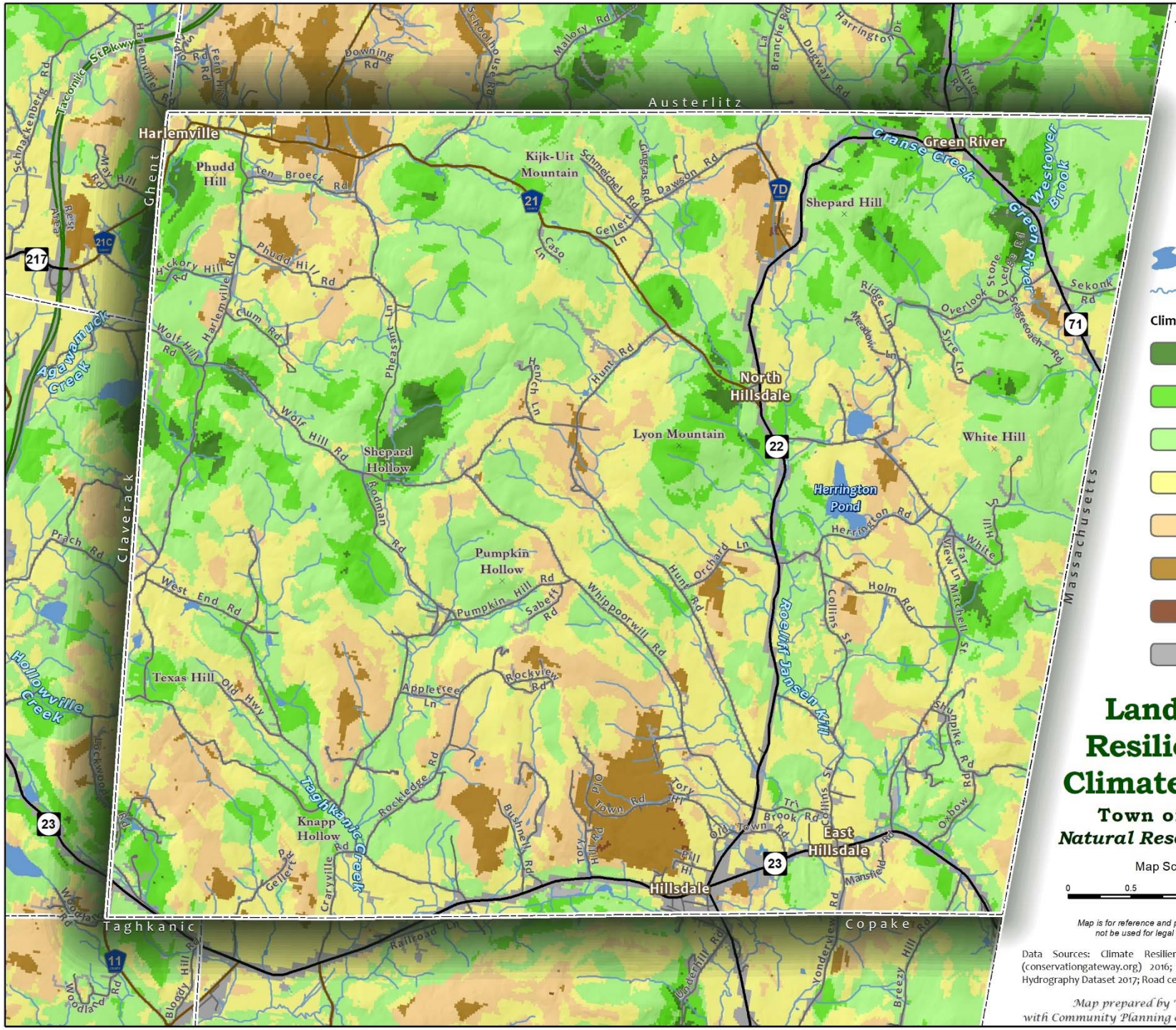
In May of 2016 the Town of Hillsdale Town Board resolved to work toward becoming a New York State Climate Smart Community. The Town Board recognized that climate change is a threat to Hillsdale's economy, environment and infrastructure and made a pledge to take local actions to reduce the Town's greenhouse gas emissions and energy consumption, among other "climate smart" initiatives.

Maintaining unfragmented forest areas wherever possible will help to preserve ecosystem resilience to climate change, store large volumes of carbon, maintain groundwater and surface water volumes, and moderate local air temperatures.

This winter wren perches in a brush pile. Winter wrens nest in mature conifer or deciduous forests usually in places with dense, tangled understories. Hillsdale is about as far north as this little bird winters regularly. Small birds like this suffer severely from extreme cold in the winter, but with warming trends, we can expect its range to extend northward. Photo © 2020 John Piwowarski

[81] Ibid.

Figure 19



Landscape Resilience to Climate Change

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Climate Resiliency: The Nature Conservancy (conservationgateway.org) 2016; Surface wate: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Scenic Resources

What is this? "Scenery" is simply the general appearance and visual features of a place or landscape. The visual condition of the landscape is dependent on both natural and human-altered features: vegetation and landforms, and the forms, colors, and textures of the viewed scene. While scenic quality is a subjective measure, this NRI assumes a general appreciation among the public for certain features of rural landscapes—vistas of meadows, forested hills, and lakes, as well as more intimate scenes of rocky streams, ponds, and barnyards. In this document the term "scenic resources" refers to the places and areas where scenic views—both expansive and intimate—can be seen from locations accessible to the public.

Why is this important? The visual environment affects the way people feel about a place, creates a sense of local identity and well-being for residents, and affects the desirability of Hillsdale for residents, businesses and visitors.

The wooded hills, pastures, hayfields, cropland, barns and silos of working farmscapes, the meandering Roeliff Jansen Kill, the smaller streams flowing through forests and meadows, and the large wetland of the Rheinstrom Hill Sanctuary provide the visual signatures that help to define the Town for the people of Hillsdale.

In 2018 and 2019 the Hillsdale Conservation Advisory Council (CAC) undertook a preliminary survey of scenic resources in the Town. The CAC solicited ideas from the public about favorite scenic places and drove the roads of Hillsdale to pinpoint places of special beauty.

Figure 20 shows the scenic places they identified. The viewpoints are all from public roads or other public-access locations, even though most scenic features are on private lands. Table 5 correlates with the locations shown on Figure 20 and lists the scenic viewpoints and road segments in Hillsdale as identified by the Hillsdale Conservation Advisory Council.

A view of the Taconics from Orchard Lane. Photo © 2020 Paul Duernberger

Hillsdale has an abundance of natural beauty that is held in high regard by the people of Hillsdale. In a 1988 survey of Hillsdale residents conducted during preparation of the Hillsdale Comprehensive Plan, respondents were asked a series of questions about their preferences for future land uses and kinds of development in the Town. The 511 respondents gave the highest percentages of "yes" answers to questions related to preserving the Town's rural character (96%), encouraging agriculture (96%), and preserving open space (93%)—all elements closely tied to scenic resources. No comparable survey has since been undertaken, but sentiments may be similar today.

Scenic vistas and viewsheds may be degraded by changes in the natural and the built environment. Identification, protection, and stewardship of our scenic assets are important components of securing a thriving future for the Town. Protecting scenic vistas will allow the Town to preserve its unique charm, build civic pride, maintain property values, build tourism revenues, and maintain the visual environment that makes Hillsdale feel like home.

The fields of the Dodds farm at the north end of the Harlem Valley are the northern gateway to the town. Photo © 2020 Nancy Stamegna

Table 5. A few scenic viewpoints and road segments In Hillsdale. Letters (A,B,C) and numbers (1,2,3) indicate locations in Figure 20. Scenic places identified by the Hillsdale Conservation Advisory Council.

Scenic Road Segments	
A.	Hayfields, pastures, farm buildings and wooded hills at Cool Whisper Farm, north and south of County Rt 21
B.	Hayfields, pastures, and farm buildings of Mettabee Farm, Phudd Hill and Harlemville roads
C.	Hayfields, cornfields, farm ponds, and wooded hills, looking northwest to east along Clum Rd
D.	Hayfields, pasture, hedgerows, and wooded hillsides of Dodds Farm east and west of County Rt 7
E.	Hayfields, pasture, hedgerows, and wooded hillsides of Dodds Farm from NYS Rt 22
F.	Cornfields, hayfields, pasture, farm buildings, and Toppel Pd from Mitchell St
G.	Farm fields and near and distant wooded hills, including Mt Fray (Catamount)
H.	Hayfields and ponds, east and west of West End Rd
I.	Hayfields and farm buildings east and west of Bushnell Rd
J.	Looking north, south, and east from NYS Rt 23 across hayfields and wetlands to wooded Scutt Hill and Taconic Mtns
K.	Hayfields, wetlands, and wooded Scutt Hill, looking south from NYS Rt 23
L.	Cornfields, hedgerows, and farm buildings east and west of Whippoorwill Rd
M.	Cornfields, hedgerows, and farm buildings west of NYS Rt 22
Scenic Viewpoints	
1.	Looking southeast from Schmeichel Rd across wooded hills
2.	View south and southeast from Dawson Rd across fields of Sam Dawson's farm
3.	Looking southeast from NYS Rt 22 across North Hillsdale pastures to Taconic Mtns
4.	Looking east from Orchard Lane across meadows to Taconic Mtns
5.	Looking southeast from Orchard Lane across fields
6.	Knapp Hollow swamp viewed from Rodman Rd
7.	Cool rocky ravine looking east from Rodman Rd
8.	Looking west to Catskill Mtns from high on Rockledge Rd
9.	Looking east-northeast from Rodman Rd across Chambers' fields
10.	Looking north from Texas Hill Rd across pasture and hayfields
11.	Looking north from West End Rd across old fields, hayfields, and pastures to a wooded hilltop
12.	Looking south and southeast from West End Rd across hayfields to forest on Scutt Hill
13.	Mowed fields, hedgerows, and wooded hills from Oxbow Rd

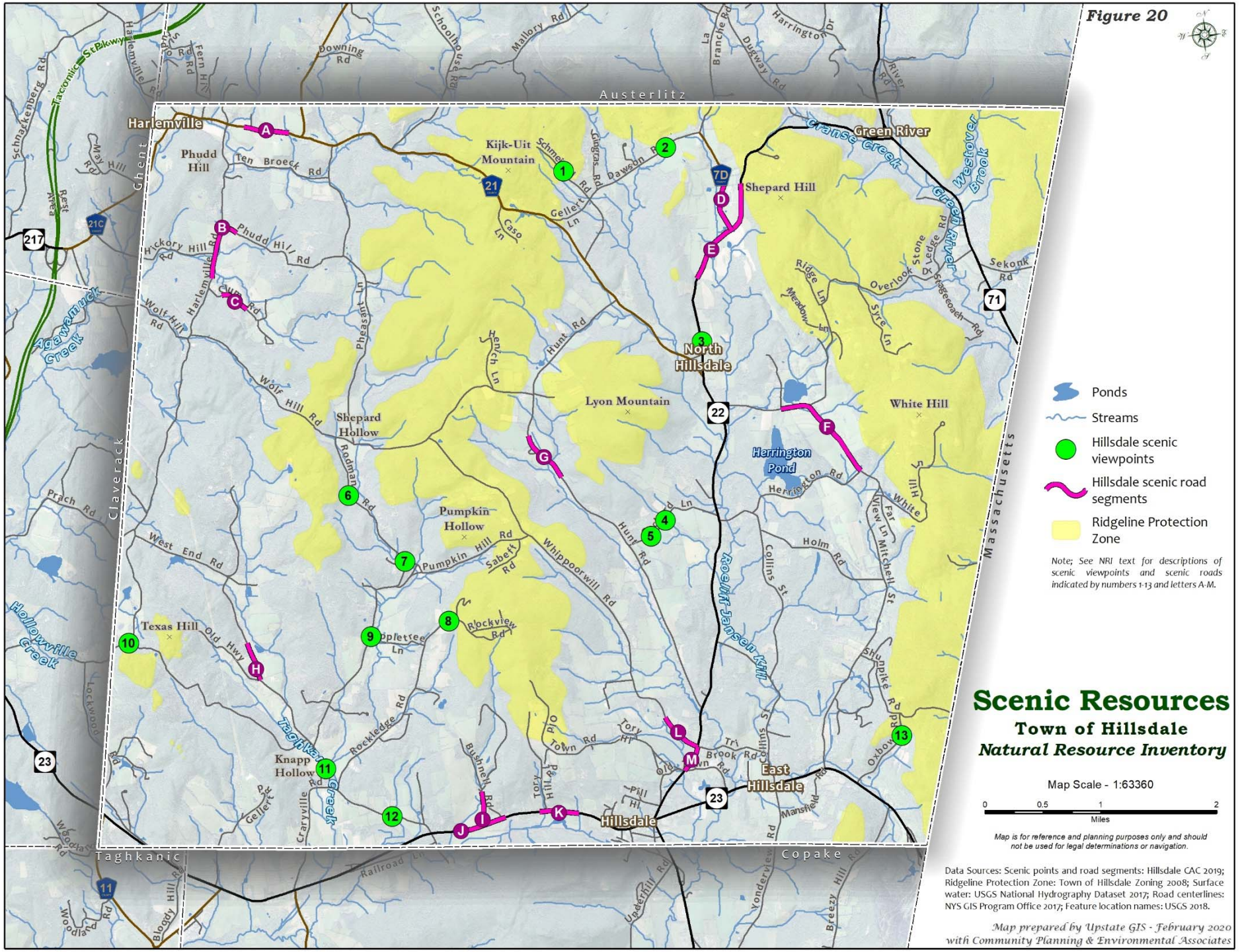


Figure 20
Austerlitz
Harlemville
Phudd Hill
Kijk-Uit Mountain
Green River
Shepard Hill
North Hillsdale
Lyon Mountain
White Hill
Herrington Pond
Shepard Hollow
Pumpkin Hollow
Texas Hill
Knapp Hollow
East Hillsdale
Hillsdale
Taghkanic
Copake
Claverack
Massachusetts
Ponds
Streams
Hillsdale scenic viewpoints
Hillsdale scenic road segments
Ridgeline Protection Zone
Note; See NRI text for descriptions of scenic viewpoints and scenic roads indicated by numbers 1-13 and letters A-M.
Scenic Resources
Town of Hillsdale
Natural Resource Inventory
Map Scale - 1:63360
0 0.5 1 2
Miles
Map is for reference and planning purposes only and should not be used for legal determinations or navigation.
Data Sources: Scenic points and road segments: Hillsdale CAC 2019; Ridgeline Protection Zone: Town of Hillsdale Zoning 2008; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.
Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Public Recreation

Why is this important? Recreation opportunities are important factors in defining the livability of communities. Although the rural setting of the Town allows most people in Hillsdale to have access to green spaces near their homes, public parks and other public outdoor spaces provide other opportunities for gathering places for families, social groups, and community events for individuals of all ages and economic status.[82]

The only land areas in Hillsdale for public recreation are the Hamlet Park and a short segment of the Hudson Valley Rail Trail. The Roe Jan Park, just outside the Town, is a great additional resource for Hillsdale townspeople.

Dedication of the Veterans Memorial at the Hamlet Park, Veterans Day, 2009. Photo from Town of Hillsdale Website (www.hillsdaleny.com).

Hunting, fishing, snowmobiling, and ATV use are popular forms of recreation in Hillsdale that mostly take place on private lands, although anglers do take advantage of bridges along public roads for stream access. While acknowledging the importance of recreation on private lands with permission of landowners, the discussion below focuses on recreation opportunities for the general public.

Below are brief descriptions of the rail trail and the two parks that are owned or managed by Hillsdale. Another public resource is the multitude of small, paved and unpaved, low-traffic roads in Hillsdale that are available to everyone for walking, running, and cycling. And, hiking trails of the Rheinstrom Hill Audubon Center and Sanctuary are nearby in the Town of Copake (see the Conserved and Protected Lands and Conservation Partners sections, below).

Hamlet Park

The Hamlet Park is a 2.6-acre parcel located next to and behind the Columbia County Sheriff's Substation (the former Town Hall). The park has a ballfield and playground equipment, and has been home to town celebrations, an annual town flea market, summer youth programs, softball games, egg hunts, a farmers' market, and many other events. The Park also has a World War II memorial on-site.

[82] Godbey and Mowen, 2010

Harlem Valley Rail Trail

The Harlem Valley Rail Trail is on the abandoned bed of the New York and Harlem Railroad. To date the trail has been completed in several disjunct segments starting at the Wassaic Metro North Station (Amenia, Dutchess County), and running north through eastern towns of Dutchess and Columbia counties. The northern-most segment, paved in 2017, is the 1.3 miles from Black Grocery Road in Copake to Anthony Street in the Hillsdale hamlet. The Rail Trail is planned to extend to Chatham, making the total length approximately 46 miles.

The trail provides recreation for bikers, walkers, runners and cross-country skiers. Parking is at the Herrington's lot near the Rail Trail kiosk. The Rail Trail is maintained through an agreement between the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP), Dutchess County, and the Harlem Valley Rail Trail Association.[83]

The main Hillsdale portion of the Rail Trail will, when completed, pass through the protected lands of the Rheinstrom Hill Sanctuary and will follow the old rail bed through the large wetland at the foot of Rheinstrom Hill. This section of trail provides views of varied wetland habitats, including a red maple swamp, a shrub swamp full of buttonbush, marshes, and open water. (See discussion in section on Conservation and Protected places.)

According to the Town's website, the Town of Hillsdale has committed to partnering with the Harlem Valley Rail Trail Association (HVRTA), the Columbia Land Conservancy, other agencies, and landowners to extend the Harlem Valley Rail Trail through Hillsdale and adjacent towns.

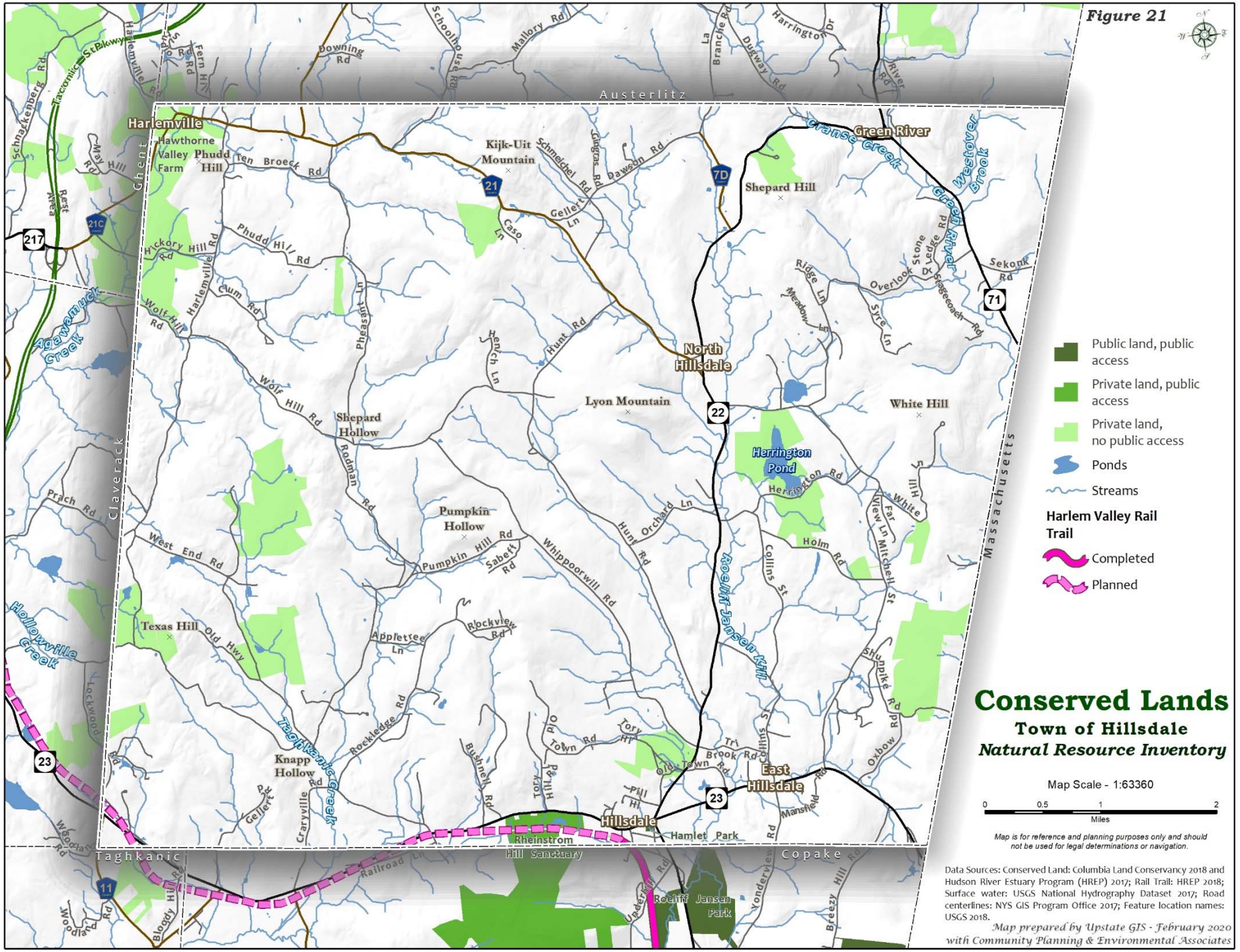
Roeliff Jansen Park. Photo from the Town of Hillsdale

Roeliff Jansen Park

Just outside of Town (on NYS Route 22 in Copake) is the Roeliff Jansen Park, a 300-acre property owned by New York State and managed by Hillsdale. The park is managed partly for agriculture and partly for year-round public enjoyment. Most of the park's acreage is actively farmed—producing hay, alfalfa, and corn to feed local dairy cows, and organic vegetables for local markets. The park has structures for large gatherings, foot trails, a dog-run, and a community garden. It offers recreational and cultural programs for families and the general public and is also available for weddings and other private events. The park hosts the weekly Copake-Hillsdale Farmers Market in the summer and fall.

[83] HVRTA, 2019

Figure 21



Conserved Lands

Town of Hillsdale

Natural Resource Inventory

Map Scale - 1:63360

0 0.5 1 2

Miles

Map is for reference and planning purposes only and should not be used for legal determinations or navigation.

Data Sources: Conserved Land: Columbia Land Conservancy 2018 and Hudson River Estuary Program (HREP) 2017; Rail Trail: HREP 2018; Surface water: USGS National Hydrography Dataset 2017; Road centerlines: NYS GIS Program Office 2017; Feature location names: USGS 2018.

Map prepared by Upstate GIS - February 2020 with Community Planning & Environmental Associates

Conserved and Protected Lands

All the Hillsdale properties with formal conservation status are in private ownership. Some are owned by conservation organizations such as Audubon New York or the Columbia Land Conservancy, but most are privately held lands with conservation easements. The total of such lands is 1,965 acres (about 6.4% of the Town). Some privately owned lands have public access, but most do not, as described below. See Figure 21 for locations of and information on conserved and protected lands.

Public-Access Conservation Lands

A great egret, the symbol of the Audubon Society, flies over the Rheinstrom Hill Audubon Sanctuary. Though it visits Hillsdale, this species is not known to breed here. It came near extinction a century ago due to the fashion for using its plumes in women's hats and was saved only by laws protecting it from hunting. Photo © 2020 David Lewis

Figure 21 shows conserved and recreational lands in and near Hillsdale. The Rheinstrom Hill Audubon Sanctuary and Center is a 1,039-acre area mostly in Copake but with 92 acres in the Town of Hillsdale along the south-central boundary of the Town. The Sanctuary provides habitat for many at-risk climate-threatened bird species. It is managed by Audubon New York for birding, nature education, and hiking.[84] In the Copake portion of the site, Audubon has an ongoing forest management project and landowner training program in using best management practices to improve habitats for birds and other at-risk wildlife.

While most of the Copake portion of the Sanctuary and most of the trails are on the forested Scutt Hill that rises above the Hillsdale hamlet, the Hillsdale portion contains mainly the large wetland at the northern base of the hill and the meadows between the wetland and NYS Route 23.

The old New York and Harlem rail bed that runs through the wetland may be the next segment of the Harlem Valley Rail Trail to be completed. The opening of this segment will make this area more easily accessible to bikers, walkers, runners, and other recreationists, and will bring the public within closer view of the wetland.

Different parts of the wetland include a red maple swamp with tussock sedge and skunk-cabbage, an inundated shrub swamp with buttonbush, winterberry holly, and other swamp shrubs, a

[84] Audubon NY, 2018

marsh with cattails and common reed, and open water. Visitors can often see birds such as green heron, great blue heron, mallard, wood duck, the occasional great egret, and many other water-associated birds. A wide variety of other birds frequent the area, including wild turkey, Baltimore oriole, several thrushes, northern flicker, red-winged blackbird, black-and-white warbler, common yellowthroat, and many more.

Several beaver lodges are visible along the open water margins, and a beaver dam impounds water in a narrow depression next to the trail. Visitors may also see muskrat, white-tailed deer, painted turtle, and snapping turtle. Peepers are raucous in the early spring, and bullfrogs can be heard later.

Butterflies, including the red-spotted purple, eastern tiger swallowtail, great spangled fritillary, and monarch take advantage of the marsh, wet meadow, and wetland edge vegetation. The swamp-loving Appalachian brown makes a habit of fluttering down the trail, accompanying, or turning and flying at, the unsuspecting walker.

Appalachian brown butterflies are regular residents on the old rail bed along the wetlands at Rheinstrom Hill. Photo © 2020 David Lewis

Other Conservation Lands

Most of the conserved land in the Town is privately-held properties with "conservation easements" that are intended to protect their conservation values in perpetuity.

A conservation easement is a legal agreement between the landowner and an authorized entity such as a land trust. The easement restricts the types of development and other land uses that can occur on the property so that conservation values—such as wildlife habitat, scenic views, agricultural potential, and water resources—are protected.

Easement lands remain in private ownership and on local tax rolls. The landowner retains full title to the land and is free to sell, lease, or mortgage the property, or pass it on to heirs, but the restrictions and responsibilities of the easement are conveyed to all future owners of the property. In this way a conservation easement allows the initial landowner to secure a permanent conservation legacy.

The Columbia Land Conservancy owns two parcels totaling 137 acres on the Taconic Ridge which adjoin two other parcels on which the CLC holds conservation easements. Together, these properties protect over 250 acres of forest on the

ridge. The CLC also holds conservation easements on 17 other privately-owned parcels totaling 1800 acres within the Town of Hillsdale. These lands are not open to the public. Fifteen of the easements are fully in Hillsdale, and two others straddle the boundaries with adjacent towns.

A red maple swamp in the Rheinstrom Hill Sanctuary. Red maple is unusual in being able to tolerate both wet conditions like the one pictured, where its roots are submerged, as well as dry upland soils. Photo © 2020 David Lewis

Land Uses, Past and Present

Influence of Natural Resources on Land Use History

This brief land use history draws on information from Hillsdale, A History*, by Herbert S. Parmet, former Hillsdale Town Historian, and posted on the Town of Hillsdale website and from the* Columbia County Natural Resources Inventory.[85]

Hillsdale's physical setting, geology, soils, and water resources have strongly influenced the habitats as well as the human land uses, patterns of settlement, and local economy since the earliest days of human occupation. Indigenous people occupied this area for thousands of years before the arrival of Europeans in the 1600s. At that time the Mahicans were the predominant group in much of Columbia County. They lived by hunting, trapping, fishing, gathering, and small-scale farming, and obtained all their life supports—food, water, shelter, clothing, tools—from the land.

In other parts of Columbia County, and perhaps in Hillsdale, the Mahicans practiced small-scale agriculture, including cultivation of corn (maize), squash, beans, lambsquarters, sunflowers, and knotweeds. They also consumed chestnuts, hickory nuts, and acorns that were native to these forests.

As in other parts of the Hudson Valley, they may have burned forests to create openings for farming, to clear the understory for hunting and gathering, to ease travel, or to create habitat for game. Most of the area that is now Columbia County, however, was still forested when Europeans began settling the land in the mid-1600s.[86]

The view from the northwestern hills looking over pastures at Lockwood and West End Roads extends all the way to Albany on a clear day. Photo © 2020 David Lewis

The Town of Hillsdale was formed from the Town of Claverack in 1782 and formally established as a municipality in 1788. The Town has five hamlets—Harlemville, Hillsdale, East Hillsdale, North Hillsdale, and Green River—where residences are clustered, and the rest of the Town is characterized by farms, forests, and low-density residential uses. Hillsdale is the largest hamlet and the commercial and civic center of the Town.

Like most communities, the history of the Town is intertwined with its natural resources. Early settlers exploited Hillsdale's abundant timber and waterpower to fuel early industries. Many small streams powered more than one grist mill,

[85] Stevens and Travis, 2018

[86] Vispo, 2014

sawmill, or other industrial enterprises. At one time the Town had several textile mills, eight sawmills, and four grist mills – all of which depended on its abundant forests and fertile valley soils.

Mineral resources also played an important role in the land use history of the Town. After the discovery of an iron ore deposit in 1800 some three miles northeast of the hamlet of Hillsdale, veins of iron ore were mined there and elsewhere intermittently in the 19th century.

By 1835, much of the forested landscape had been cleared for fuel, for building materials, for agriculture, and for charcoal production.[87] Charcoal, a primary industrial fuel in the 1800s, was made by slowly heating logs in an outdoor earthen kiln—a pile of logs covered with soil and green vegetation. Large areas of forest around the charcoal pits (kilns) were cut for charcoal production.

Sheep farming and wool production expanded in Columbia County in the late 1700s and early 1800s, and then tariffs on imported wool in 1824 raised the price of domestic wool and led to an explosion of sheep farming in much of the Northeast. By 1835, with the expansion of sheep pastures even on steep hillsides and summits, 75-80% of Columbia County land had been cleared.[88]

The New York and Harlem Railroad came to Hillsdale in 1852, connecting Chatham and Hillsdale with New York City. This event has been credited with bringing a gradual upward spike in population. For a while, Hillsdale was an important stop on the railroad. Agriculture remained the dominant land activity during the two post-Civil War decades. Dairy farming replaced grain farms in the 1870s and 1880s, promoted by good soils, growing urban markets to the south, and easy access to the railroad for shipping. At one time, Hillsdale had 103 dairy farms and the most cows of any town in the county.[89]

In addition to agriculture, tourism also became an important mid- to late 1800's land use dependent on natural resources. Visitors came to the area to enjoy the scenery, fresh air, and countryside. Dairy farming remained the dominant agricultural land use through the 1950s and 1960s, but with agricultural and industrial production shifting away from the Northeast in the 20th century, many forests gradually reestablished.

Today, Hillsdale is approximately 70% forested, and just two dairy farms remain. Pastures, hayfields, and cornfields to support beef and other livestock constitute much of the unforested land.

[87] Stott, 2007

[88] Vispo, 2014

[89] Parmet, undated.

Archaeologically Sensitive Areas

There are ten archaeologically sensitive areas found in Town documented by the NYS Office of Parks, Recreation, and Historic Preservation (OPRHP). Because of the potential for illegal looting of historic or pre-historic artifacts, specific information on these sites is not presented here. Details on the locations and features of the sites can be obtained on an as-needed basis from the NYS OPRHP.

Summary of Current Land Use Patterns

The Town of Hillsdale encompasses approximately 30,675 acres. The predominant land uses in Town are agricultural and residential. Much of the Town remains forested, but meadows and active agricultural uses are prevalent in the valleys. Except in some of the hamlets, residential development is low density, and mostly single-family homes. About 11,500 acres of land in Town are classified as residential uses for tax assessment purposes but much of that land remains forested, agricultural, or otherwise undeveloped. The average size of a "residential" parcel is 11.6 acres, but those parcels range from less than one acre to almost 300 acres. There are about 8,300 acres classified as agricultural, but many residential parcels also support agricultural activities. Agricultural parcels also range from about 2 acres to almost 600 acres and include unfarmed as well as actively farmed areas.

Although the Hillsdale landscape has been fragmented by roads and widely dispersed residences, there are still large intact areas of forest, meadow, wetland and stream habitats that help to maintain habitat complexes, wildlife corridors, connectivity with the larger region, and important ecological systems.

Active Farmland

Just over 9,000 acres in Hillsdale are in land parcels with agricultural tax exemptions, and an additional 1,000 acres are farmed on land without exemptions. The primary agricultural land use is for beef cattle. There are currently 12 beef cattle operations ranging from 5 to 450 head. Dairy farming, once the predominant farming activity in the Town, accounts for only two farms as of early 2019. Other animal operations include two sheep farms, an alpaca farm, and a horse farm. Pasture, hay, silage, and grain crops for livestock feed are the predominant uses of land to support these farms.

Commercial fruit growing includes pick-your-own raspberry and blueberry operations, an apple

orchard, and a cidery. Many additional acres have been planted with apple trees for future production. A more intensive use of local farmland with very high yield is vegetable production. Eight commercial farms are growing a wide range of vegetables. Three of these have their own vegetable stands, and most participate in farmers markets as well as some wholesale markets.

Hillsdale has one large-scale commercial greenhouse for bedding plants. The number of farms with flowers grown as crops is increasing with seven growers as of early 2019. The flowers are sold at farm stands and farmers markets and are also used by floral designers for weddings and other events. Hillsdale has nine commercial beekeepers and several commercial sugaring operations with over 800 sugar maple trees tapped for maple syrup production.

A supplementary use of farmland is for outdoor music festivals. Two Hillsdale farms host annual festivals that have proved to be popular and provide an important income source for the farmers.

The Town has lost agricultural operations and land over the years and many locations that had been actively farmed have reverted (or are reverting) to forest land.

Figure 18 shows the location and extent of New York State Agricultural Districts in Hillsdale. An Agricultural District is a land area identified through New York's Agricultural Districts Law (Article 25-AA) to help protect current and future farmland from non-agricultural development by reducing competition for limited land resources and helping to prevent local laws that would inhibit farming and raise farm taxes.[90]

Red foxes, like this one on White Hill, have adapted well to human environments, such as farms and suburbs, and their populations are secure. They provide a benefit to humans by controlling populations of small rodents and rabbits, although they occasionally prey on chickens and can be a vector for rabies. Photo © 2020 Bob Kessler

The NY Commissioner of Agriculture is authorized to review local comprehensive plans, legislation, regulations, and approve or disapprove them according to whether they unreasonably restrict or regulate farm operations within an agricultural district. The Commissioner also reviews any purchase by a municipal or state agency of active farmland larger than one acre, or any land over 10 acres within an agricultural district, to assess the potential impacts on local agricultural resources.

Agricultural Districts are developed when interested landowners, who collectively own at least 500 acres of land, request formation of such a district. Farmers and rural landowners enrolled in a state-certified Agricultural District receive important "right-to-farm" protections.

[90] CCAFPB, 2013

In Hillsdale, 14,484 acres of land are in three separate Agricultural Districts. About half of that land is actively farmed. Figure 18 shows locations of the Agricultural Districts and important farmland soils.

Priority Farmlands

The Columbia County Agricultural and Farmland Protection Plan used a Land Evaluation and Site Assessment (LESA) model "to rate the agricultural importance of lands and to identify and prioritize lands that should be protected from conversion to non-agricultural uses." [91]

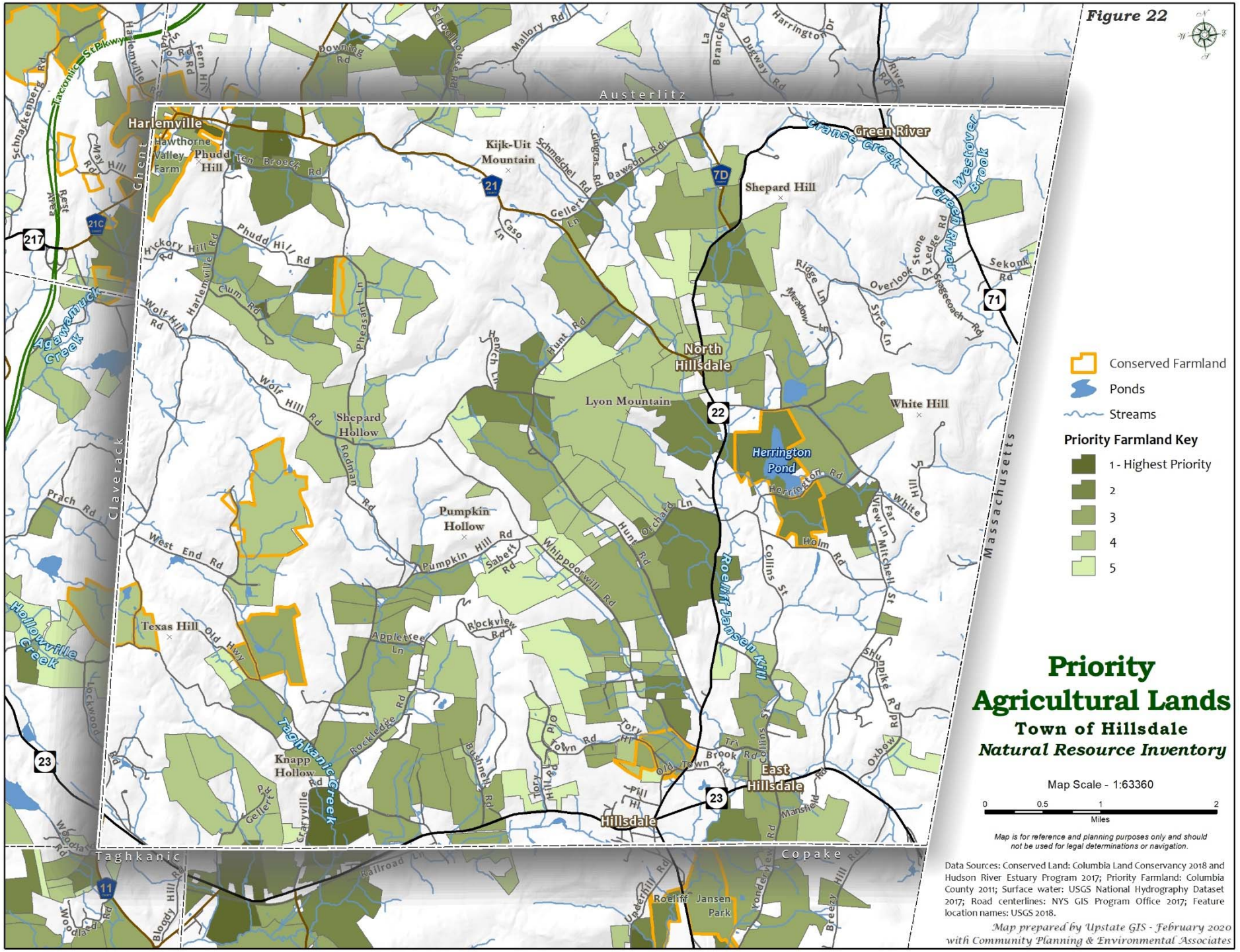
The LESA evaluation looks at soil capabilities, water resources, and other factors related to the continued viability of farming (e.g., commitment of current farmers, status of surrounding lands, local conversion pressure). The evaluation also considers features such as nearby open space, known biodiversity importance, and scenic or historic values. It uses a weighted point system to rate and prioritize these criteria on a parcel basis.

Parcels with scores of 44-62 are identified as being the "highest priority" for farmland conservation on the countywide scale. The County Plan does, however, recognize that at the town-wide scale, some municipalities may want to use different criteria in the LESA model for ranking local priorities. The LESA analysis can be adapted to focus local efforts where they might be most effective.

The results of the county-wide LESA analysis for Hillsdale are shown in Figure 22. That map shows farmlands having high preservation value. Priority parcels are mostly in valleys, especially in those associated with the Roeliff Jansen Kill and Taghkanic Creek. Several parcels in Town are ranked in the high and highest categories.

Beef cattle on Tribrook Road at Collins Street. Photo © 2020David Lewis

[91] Ibid.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Hollowville Creek
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5
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Map prepared by Upstate GIS - February 2020
with Community Planning & Environmental Associates

Local Land Use Regulations

The Hillsdale zoning law establishes several overlay districts designed to protect natural resources including stream corridors, agricultural land, floodplains, ridgelines, and aquifers. The law establishes these overlay districts, but they do not become effective until mapped. To date, the Town has mapped stream corridor, ridgeline, and aquifer overlays.

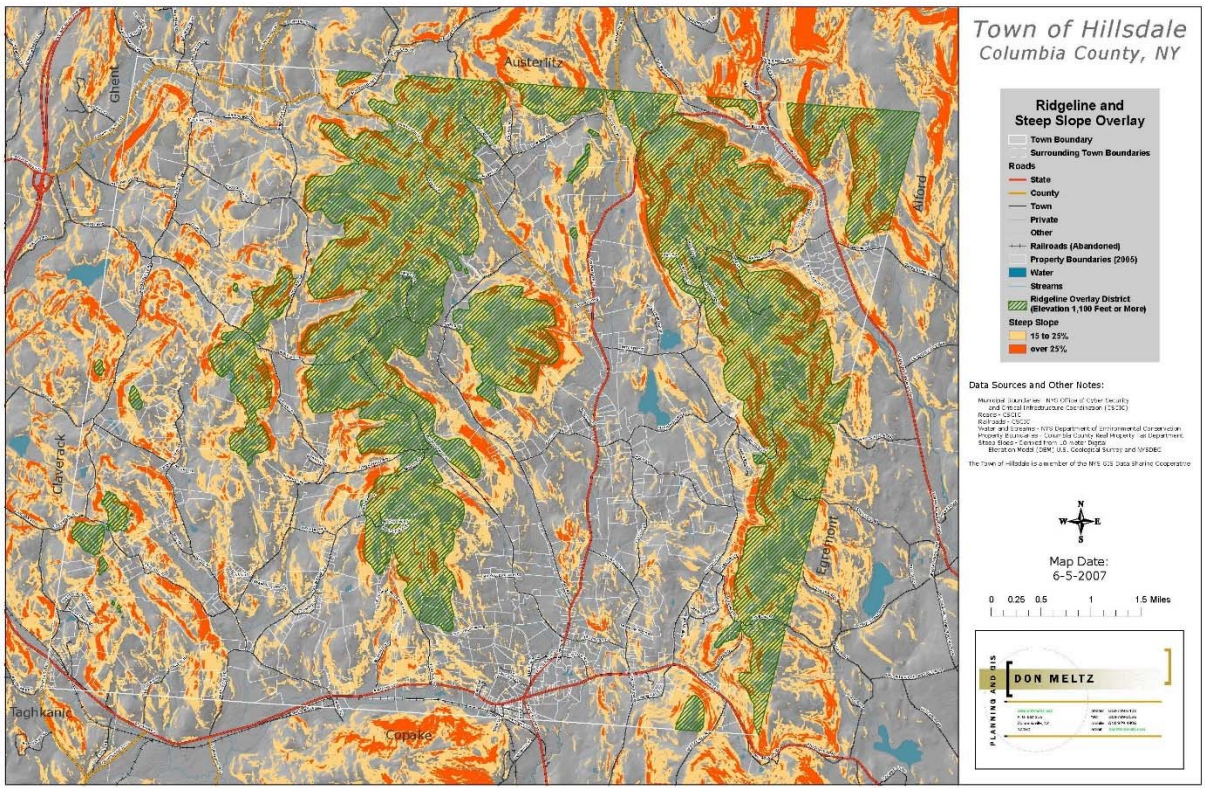
An overlay district can be established to protect specific resources that do not follow property or lot lines. Overlay districts can impose land use regulations designed to protect the resource in addition to the normal zoning district requirements. The purposes of the overlay districts established in Hillsdale are described below.

- **Stream Corridor Overlay District**. The purpose of this mapped Overlay District is to protect the water quality and scenic integrity of corridors of streams classified by the New York State Department of Environmental Conservation. The Hillsdale Zoning and Land Use Control Law recognizes that "[t]he protection of stream corridors is essential to the maintenance of water quality and the scenic beauty of the Town." (Section 5.1-2).
- **Ridgeline Overlay District.** The purpose included in the 2014 amended zoning for this mapped Overlay District is to "protect the town's scenic beauty and rural character and the scenic beauty of the Taconic region."
- **Aquifer Overlay District.** The purpose of this mapped Overlay District is to protect identified areas containing significant groundwater resources. The Aquifer Overlay District map was adopted in 2017.

The Town also has a logging permit requirement (Local Law 2 of 2008), and recently passed a local law regulating solar facilities (Local Law 3 of 2018).

The overlay districts in Hillsdale add additional regulations to protect specified environmental resources or to encourage or allow certain desirable activities. For example, the stream corridor overlay requires a special use permit for construction, filling, excavation, grading, dumping, application of fertilizers or pesticides, or clearcutting of more than 10,000 square feet in the overlay area.

Zoning also includes a soil mining overlay district (unmapped, so not in effect) and a Village-Mixed Use Floating District designed to promote more compact development that emulates traditional hamlet patterns.



Ridgeline and Steep Slope Overlay Map established in the Town of Hillsdale Zoning Law, 2007

Other overlay districts included in zoning, but not effective until mapped include:

- **Agricultural Preservation Overlay District.** The purpose of this Overlay District is to protect agricultural land and to encourage a development pattern that keeps agricultural land in productive use.
- **Floodplain Overlay District.** The purpose of this Overlay District is to limit development within identified floodplain areas to protect public safety. This overlay includes all lands identified by FEMA on the flood insurance maps as an area of special flood hazard.
- **Soil Mining Overlay District.** The purpose of this Overlay District is to identify specific areas where commercial extraction of sand, stone, and gravel can be permitted. Until such time as a Soil Mining Overlay District is mapped, soil mining can be permitted only by special permit in the RU District.

Threats to Resources

"Biodiversity and nature's contributions to people are our common heritage and humanity's most important life-supporting 'safety net.' But our safety net is stretched almost to the breaking point….The diversity within species, between species and of ecosystems, as well as many fundamental contributions we derive from nature, are declining fast, although we still have the means to ensure a sustainable future for people and the planet." (2019 United Nations Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES))

Climate Change

What is this? The term "climate change" refers to the range of phenomena occurring in response to warming of the Earth's atmosphere. Climate change is driven by emissions of greenhouse gases (GHGs) to the atmosphere—especially carbon dioxide, methane, and nitrous oxide—that trap heat near the earth's surface. The increased emissions are largely due to human activities such as production, transport, and burning of fossil fuels in power plants and automobiles, and the accumulated effects of many other activities, such as burning of wood and other organic materials, and emissions from agriculture and industry.

Why is this important? Predicted effects of climate change—higher temperatures, larger and more frequent storms and floods, more frequent and more prolonged droughts, more frequent wildfires, and related effects such as increases in invasive pests and pathogens affecting humans, livestock, and wildlife, and depletion of native biological diversity—could affect all aspects of our lives.

Global air temperatures have been increasing for the last century.[92] Although there is great year-to-year variation, the trends in the northeastern U.S. have been toward earlier spring thaws, hotter summers, later first frosts in the fall, and warmer and less snowy winters than those of past decades. These and other effects are likely to be felt more acutely in the coming years.[93]

Temperature rise in the Northeast has been much more rapid than national or global averages. In New York, annual average temperatures have increased 2° F since 1970 and average winter temperatures have increased 5° F. The average annual temperature in Columbia County is projected to increase approximately 4-6° F by mid-century and as much as 11° by the end of the century.[94] Even at the lowest projected rate of carbon emissions, by 2100, Columbia County summers could be similar to those of North Carolina today.[95]

[92] Horton et al., 2011

[93] Rosenzweig et al., 2011

[94] Horton et al., 2011

[95] Union of Concerned Scientists, 2006

Weather extremes—large rainstorms and snowstorms, ice storms, heat waves, and droughts—have long been characteristic of the northeastern climate, but overall climate patterns remained fairly consistent until the second half of the 20th century.[96] The total precipitation amount has increased only slightly in recent decades in the Northeast, but has become much more variable and more extreme. The amount of rain falling in heavy storm events increased 74% from 1958 to 2011. The current models predict that total annual precipitation could increase as much as 12% by 2050 and 21% by 2100. The models also project more frequent and more severe droughts, heavier rains in the intervening periods, and reduced snow cover in winter.[97]

Droughts can threaten local drinking water supplies, crop production, and livestock, and can severely stress communities of streams, ponds, wetlands, and upland habitats. Droughts can extend the low-flow period of streams and further stress the fish and other organisms that are already suffering from pollution, warmer stream temperatures, and stream barriers. Drought may become a long-term concern for agriculture in Hillsdale and could threaten drinking water supplies.

Disruptions to agriculture from frequent drought, flooding and unseasonal heat or frost events can interfere with successful food production and stress the delicate economies of small farms. Altered growing and storage conditions could require changes in crop and livestock species or food production practices. The changing climate is also bringing new insect pests and pathogens to the region.

Common redpolls, like this one perched among red maples off Route 21, breed in the boreal forests and tundra of the Arctic and winter with us. Previously, birds that breed in the Arctic have not suffered population declines like our grasslands or forest birds have, but there is evidence that climate change is putting them at risk for greater nest predation, and we may see declines in their numbers here. Photo © 2020 John Piwowarski

If the new stresses lead to further abandonment of active farms, then meadow habitats are likely to be converted to developed uses or to revert to shrubland and forest; these are also valuable habitats, but loss of large meadows will further the decline of grassland breeding bird populations that are already suffering from farmland conversion.

Expected climate-related health effects include increases in heat-related illness and death, respiratory disorders from exposure to increased air-borne allergens and air pollution, physical injuries from large flood events, and a range of infectious diseases. People with pre-existing disease or otherwise compromised health—such as those with asthma, cardiovascular diseases, or

[96] Union of Concerned Scientists, 2006

[97] Horton et al., 2011

infectious diseases—may be among the most vulnerable to the impacts of climate change. [98]

A warming climate and accompanying large rainstorms are likely to increase mosquito and tick populations along with the risk of diseases carried by those organisms. Many pathogens—such as those for Lyme disease, ehrlichiosis, West Nile Virus, and malaria—have increased their geographic range in recent decades in part due to warming winter temperatures.[99] Ticks do not survive prolonged periods of very cold temperatures; the flourishing populations of wood ticks and Lyme-infected black-legged ticks in Columbia County will continue to be aided by the warmer winter temperatures.

Degradation of Resources

Why are these issues important? Land use changes including transportation development (roads, driveways, stream crossings, and railroads); water diversions and damming; transmission lines, power lines and pipelines; and urban development remove or fragment habitats and can create habitat barriers that impede fish and wildlife movement and migration. Degradation can also occur due to pollution, night-time lighting, noise, invasive species, damage to soils, and loss of farmland. The direct result may be mortality or injury to individual animals and depletion of whole populations.

Loss and Degradation of Habitats

Loss of habitat occurs when new roads or residential, commercial, or industrial development eliminates former meadow or forest habitat, for example, or when unprotected wetlands are drained, filled, or converted to ornamental ponds.

Habitat fragmentation and other forms of degradation are less visible but more widespread than direct loss of habitats. New development such as roads or driveways not only creates barriers that many species will not cross or cannot safely cross but also alters the conditions of light, noise, and predator access in adjacent habitats, affecting habitat quality for nesting songbirds, amphibians, and other wildlife. Loss of understory during forestry operations, soil compaction, or removal of dead and downed trees can profoundly affect the habitat quality for forest wildlife, plants, and soil biota.

Landscape fragmentation is a process by which larger areas become smaller and isolated from each other by physical or other barriers or breaks in vegetation, as by roads, driveways, developed lots, and utility corridors. The ecological effects of a fragmenting feature is much larger than the footprint of the road, driveway, or clearing. The "edge effects" of these kinds of disturbances can reach well over 300 feet into forest patches,[100] for

[98] Kinney et al., 2011

[99] Leighton et al., 2012; Quarles, 2017

example. Fragmentation of large forests reduces the habitat suitability for area-sensitive wildlife and forest-interior plants and animals. A road or driveway through a large meadow can similarly reduce the habitat values of the meadow for grassland breeding birds, making the formerly deep interior meadow areas newly accessible to nest predators and other disturbance.

Loss and degradation of habitats can result in loss of native biodiversity, an essential component of a healthy ecosystem. Maintaining the full range of native plants and animals in an area allows an ecosystem to withstand stress and adapt to changing environmental conditions. This is likely to become even more important with the changing climate.

Degradation of Water Resources

Why is this important? Groundwater and surface water support all aspects of our lives and are essential components of Hillsdale's ecosystems. Depletion of water volumes or degradation of water quality profoundly affects habitats, plants, animals, and human uses for daily living, businesses, agriculture, and recreation.

Many of our activities on the land influence the quality and quantity of our surface waters and groundwater, even though some of the mechanisms are indirect and invisible to us.

Groundwater

Groundwater can be depleted by reducing recharge from the ground surface (e.g., by expansion of impervious surfaces that prevent infiltration of water to the soils) and by excessive groundwater withdrawals (e.g., for industrial processes or commercial products or from crowded wells in residential areas). The last could become a more common problem in the more densely settled areas of the hamlets, especially with the increasing frequency and severity of droughts predicted by climate scientists.

Groundwater quality can be degraded by fertilizers and pesticides applied to farm fields and lawns, nitrates and bacteria from septic systems, deicing salts from roads and driveways, and volatile polluting substances, such as from leaks and improper disposal of petroleum and other fluids. Groundwater is especially vulnerable to pollution in areas of coarse-textured soils (sand, gravel) or carbonate bedrock (limestone, dolostone).[101] A small volume of a harmful substance can contaminate a large volume of groundwater and, once contaminated, groundwater can be very difficult and costly to clean up. Nearly all Hillsdale residents and businesses obtain their drinking water from groundwater wells, so the quality and quantity of groundwater is fundamental to the public welfare.

[101] Winkley, 2009

Surface Water

Without specially designed measures for managing stormwater, impervious surfaces increase surface runoff of rainwater and snowmelt, and reduce groundwater infiltration, leading to erosion of stream banks and siltation of stream bottoms. This degrades stream habitat quality and water quality and reduces the base flows of streams. Runoff from impervious surfaces also raises the water temperature of nearby streams, leading to reduced levels of dissolved oxygen and degraded habitat for sensitive stream organisms.

Clearing vegetation and disturbing soils on steep slopes or in areas of shallow soils (e.g., during construction of roads, driveways, or houses) often increases the surface runoff, erosion of soils, and destabilization and siltation of nearby streams. These effects lead to reduced groundwater recharge, loss of soils, and degradation of stream habitats for fish and other stream organisms. Stormwater management measures employed at development sites, unless carefully designed and constructed, are often inadequate to restore and maintain the patterns, volumes, and quality of surface runoff and groundwater recharge that occurred prior to development.

Forested land, on the other hand, is very effective at facilitating the infiltration of rainwater and snowmelt to the soils, thus making it available for uptake by vegetation, for recharging the groundwater, and for slowly feeding streams, lakes, and ponds. Clearing of forests can greatly reduce infiltration to the soils and greatly increase the rapid runoff of surface water. This leads to "flashy" streams that run at high volumes during runoff events and then dry up at other times because groundwater is unavailable to feed the base flow.

Roadside ditches often carry contaminants, such as motor oil, heavy metals, road salt and other de-icing chemicals, sand, and silt, into nearby streams and wetlands. Applications of fertilizers and pesticides to agricultural fields, golf courses, lawns, and gardens can degrade the water quality and alter the biological communities of surface waters. Leachate from failing septic systems often introduces elevated levels of nutrients, especially phosphorus and nitrogen compounds, into surface waters, leading to a cascade of effects on water chemistry, biota, and whole aquatic ecosystems. A Hudson Valley study[102] found that the amount of nutrients and sediments entering a stream is affected by the amount of development within 300 ft of the stream. Streams, lakes, and ponds are also subject to atmospheric deposition of substances such as sulfur dioxide, mercury, and nitrogen from fossil-fuel-burning power plants in the Midwest, as well as nitrogen compounds from distant agriculture.[103]

Removal of shade-providing vegetation along a stream or pond shore for landscaping, agriculture, or other purposes can lead to elevated water temperatures and severely impact the aquatic communities that depend on cool environments. Clearing of vegetation and conversion of riparian areas to developed uses can also reduce the important exchange of nutrients and organic materials between the stream and the floodplain, diminish the capacity for flood attenuation, and increase downstream flooding.

The warming climate is expected to affect both the quantity and quality of groundwater and surface

[102] Cunningham et al., 2009

[103] Driscoll et al., 2001

water resources in the region, as well as the habitat quality of streams and ponds. Both total annual rainfall and rainstorm intensity are predicted to increase in New York in the coming years, with multiple consequences to the land, water resources, and agriculture.

Flooding hazards will increase with the increasing frequency and intensity of large rainstorms. The areas within the 100-year and 500-year flood zones will be particularly at risk, but additional areas may also be affected. The magnitude of flooding at any location will depend on the timing and intensity of large storms and the condition of the land—the ability to absorb large water volumes at the time of the storm—as well as the structures or other obstacles in the flood zone that may act to divert, concentrate, and accelerate flood flows.

More extended and more frequent droughts are also predicted in the coming decades[104] and are likely to affect public water supplies, private drinking water wells, and farm ponds for watering livestock, as well as streams, other natural habitats, and native plants and animals. More extreme floods and droughts, as well as increases in water temperatures, are likely to adversely impact populations of trout and other sensitive stream organisms that rely on cool, clear streams.

Degradation of Scenic Views

Scenic, historic, and cultural resources provide the people of Hillsdale with a sense of place, cultural continuity, and a visual backdrop for their daily lives, and contribute to the overall quality and enjoyment of life.

What constitutes a "scenic area" can be somewhat subjective, but there is probably general agreement on the scenic quality of some aspects of the landscape, such as forested hills, expanses of hayfields and pastures, and lakes such as Herrington Pond and Toppel Pond. Scenic areas can include large vistas as well as local landscapes of fields and streams. The scenic qualities of these areas can be degraded by structures, roads, utility lines, and other components of the built environment.

The scenic visual environment—panoramas of rolling forested hills, open fields, wetlands, and streams—is important to the people of Hillsdale, as noted in both the Comprehensive Plan and the Zoning and Land Use Law. The zoning law specifically states that among its purposes are to protect "visually" as well as "environmentally sensitive areas" from development and includes in those "sensitive" areas "scenic view sheds…stream corridors, wetlands, floodplains, and active farmlands" (§ 1.3-2).

The law further states the purpose to "protect existing ... scenic views [and to] ... maintain large areas of contiguous open space in their current undeveloped state, in order to preserve the predominantly open and rural character of the Town" (§ 1.3-3). Unfortunately, however, the law

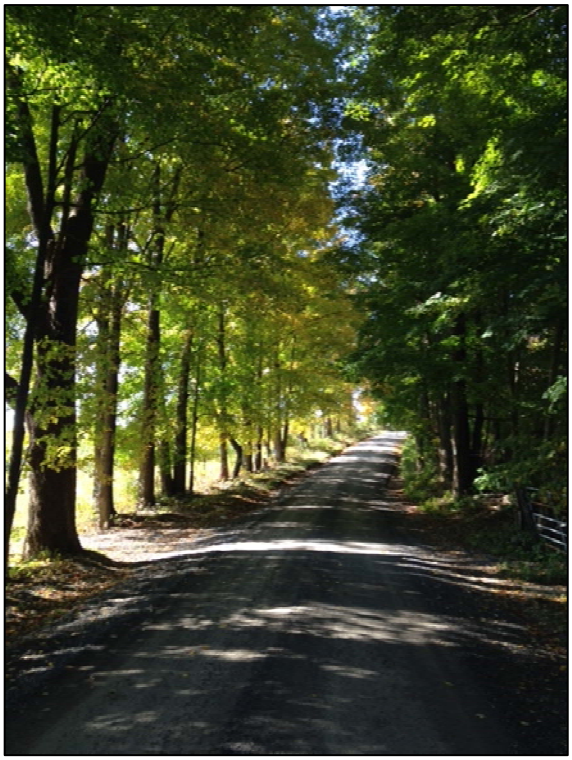
[104] Shaw et al., 2011

provides few specific protections for most of the scenic aspects of the Town.

The zoning law does, however, explicitly seek to protect the ridgeline areas from land uses that would despoil the scenic beauty of the high hills. The ridgeline areas are those lands above 1100 feet in elevation.

Proposed development projects in the ridgeline areas are subject to site plan review by the Planning Board, and the law specifies that no site plan, variance, or subdivision approval shall be granted if the development would "result in a degradation of scenic character" (§ 5.4-1[G]). It also provides that "removal of native vegetation" must be minimized and that buildings must be situated to minimize their visibility from a public road (§ 5.4.1[G][2]).

Apart from lands in the Ridgeline District, however, there are no legal protections for the fields, forests, streams and other scenic areas of the town.



Hillsdale has dozens of miles of local roads like this one, bordered by woods and fields. Photo © 2020 Paul Duernberger

Loss of Farmland

Loss of active farms and good farmland soils reduces our ability to grow high-quality food locally and reduces the economic and cultural benefits that farms provide to the Town. Loss of farmland also reduces the availability of certain open habitats—pastures, hayfields, fallow fields, and old fields—that are used in various ways by native plants and animals. Large hayfields or pastures, for example, can support grassland breeding birds (depending on the mowing schedule or intensity of grazing), such as bobolink and eastern meadowlark.

The future of farming in Hillsdale is fraught with challenges. The difficult economies of small-scale agriculture and unavoidable competition with products of large corporate farms that flood local markets can reduce local profits to near zero, and a single extreme weather event can easily erase any marginal profit in any given year.

Climate scientists predict greater frequency and intensity of extreme events such as heat waves, droughts, and floods, and adapting to other shifts in climatic norms may be difficult and expensive

for small farms. On family farms, the next generation is often uninterested in carrying on the farm enterprise, and the high price of land prevents many new, young farmers from getting a foothold. Leasing land can provide a temporary solution for new farmers, but uncertainties about the future of land tenure may reduce their investment in land stewardship.

Soils can be easily damaged by overgrazing, compaction, depletion of nutrients and organic matter, toxic contamination, and other poor farming practices, and can be easily lost to erosion where unvegetated crop fields are exposed to large rainstorms or floods. Protecting good farmland soils from damage and loss is essential to maintaining the potential for viable local agriculture.

The resurgence of the black bear population, after a long period of decline due to overhunting and habitat loss and fragmentation, has brought bears increasingly into populated areas including Hillsdale. This bear in a yard on White Hill is casing the site for access to the bird feeder suspended at the top of the picture, which it eventually succeeded in bringing down. Photo © 2020 Bob Kessler

Retiring farmers are sometimes forced to sell their land for non-farm uses to cover accumulated debt and the costs of retirement, and once developed with pavement, lawns, and structures, the potential for farming the land is lost for the foreseeable future. Subdivision of large farmland parcels into smaller lots often means the permanent end of farming on those parcels. Although some types of farming, such as flower- or herb-growing, are practical on small parcels, many types of farm operations are too inefficient on small parcels to be practical.

According to the American Farmland Trust,[105] New York State has lost half a million acres of farmland to suburban sprawl since the 1980's, the equivalent of 4,500 farms. Financial needs of retiring farmers, the difficulties of recruiting new farmers, and the temptations of more profitable land uses are all threats to continuing agriculture in Hillsdale.

When abandoned farmland is not developed for non-farm uses, however, the unmanaged meadows usually recruit diverse plant communities of grasses, forbs, and shrubs, and support a diverse array of invertebrates, amphibians, reptiles, mammals, and birds. All stages after abandonment can be valuable for native biodiversity, including the ultimate transition to forest.

[105] AFT, Undated

Resource Conservation Principles

Sustainable Uses

Sustainable uses of natural resources are those that do not permanently deplete or permanently damage the resource.[106]

Sustainable resource management looks for ways to thrive within the Earth's capacity to supply essential resources and assimilate our wastes.[107] Some key approaches to sustainability include reduction of material consumption and waste (resource conservation), improved efficiency of uses, recycling of materials, use of renewable sources of energy and materials, and restoration of damaged or depleted resources (reduce, reuse, recycle, rebuy, restore).

Ecosystems have persisted for millennia because organisms use the resources they need efficiently. Learning to mimic the efficiencies of natural systems will help the human community return to more sustainable relationships with the resources that support us.

This NRI outlines some basic principles and measures for sustainable uses and conservation of water, biological resources, farmland, and other natural resources.

Water Conservation

The quantity and quality of surface water resources—streams, lakes, and ponds—and groundwater is highly influenced by our uses of the land and has large implications for natural habitats and ecosystems.

- Forested landscapes are the most effective for maintaining clean and ample supplies of surface water and groundwater. Maintaining forested landscapes is the best protection for water supplies.
- Intact (undeveloped) riparian zones with undisturbed vegetation and soils help to absorb and slow floodwaters, process nutrients, intercept sediments, and stabilize stream banks.
- The coarse sediments and limestone bedrock in the lowland aquifer areas are efficient conduits of water for recharging the aquifer but also readily transmit contaminants to the groundwater. Minimizing impervious surfaces and use of toxic substances in these areas will help to maintain the high yield and water quality of the aquifers.
- Managing stormwater to maintain pre-development patterns and volumes of water infiltration to the soils on new or existing

[106] CBD, 1992

[107] Chiras et al., 2002

development sites will help to recharge groundwater and protect nearby streams from the multiple hazards of flashy runoff events.

- Protection of small streams can be accomplished by maintaining ample buffer zones of undisturbed vegetation and restoring forested corridors wherever possible. Intermittent streams are the lifeblood of more permanent streams and other waterbodies and help to govern the water quality and quantity available to those larger waterbodies.
- Avoiding or minimizing the use of de-icing salts and other toxic substances helps to protect the quality of water resources. De-icing salts applied to pavement, and fertilizers and pesticides applied to lawns and crop fields are potential contaminants of streams, ponds, and groundwater.

Agricultural Practices for Water Conservation

- Conservation tillage—leaving crop residue on the soil surface reduces runoff and soil erosion, conserves soil moisture— helps keep nutrients and pesticides on the field, and improves soil, water, and air quality;
- Crop nutrient management—tightly managing and accounting for all fertilizer input, and strategic timing of fertilizer applications—helps ensure that nutrients are available to meet crop needs while reducing nutrient movements off fields into nearby habitats and waterways. It also helps prevent excessive buildup of fertilizers in soils and helps protect air quality;
- Avoiding or minimizing applications of insecticides, herbicides, fungicides, and algicides will reduce contamination of soils and water. Crop rotations, biological control organisms, and Integrated Pest Management (IPM) techniques can help reduce the need for toxic pesticides, and keep pests below economically harmful levels while protecting soil, water, and air quality;
- Conservation buffers, from simple grassed swales to well-vegetated riparian areas, provide a protective barrier by capturing potential pollutants and sediments that might otherwise move into surface waters.
- Proper animal feeding operations (AFOs) management minimizes impacts of intensive animal feeding and waste discharges through runoff controls, waste storage, waste utilization, and nutrient management.
- Erosion and sediment control, that is, conserving soil and reducing the mass of sediment reaching a water body, protects both the soils for onsite agricultural use and water quality and habitat in offsite areas.[108]

[108] USEPA, 2018

The Roeliff Jansen Kill is a small stream in its upper reaches but grows substantially as it makes its way through town. Photo © 2020 David Lewis

Biodiversity

The *Biodiversity Assessment Manual for the Hudson River Estuary Corridor*[109] sets forth some basic measures for biological resource conservation that are relevant to town-wide planning and to land management by individual landowners; for example:

- Consider environmental concerns early in the planning process for new developments. Incorporate biodiversity conservation principles into the choice of development sites, the site design, and the construction practices.
- Identify habitats and species of conservation concern early in the planning for new developments, so that the development can be designed to protect those elements.
- Protect large, contiguous, unaltered tracts of land wherever possible. Avoid fragmentation of such areas by roads, driveways, and other developed uses.
- Maintain forested landscapes in the vicinities of streams, wetlands, and ponds to provide organic materials that support the food webs and habitat structure of those waterbodies and help to maintain cool water temperatures.

[109] Kiviat and Stevens, 2001

- Preserve broad links between natural habitats on adjacent properties. Broad connections between intact habitat areas allow wildlife to move safely across the landscape to fulfill their seasonal, annual, or longer-term life needs, maintain genetic exchange among distant populations, and migrate to new habitats under deteriorating environmental conditions or climate change.

- Restore and maintain broad buffer zones of natural vegetation along streams, along shores of other waterbodies and wetlands, and at the perimeters of other sensitive habitats.

- Promote redevelopment of brownfields and other previously altered sites, "infill" development, and "adaptive re-use" of existing structures wherever possible, instead of breaking new ground in unaltered areas.

- Direct human uses toward the least sensitive areas and minimize alteration of vegetation, soils, bedrock, waterways, and other natural features.

- Prevent or minimize noise and light pollution from developed areas.

- Concentrate development along existing roads; discourage construction of new roads or long driveways in undeveloped areas.

- Encourage pedestrian-centered developments that enhance existing neighborhoods, instead of isolated developments requiring new roads or expanded vehicle use.

- Minimize areas of impervious surfaces (roof surfaces, roads, parking lots, driveways, etc.), and maximize onsite retention and infiltration of stormwater runoff, to help protect the quality and quantity of groundwater and surface water resources, and the habitat quality of nearby streams. Design new development such that surface runoff from the site during and after construction does not exceed pre-construction runoff volumes.

A ruffed grouse comes into the open and starts to cross County Route 21. These birds generally prefer dense thickets in forested areas. The grouse is listed as a NYS Species of Greatest Conservation Need. The greatest threat to its population in the region may be the loss of young forest habitat. Photo © 2020 John Piwowarski

- Restore degraded habitats wherever possible, but do not use restoration projects as a "license" to destroy existing high-quality habitats.

Summarized below from the *Natural Resources Inventory for Columbia County*[110] are a few more-specific measures for biodiversity conservation in forests and meadows.

Forest Conservation

- Maintain broad landscape connections with other habitat areas. Connectivity between forests and other intact habitat areas helps to facilitate wildlife movement between habitats, allow other important ecological interactions, and help the plants and animals of forests respond and adapt to the many effects of climate change.[111]

- Locate any new development at forest edges near existing roads and other development, instead of the deep forest interiors.

- Avoid construction of utility corridors, roads, and long driveways deep into a forest interior; these can be a significant fragmenting feature, disrupting wildlife uses and inviting invasive plant species, nest predators and brood parasites.

- Maintain an undisturbed forest floor, and retain understory and ground vegetation, standing snags, downwood, and other organic debris. These elements provide the nutrients and microhabitats needed by forest plants and animals.

Meadow Conservation

- Meadows of unmowed grasses, sedges, rushes, and forbs provide valuable habitat for butterflies, moths, bees, ants, beetles, spiders, and a host of other important invertebrates, as well as small mammals such as meadow vole, and their predators such as eastern coyote, foxes, and raptors.

- Maintain meadow areas with diverse plant species, diverse vegetation structure, and uncompacted soils.

- Leave cut vegetation in place (if not harvested as hay). This provides the thatch ground cover that is important to small mammals, and ultimately becomes part of the meadow food web.

- Avoid use of broad-spectrum pesticides (herbicides, insecticides, fungicides, algicides, rodenticides) in or near meadows to protect the plants and animals of these habitats. Pesticides contaminate the vegetation, pollen, and nectar foods of pollinators, and can harm whole populations in the localities where they are used.

[110] Stevens and Travis, 2018

[111] Luque et al., 2012

A great spangled fritillary and pearl crescent nectar on common milkweed in an old field at the Rheinstrom Hill Sanctuary. Milkweed is famous for being the host plant for the monarch butterfly, but it is also a prolific source of nutrition for other insects that feed on its nectar. Photo © 2020 David Lewis

- Promote the larval host plants for butterfly and moth species of conservation concern—such as milkweeds for monarch and violets for fritillaries—and promote plenty of nectar plants to ensure ample food for butterflies, moths, bees, and other pollinators.

- Keep large meadows (10+ acres) intact, unfragmented by roads, driveways, or developed lots. Locate new development at meadow edges and near existing roads. Large meadows have value for grassland breeding birds, such as bobolink, eastern meadowlark, and grasshopper sparrow, which are of significant conservation concern in the Northeast.

- For large meadows that do not need to be intensively hayed, delay mowing until late spring or summer or (even better) fall. Many grassland breeding birds nest in the spring and the young do not fledge until late spring or summer, so mowing or intensive grazing of meadows in the spring or early summer is likely to be fatal to eggs and nestlings.

- For large meadows used as pasture, employ rotational grazing that allows for enough regeneration of vegetation between grazing periods. This will improve the survival rates of eggs and nestlings of ground-nesting birds.

Local regulatory measures for protecting important biodiversity resources include adoption of explicit language in the municipal comprehensive plan; adoption of conservation overlay districts, buffer zones, and other protective measures in the zoning ordinance; insertion of explicit provisions for biodiversity conservation in subdivision regulations, applicable to both minor and major subdivisions; site plan review requirements; stormwater management regulations; and local water resource protection laws. These are further described in the Conservation Tools section below.

Farmland Conservation

Some strategies to conserve farmland include:

- Prohibit or minimize new non-farm development on Prime Farmland Soils, or Farmland Soils of Statewide Importance.
- Avoid fragmentation of contiguous farmland by new roads, driveways, and other non-agricultural uses.
- Support economies of local farms by reducing tax assessments and other means.

Farmland conservation programs will also benefit when coupled with broader strategies that include building coalitions to advocate for programs and policies to permanently protect farmland, supporting family farmers who steward the land, and developing innovative policies and programs to protect the land on a large scale.

Improving the Carbon Balance

Reducing the carbon footprint of Hillsdale residents, businesses, and municipal operations can be accomplished through many means by individuals and agencies. For example:

- Establish education programs for town agencies, businesses, and residents on reducing greenhouse gas emissions in our daily lives.
- Maintain forested landscapes and other natural vegetation and undisturbed soils to promote carbon sequestration wherever possible.
- Encourage and provide incentives for private installations of solar panels, windmills, geothermal heating and cooling systems, and other technologies for renewable and low-carbon energy production.
- Develop town policies that help to concentrate new development near existing residential or commercial centers to minimize vehicle usage. Upgrading sewer and water infrastructure may be necessary to enable further concentration.

The Hillsdale Climate Smart Task Force has been working on reducing the carbon footprint of town operations since 2016, with such projects as installation of an electric car recharging station at the Town Hall, installation of solar panels on the Town garage, and replacement of street lights in the Hillsdale hamlet with LED lights to reduce energy use.

The northern flicker, a woodpecker, excavates a cavity for nesting in dead trees like this one just off Route 21. The flicker primarily eats insects and has a particular taste for ants. Adult flickers are preyed upon by bird-hunting hawks, such as the sharp-shinned hawk of our area. In addition, its young in the nest are vulnerable to predation by squirrels, raccoons, and snakes. Photo © 2020 John Piwowarski

Forest Management Practices

Most of our forests need no human management. Forests have been developing and persisting here for thousands of years, while intermittently withstanding and recovering from wildfires, ice storms, wind bursts and tornadoes, clearcutting, agricultural uses, and diseases. Forests that are left undisturbed by humans are more likely to be free of non-native invasive plants and non-native earthworms and may stave off infestations of emerging insect pests such as hemlock woolly adelgid and emerald ash borer, at least temporarily.

Forest management is advisable, however, for landowners who wish to harvest timber, firewood, or other forest products in a sustainable way that protects the forest soils, waterways, and native biological diversity, and promotes long term forest productivity. Forests can also be managed to reduce infestations of non-native invasive plants, or reduce vulnerability to non-native insects and diseases. There may be situations where it is advisable to manage a forest to promote habitat conditions for particular plant or animal species of conservation concern. Where none of these situations apply, however, the forests will probably do best if left alone, with little or no human disturbance.

"Sustainable forest management is the practice of meeting the forest resource needs and values of the present without compromising the similar capability of future generations."[112] Forestry best management practices (BMPs) are practical methods used to achieve goals that relate to water quality, biodiversity, silviculture, aesthetics and (sometimes) recreation.

The New York State Forestry Best Management Practices for Water Quality, prepared by NYSDEC, sets forth statewide management guidelines for ensuring water quality. Although these are geared toward State land, the principles are applicable everywhere. The document promotes management for diverse habitats, communities, and species.

The NYSDEC Best Management Practices include measures such as these:

- Water quality – to reduce or eliminate non-point source pollution; maintain water quality, quantity and clarity:
  - Plan the harvest and design skid roads and log landings to minimize stream crossings and other disturbance near streams, wetlands, and waterbodies.
  - Avoid areas of steep slopes or poorly drained soils.
  - Schedule harvests for when soils are deeply frozen, if possible.
  - Suspend harvest during wet periods.
  - Maintain equipment and storage facilities to prevent leaks and spills.
  - Store fuel, lubricants, and other toxic materials far from streams, wetlands, and waterbodies.
  - Install silt fences, haybales, geotextiles, and other devices to prevent or minimize soil erosion and siltation of streams and wetlands.

- Wildlife and biodiversity – manage the forest and design the harvest to maintain habitat, cover and food for diverse wildlife species.

- Soil quality – maintain soil characteristics to ensure continued productivity; schedule harvests for winter when soils are frozen; avoid working on wet soils; minimize areas of soil compaction from logging vehicles and equipment.

- Recreation – provide the landowner opportunity to pursue recreational activities.

The BMP field guide[113] provides technical and practical information to help identify potential problem areas, select the best protective measures, and implement the best practices for sustainable forest uses.

Erosion and sedimentation are the primary potential nonpoint source pollution problems associated with forest management activities, especially at stream crossings, but spills and leaks of petroleum fuels and lubricants can also introduce toxins to soils and waterways. Erosion moves soil and can damage or destroy forest roads. The resulting sedimentation and turbidity in streams can damage habitats for invertebrates, salamanders, and fish, and make the water and stream substrate unsuitable for other uses downstream.

[112] NYSDEC, 2018

[113] Ibid.

At the planning stage for a timber harvest, important nearby features such as streams, ponds, lakes, wetlands, existing access, steep slopes, and highly erodible or wet soils should be identified from maps and field observations. Other areas of special interest such as seeps, springs, nesting sites, and other important habitats should be identified by walking the property. Most sediment is introduced to water bodies from roads and trails. Careful layout, installation, and maintenance of logging roads will provide access to the resource and minimize opportunities for erosion, pollution, and sedimentation.[114]

For landowners who are not seeking to harvest trees or other products from their forests, other management measures will help to support the forest ecosystem:

- Leave standing dead trees, diseased trees, injured trees, and downwood in place wherever they do not pose a safety hazard to humans or structures.
- Leave the forest floor undisturbed as much as possible.
- Monitor the forest for early invasions of non-native plants, and use non-toxic methods to remove any pioneers as soon as they appear (https://hudsonia.org/wp-content/uploads/2018/07/BMPs_Invasive-Plants_Hudsonia-with-appx.pdf).

Conservation Measures

The 2011 Hillsdale Comprehensive Plan establishes a set of goals the Town desires to attain over time. Many relate to preserving the environmental features of the Town and maintaining Hillsdale's community character. In particular, the Town recognizes the importance of agriculture, land uses and small businesses that do not harm the natural environment, and the desire to preserve open space and "the most important environmental, visual, and historic resources in the Town, including high quality agricultural land, scenic roads, ridgelines, wetlands, stream corridors, aquifers, mature forests, important wildlife habitats, and historic structures and land areas."[115]

This section offers a brief discussion of the conservation tools that can be used by the Town to achieve environmental goals. This NRI can help users identify the most important resources and those that are vulnerable to existing and future threats.

To promote biodiversity and environmental sustainability, the Town can identify priority areas, habitats, and systems that need conservation. Priorities can be identified based on natural resource attributes such as size, connectivity, habitat quality, habitat diversity, local ecological importance, and compatibility with existing and future community needs.

Natural resource protection should be undertaken with a comprehensive view of potential land uses and landscape changes. This should be done in recognition that our environment is complex, and

[114] Ibid.

[115] TOH CP, 2011

that natural systems often cross both property lines and municipal boundaries.

A variety of regulatory and non-regulatory measures can help accomplish the Town's conservation goals, including amendments to the local zoning code, careful environmental review of proposed development projects, and education initiatives for landowners and land use applicants.

Non-Regulatory Measures

The following actions are non-regulatory measures that can be implemented by individuals, organizations, and agencies to protect and conserve the natural resources of the Town of Hillsdale.

Non-Regulatory Measures for Conservation
Minimize applications of polluting substances, such as de-icing salts to roads, parking lots, and driveways, and pesticides and fertilizers to lawns, gardens, and agricultural fields.
Redesign and retrofit roadside ditches and other stormwater systems to maximize water infiltration to the soils, and minimize rapid and direct runoff into streams, ponds, and wetlands.
Design new culverts and bridges and retrofit existing ones to accommodate storms of 500-year intensity in anticipation of more frequent and severe storms in coming decades.
Design, install, and retrofit culverts to maintain the continuity of stream gradients and substrates.
Consider the 100-year and 500-year floodplain when considering land management and land uses along streams.
Keep floodplain meadows well-vegetated. Minimize tillage in floodplains; seed immediately after tilling; leave abundant thatch to cover exposed soils; use cover crops in winter.
Remove structures, pavement, and hazardous materials from floodplains wherever possible.
Direct runoff from agricultural fields into basins and well-vegetated swales, instead of directly into streams or wetlands, to prevent the introduction of excess sediments, nutrients and toxins.
Support and continue the Town of Hillsdale Climate Smart Community Program.
Upgrade and expand water and sewer infrastructure in the Hillsdale hamlet so that future development can occur without harm to soil or water resources.
In areas of high hydrogeologic sensitivity, avoid siting land uses with potential for contaminating soils and water. Educate landowners in these areas about the vulnerability of groundwater resources.
Protect habitat areas in large, broad configurations, with broad connections to other habitat areas.
Avoid fragmentation of large forest patches by roads, driveways, clearings, and other disturbances that open the forest canopy.[116]

[116] Smallidge and Goff, 1998

Non-Regulatory Measures for Conservation, Continued
Avoid fragmentation of contiguous farmland by roads, driveways, or other non-farm uses.
Promote wildlife-friendly agricultural practices, such as late mowing of large meadows to accommodate ground-nesting grassland birds, leaving unmowed strips and fallow rotations to support pollinators and other beneficial invertebrates, and minimizing applications of pesticides and fertilizers.
Employ sustainable forestry practices in working forests and sustainable agricultural practices that build living soils and conserve water.[117]
Inform town agencies, landowners, and the general public about the NRI and its maps to heighten awareness and use of the information.
Encourage voluntary land donations of land or easements from interested landowners to a local land trust to protect open spaces and areas with sensitive environmental features.
Create a municipal funding stream to purchase lands or easements such as use of a Community Preservation Fund. See explanatory note below.
Encourage farmland owners to participate in NYS Department of Agriculture and Markets farmland protection programs. These programs provide state funding to landowners who desire to voluntarily sell the development rights to their land and establish a permanent conservation easement to allow lands to stay in agricultural production.

Most conservation work will be accomplished voluntarily by private landowners on their own land, but where public purchase of land or easements seems appropriate, funds can be raised through local bond acts, municipal budget surpluses, foundation grants, or private donations from individuals. A Community Preservation Fund is a way to establish an ongoing stream of funding for conservation purposes.

A Community Preservation Fund is established by local law pursuant to General Municipal Law Section 6-S, and the funds are to be used for conservation of natural or cultural resources. Deposits into the fund may include revenues from a tax on the transfer of real property interests, or other revenues of the local government.

Such funds can be used for establishment of parks, nature preserves or recreation areas; preservation of open space; preservation of lands of exceptional scenic value; preservation of aquifer recharge areas; establishment of wildlife refuges for the purpose of maintaining native animal species diversity, including the protection of habitat essential to the recovery of rare, threatened or endangered species; preservation of unique or threatened ecological areas; preservation of rivers and river areas in a natural, free-flowing condition; preservation of forested land; preservation of public access to lands for public use including stream rights and waterways; preservation of historic places and properties listed on the New York State register of historic places and/or protected under a municipal historic preservation ordinance or law; and preservation of land which is predominantly viable agricultural land (NYS General Municipal Law GMU 6-s.4).

[117] Shifley et al., 2012

Regulatory Measures

The following are existing or new regulatory measures that can contribute to natural resource conservation in the Town of Hillsdale.

Existing State and Federal Laws
Federal Endangered Species Act (for protection of federally listed endangered and threatened plants and animals)
Federal Clean Water Act (for protection of certain wetlands and streams)
New York State Environmental Conservation Laws (for protection of certain wetlands and streams, and state-listed rare plants and animals)
New York State Agriculture and Markets Law 25-AA

Local Zoning, Subdivision and other Related Laws
Development Standards That Can Be Included in Local Zoning:
Create buffer zones of undisturbed vegetation and soils along streams and around wetlands, lakes, and ponds.
Minimize impervious surfaces and use low impact development designs (LID) to manage stormwater in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.
In floodplains, allow only new land uses that are resilient to flooding and will not obstruct, redirect, or hasten flood flows.
Direct new land uses to those portions of a parcel that are the least sensitive and minimize alteration of natural features, including vegetation, soils, bedrock, and waterways.
Protect habitat complexes for species of conservation concern wherever possible.
Protect active farmland, Prime Farmland Soils, and Farmland Soils of Statewide Importance from development as much as possible.
Design new subdivisions and development sites in ways that preserve the areas of best farmland soils as much as possible.
Protect viewsheds by careful design and placement of new structures. Maintain intact hilltops and slopes wherever possible, including those below the 1100-ft elevation of the Ridgeline Zone.
Minimize outdoor lighting and apply International Dark Sky Association outdoor lighting standards to prevent light pollution.
Use green infrastructure wherever possible and practical.

Local Zoning, Subdivision and other Related Laws, Continued
Other Useful Zoning Techniques That Could Be Incorporated into Local Zoning Law:
Offer incentives such as density bonuses to promote protection of sensitive environmental areas on proposed development sites.
Require a Flexible Lot Subdivision design as the default for all minor and major subdivisions. The Flexible Lot Subdivision tool is available in the Hillsdale local code but has rarely been used.
On sites with sensitive environmental features, identify potential driveway alignments and building envelopes during the subdivision approval process, so that the most sensitive areas can be protected from disturbance.

Measures to Enhance Environmental Review of Development Projects

The following actions are measures that can be implemented by the Town Planning Board or Zoning Board of Appeals to protect and conserve the natural resources of the Town of Hillsdale.

Planning Board and Zoning Board of Appeals Actions
Formally adopt this NRI as a town reference document and require its use by applicants and agencies during SEQR and other reviews of land development projects.
Consider environmental concerns early in the planning process for new development projects and incorporate conservation principles into the choice of development sites, the site design, the stormwater management, and the construction practices.
Require that applicants conduct habitat and biodiversity assessments as part of project applications.
Establish Critical Environmental Areas to focus attention on especially sensitive resource areas during environmental reviews when new development is proposed in the vicinity.
Use SEQR workbooks and the EAF Mapper to enhance environmental reviews https://www.dec.ny.gov/eafmapper/. The EAF Mapper is an online tool that allows a user to search for a parcel or land area and receive mapped information from the NYSDEC database of certain environmental features such as wetlands, critical habitats, listed rare species, archaeologically sensitive areas, and others. This tool can also be used by project applicants to partially fill out Part I of the Short and Full Environmental Assessment Forms required in a SEQR process. A caution: much of the mapped information is very general and incomplete and should not substitute for on-site evaluations and inventories of environmental features.

Conservation Partners

Federal, State, and County Agencies

- **New York State Department of Environmental Conservation (NYSDEC)**
  The regional NYSDEC office conducts ongoing reviews of potential land protection projects based on priorities identified in the State Open Space Conservation Plan (2016). Projects that fit the scope of a listed priority conservation project and pass a thorough review process are eligible for funding from the State's Environmental Protection Fund and other state, federal and local funding sources. The New York State Open Space Conservation Plan discusses the need for protection of the Taconic Ridge, Harlem Valley, and the Route 22 corridor and its scenic viewsheds

  The NYSDEC's Climate Smart Communities program is a "state-local partnership to meet the economic, social and environmental challenges that climate change poses for New York's local governments." The program supports local governments and communities as they work to balance the goals of confronting and adapting to climate change, reducing local tax burdens, and advancing other community priorities. Participating communities will be alerted to the availability of state and federal grants, will have privileged access to certain state grants, and will be part of a network of governments working to achieve "climate smart" practices and policies. Hillsdale signed on to the program in 2016 and has been pursuing projects to improve the efficiency of energy use by Town operations.

  The Hudson River Estuary Program of the NYSDEC has a strong interest in developing the capability of municipalities to conserve important resources. They offer education opportunities for municipal officials, and grants to municipalities and nonprofit organizations for projects that advance local biodiversity and water conservation efforts. The Estuary Program prepared a "Habitat Summary" for the Town, available on the Hillsdale CAC webpage (https://hillsdaleny.com/committees/conservation-advisory-council/), and funded the preparation of this NRI.

  The Hudson River Estuary program and the Cornell Cooperative Extension conducted a survey of Hillsdale's culverts to identify where undersized, suspended, or otherwise inadequate culverts occur throughout the Town, and recommend measures that will reduce floods and infrastructure damage and restore stream habitat continuity for aquatic organisms (Figure 11). The CCE and Trout Unlimited have been working with the Hillsdale Highway Department to obtain funding to replace the highest priority culverts.

  Other offices of NYSDEC can provide information and technical assistance with stream and lake monitoring, groundwater protection, and floodplain mapping.

- **New York State Department of State (NYS DOS)**
  The NYS DOS offers training opportunities, educational publications, and technical assistance for municipal agencies on a variety of topics including the State Environmental Quality Review (SEQR) process and developing local legislation. SEQR and local legislation can be powerful tools in the protection and stewardship of local resources.

- **New York State Office of Parks, Recreation, and Historic Preservation (OPRHP)**
  The OPRHP manages the Taconic State Park (in Copake, Ancram, and North East) for purposes of conserving natural resources and providing recreational and educational opportunities for the public. The agency could be a willing partner providing information, technical assistance, and other support for projects related to biodiversity conservation, water conservation, publicly accessible trails, and public education on land in the Taconic Ridge. OPRHP is also a partner in the development of the Harlem Valley Rail Trail.

- **Hudson River Valley Greenway**
  The Greenway offers technical assistance and small grants to local municipalities and nonprofit organizations for projects related to community planning, economic development, and protection of open space and of natural, cultural, and scenic resources.

- **Cornell Cooperative Extension—Columbia and Greene Counties**
  The Cooperative Extension is part of a statewide program that aims to put "knowledge to work in pursuit of economic vitality, ecological sustainability and social well-being," serving local families, farms, and communities. Their agricultural education programs provide research-based information on production and marketing of agricultural and horticultural products, through workshops, publications, and consultations. Their natural resource programs provide information, workshops, and assistance on such topics as woodland stewardship, water resource protection, invasive species, and agroforestry.

- **Natural Resource Conservation Service**
  The NRCS (of the U.S. Department of Agriculture) collaborates with farmers, communities, and other individuals and groups to protect natural resources on private lands. They identify natural resource concerns related to water quality and quantity, soil erosion, air quality, wetlands, and wildlife habitat, develop conservation plans for restoring and protecting resources, and help to direct federal funding to local conservation projects.

- **Columbia County Soil and Water Conservation District**
  The District office provides technical assistance and education on matters related to water, soils, and other natural resources to municipalities, farmers, landowners, and residents, and promotes resource conservation and environmental stewardship. They host educational programs, provide consultations, and assist with obtaining funding for projects that enhance environmental quality or economic viability of farm-related enterprises.

- **Columbia County Agriculture and Farmland Protection Board**
  The Agriculture and Farmland Protection Board, a committee of active farmers and representatives of several county agencies, advises the Columbia County Board of Supervisors on matters related to state-certified agricultural districts and acts as a liaison between county agencies, landowners, and state agencies on matters affecting agricultural district lands. The Board was the lead agency in preparing the Columbia County Farmland Protection Plan (2015).

Municipal Agencies

- **Neighboring Towns**
  Neighboring towns can be valuable partners in land conservation and can help achieve Hillsdale's goals, especially where shared natural resources straddle municipal boundaries. Adjoining towns can collaborate on developing conservation funding, supportive land use ordinances and other regulatory measures, strong open space plans, and ownership and management of conservation lands.

  The "Habitat Summary" for Copake prepared by the Hudson River Estuary Program (http://townofcopake.org/government/committees/conservation-advisory-committee/) also illustrates some of the natural resources of mutual interest—such as large forests, streams, and aquifers—that cross town boundaries. Copake's "Climate Summary" and "Water Resource Summary" (prepared by the Hudson River Estuary Program) and their Groundwater Protection Plan also contain information relevant to Hillsdale.

Statewide and Regional Conservation Organizations

- **Audubon New York**

Audubon New York is a state program of the National Audubon Society. Its mission is to protect birds and their habitats through science, advocacy, education, and on-the-ground conservation programs. The organization manages seven sanctuaries and centers throughout the state, including the Rheinstrom Hill Sanctuary and Center in Copake and Hillsdale. Audubon New York sponsors public education programs, leads public outings, identifies Important Bird Areas throughout the state, monitors bird populations and trends, promotes conservation legislation, and works with other organizations to promote policies and practices that protect important lands for wildlife.

- **Columbia Land Conservancy**

The Columbia Land Conservancy's mission is to conserve the farmland, forests, wildlife habitat, and rural character of the county, and to strengthen connections between people and the land. They own and manage ten Columbia County properties as public conservation areas, and they hold conservation easements on over 23,000 acres of privately-owned land in the county. The CLC sponsors education programs for residents on natural history and conservation, workshops on development of public trails, and workshops for town agencies on incorporating natural resource conservation into land use planning, environmental reviews, and decision-making. The CLC also hosts regular "roundtable" meetings that bring together the county's Conservation Advisory Councils to discuss shared issues. The CLC is an energetic and willing partner in local conservation.

- **Housatonic Valley Association**

The HVA is a non-profit organization that "works to conserve the natural character, environmental health, and economies of our region by protecting and restoring its land and waters…." The HVA works in the three states—New York, Massachusetts, and Connecticut—that contain the watershed of the Housatonic River. (The northeastern corner and eastern edge of Hillsdale are in the watershed of the Housatonic.) The HVA conducts research, sponsors public education, and works with other agencies and organizations on many fronts to improve environmental quality and promote land conservation throughout its service area.

- **The Nature Conservancy**

The Nature Conservancy (TNC) is an international land conservation organization that has worked extensively throughout the state to further land protection. It encourages conservation easements and works with other organizations, agencies, and private landowners to prevent further fragmentation of important ecosystems. TNC's conservation targets include matrix forest blocks, wetlands, drinking water sources, rare and endangered plants, and rare animals such as the timber rattlesnake and the bog turtle. In addition, TNC has a particular interest in helping communities adapt to climate change. TNC has designated the Berkshire-Taconic region as one of the world's "Last Great Places" and has joined with other organizations and public agencies to develop a recovery plan for the bog turtle.

- **Open Space Institute**

The Open Space Institute (OSI) works in the eastern U.S. to protect scenic, natural, and historic landscapes through direct acquisition and conservation easements, and partners with local and state government to expand parklands. OSI's conservation strategy focuses on permanent protection at the landscape-level scale. OSI has protected over 46,000 acres in the Hudson Valley, creating connecting corridors that benefit both recreationists and wildlife, and protecting prime farmland.

- **Preservation League of New York State**

The Preservation League of New York State seeks to protect New York's heritage of historic buildings, districts, and landscapes. It leads advocacy, economic development, and education programs, and provides grants, loans, and technical assistance to individuals, organizations, and communities. Most of the historic landscapes in Hillsdale include farmland and/or forests, so may fall under agricultural and scenic as well as historic classifications from the perspectives of potential funders of conservation projects.

- **Trout Unlimited**

Trout Unlimited (TU) is a national organization whose mission is to conserve, protect and restore the cold-water streams and fisheries of North America through habitat restoration, land conservation, public education, and legislative advocacy. They have a long history of collaborating with conservation organizations and local, state and federal government agencies to achieve shared goals. The local chapter of TU is the Columbia-Greene Chapter #569 (Hudson). TU has an extensive network of volunteers who work on local conservation projects and issues. The New York State Council Trout Unlimited Conservation Fund provides small grants to local TU chapters for coldwater fisheries conservation projects. TU has been collaborating recently with the Hudson River Estuary Program and the Cornell Cooperative Extension in identifying aquatic barriers and securing funding for municipalities to replace inadequate culverts. Due to the presence of many small and large trout streams in Hillsdale, the local TU chapter (Columbia-Greene, Hudson) might also be well-positioned to obtain other funding for projects to restore, enhance, or protect the habitat quality of Hillsdale's streams.

- **Trust for Public Land**

The Trust for Public Land (TPL) is a nationwide conservation organization working in many disparate environments, from inner cities to wilderness areas. In the ten-county area of the Hudson Valley below the Troy dam, TPL has assisted the state, counties, and municipalities in protecting more than 51,000 acres.

Regional Recreation Organizations

- **Harlem Valley Rail Trail Association**

The Harlem Valley Rail Trail is a joint effort between the Harlem Valley Rail Trail Association (HVRTA), the New York State Office of Parks, Recreation & Historic Preservation (OPRHP), the New York State Department of Transportation, Dutchess County, and the municipalities along the Harlem Valley Rail Line, from its northern terminus at Wassaic (Dutchess County) to Chatham (Columbia County). The HVRTA advocates for, promotes community support for, and raises funds for completing sections of the rail trail. It cooperates with local, county, and state agencies in establishing and maintaining the trail and helps to educate the public about safe use of the trail. In Columbia County, the developed portion of the rail trail is part of Taconic State Park and is maintained by the OPRHP and HVRT volunteers.

- **Columbia County Mountain Bike Association**

The Columbia County Mountain Bike Association and the International Mountain Bike Association are non-profit trails advocacy groups that conduct research and help to build and maintain sustainable multi-use trails. Both organizations could be partners with Hillsdale in building and maintaining biking trails should other properties become available for these uses.

- **New York–New Jersey Trail Conference**

The New York–New Jersey Trail Conference is "a federation of member clubs and individuals dedicated to providing recreational hiking opportunities in the region and representing the interests and concerns of the hiking community. It is a volunteer-directed public service organization" that develops, builds, and maintains hiking trails, protects hiking trail lands through support and advocacy, and educates the public in the responsible use of trails and the natural environment. The NY-NJTC maintains the South Taconic Trail, which runs from Boston Corners (in Ancram) to just north of Catamount (in Egremont, MA) and is currently being extended south to Rudd Pond (in North East).

Research and Education Organizations

- **Farmscape Ecology Program**

The Hawthorne Valley Farmscape Ecology Program (FEP) is a research and outreach branch of the Hawthorne Valley Association at the Hawthorne Valley Farm in Ghent and Hillsdale. The FEP studies the ecology of agricultural and natural landscapes of the county and the region and the interactions of people with the land, both historically and in the present. They explore the natural and social ecology of the region, inform people of their findings, and seek to deepen everyone's connections to the land. The FEP has conducted biological field studies of properties in Hillsdale as part of county-wide studies of the plants, animals, and important ecological communities. The FEP and Hudsonia are preparing an *Ecological and Cultural Field Guide to the Habitats of Columbia County*. The FEP also leads field workshops to educate the public about habitats, plants and animals, and

the ecology of farmland and wildlands here and elsewhere in the county.

- **Hudsonia Ltd.**

Hudsonia is an environmental research institute that studies the plants, animals, and habitats of the region, their ecology and their conservation. Hudsonia biologists conduct pure and applied research throughout the Hudson Valley and elsewhere in the Northeast, produce educational and scientific publications, and conduct training and other educational programs for scientists, environmental practitioners, and land use decision-makers to help participants better understand how to recognize, assess, and protect important biological resources.

Local Businesses

Many local business owners have a deep personal appreciation for and commitment to the Town and the region and recognize that their business success is closely tied to the Town's natural and cultural environment. Hillsdale businesses have been generous in supporting cultural and environmental projects in the town. Contributing to conservation efforts can offer business owners the personal satisfaction that comes with taking care of the places they love, can serve as an investment in the landscape that supports their livelihood, can demonstrate their commitment to conservation and the community as a prominent aspect of their business profile, and can help build positive relationships with the community. For all these reasons businesses are often enthusiastic partners in conservation initiatives and should not be overlooked in the quest for funding, publicity, and in-kind assistance.

Landowners and Others

Private owners of large land parcels or of smaller parcels containing important resources play a critical role in the future of land conservation and can be essential partners in conservation action and funding. Landowners can take specific measures to protect habitats and water resources on their own land, can collaborate with their neighbors to protect and manage resources in nearby areas, and can assist the Town with larger conservation efforts. Landowners in Hillsdale are diverse and represent a broad spectrum of views on conservation. Town-sponsored conservation efforts can benefit from reaching out to landowners on a regular basis to build partnerships and to understand owners' relationships to their land and their interests, goals, and concerns. Education programs can help landowners understand the role they play in shaping their community's future landscape and the available options for land management and land conservation.

Local professionals, such as biologists, ecologists, teachers, environmental engineers, landscape architects, as well as amateur naturalists, often have a wealth of knowledge and expertise related to natural resources. Many have a strong personal interest in resource conservation, and some can offer their volunteer services to the Town for technical assistance, grant-writing, or public education. The Town should remember to call on such local expertise when appropriate.

A fall view from White Hill looking over the Harlem Valley and North Hillsdale to the western hills of the Town. Photo © 2020 Janet Lincoln

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Map Data Sources and References

Base data on most maps:

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- Roadways, Source: NYS GIS Program Office: http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=932
- Ponds, Source: National Hydrography Dataset: http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=928
- Rivers and Streams, Source: National Hydrography Dataset: http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=928
- Hillshade, Derived from 10-meter elevation data, Source: U.S Geological Survey: https://www.usgs.gov/products/data-and-tools/gis-data

Figure 1 Topography

- Topographic base map, Source: USGSTopo (MapServer): https://basemap.nationalmap.gov/arcgis/rest/services/USGSTopo/MapServer

Figure 2 Elevation

- Elevation, 10-meter elevation data, Source: U.S Geological Survey: https://www.usgs.gov/products/data-and-tools/gis-data

Figure 3 Aerial Photograph

- Image, 1-meter National Ag. Imagery Program (NAIP) natural color summer 2017, Source: USDA NRCS: https://nrcs.app.box.com/v/naip/folder/44540012092

Figure 4 Steep Slopes

- Slopes, Derived from 10-meter elevation data, Source: U.S Geological Survey: https://www.usgs.gov/products/data-and-tools/gis-data

Figure 5 Bedrock Geology

- Bedrock Geology, Source: New York State Museum: http://www.nysm.nysed.gov/research-collections/geology/gis
- Mines, Source: https://thediggings.com/usa/new-york

Figure 6 Surficial Geology

- Surficial Geology, Source: New York State Museum: http://www.nysm.nysed.gov/research-collections/geology/gis
- Mines, Source: New York State DEC: https://www.dec.ny.gov/lands/5374.html

Figure 7 Soil Drainage

- Soils, Source: USDA Natural Resources Conservation Service (NRCS): https://datagateway.nrcs.usda.gov/GDGOrder.aspx

Figure 8 Watersheds

- Watershed Boundaries (HUC 12). Source: USDA NRCS: https://datagateway.nrcs.usda.gov/GDGOrder.aspx

Figure 9 Surface Water Classes

- Mapped Wetlands, Combination of NYSDEC and USFWS National Wetland Inventory (NWI) wetlands, Sources: NYS Division of Information Services and U.S. Fish and Wildlife Service: https://cugir.library.cornell.edu/catalog/cugir-008187?id=111 and https://www.fws.gov/wetlands/data/State-Downloads.html
- NYSDEC Classified Streams, Source: NYSDEC via NYS GIS Clearinghouse http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1118

Figure 10 Flood Zones

- 100-year floodzone, Digital Q3 Flood Zone Data, Source: FEMA via NYS GIS Clearinghouse: http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=246
- Riparian Buffers, Source: NY Natural Heritage Program: https://www.nynhp.org/treesfortribsny

Figure 11 Aquatic Barriers and Potential Contaminant Sources

- Bulk Storage Facilities, Source: NYSDEC Division of Environmental Remediation: http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=4.
- State Pollutant Discharge Elimination System (SPDES), Source: NYSDEC https://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1010
- Road Salt Storage and Landfills, Source: Landfill data from the RPS data. Hillsdale CAC provided location of salt storage which were then digitized as part of this project.
- Aquatic Barriers, bridge and culvert locations and evaluations, Source: North Atlantic Aquatic Connectivity Collaborative: https://www.streamcontinuity.org
- Dams, most locations were modified based on image analysis, Original Source: NYSDEC: https://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1130

Figure 12 Unconsolidated Aquifers

- Hydrologic Sensitivity and Unconsolidated Aquifers, Data provided for this project originated as part of a 2009 Groundwater Resources Study and Protection Plan prepared by NY Rural Water Association project, Source: Steven Winkley, P.G.: https://www.nyruralwater.org

Figure 13 Wetlands

- NYSDEC Regulated Wetlands, Source: NYS Division of Information Services: https://cugir.library.cornell.edu/catalog/cugir-008187
- NWI Mapped Wetlands, Source: USFWS National Wetland Inventory (NWI) wetlands: https://www.fws.gov/wetlands/data/State-Downloads.html
  Probable and Possible Wetlands, derived from soils classified as very poorly drained or poorly drained (probable) or somewhat poorly drained (possible), Source: USDA NRCS: https://datagateway.nrcs.usda.gov/GDGOrder.aspx

Figure 14 Large Forests & Floodplain Forests

- Matrix Forest Blocks and Linkage Zones, Source: The Nature Conservancy – Eastern Conservation Science: https://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1261
- Forest Patches, Source: Cornell University's Department of Natural Resources in cooperation with the NYSDEC Hudson River Estuary Program (HREP): Data provided directly from HREP

Figure 15 Large Meadows

- Large Meadows, Source: Subset of the Nature Conservancy's Northeast Terrestrial Wildlife Habitat Classification System: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/mapsdata/Pages/default.aspx (Terrestrial Habitat Map)

Figure 16 Ecological Systems

- Ecological Systems, Categories are a grouping (provided by the Hillsdale CAC) of more detailed classifications, Source: The Nature Conservancy's Northeast Terrestrial Wildlife Habitat Classification System: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/mapsdata/Pages/default.aspx (Terrestrial Habitat Map)

Original Category	Revised Category
NE Interior Dry-Mesic Oak Forest: typic	hardwood forest
Laurentian-Acadian Northern Hardwood Forest: typic	
NE Interior Dry-Mesic Oak Forest: moist/cool	
Laur-Acad N. Hwd Forest, moist-cool	

Original Category	Revised Category
Appal Hem-N. Hwd Forest: typic	hemlock-hardwood forest
Appal Hem-N. Hwd Forest: moist-cool	
Appal Hem-N. Hwd Forest: drier	
Central Appal Dry Oak-Pine Forest	oak-pine forest
Central App Pine-Oak Rocky Woodland	pine-oak woodland
Central App Alkaline Glade/Woodland	alkaline woodland
N Appal-Acad Rocky Heath Outcrop	rocky heath
North-Central Appal Acidic Cliff/Talus	acidic ledge & talus
N-Central Appal Circumneut Cliff/Talus	circumneutral ledge & talus
N-Central Appal Acidic Swamp	acidic hardwood swamp
N-Central Interior and Appal Rich Swamp	rich hardwood swamp
Laur-Acad Alkaline Conif-Hwd Swamp	rich mixed swamp
Laur-Acad Wet Meadow/Shrub Swamp	wet meadow/shrub swamp
Laurentian- Acadian Freshwater Marsh	marsh
NLCD agricultural classes 81-82	agricultural
NLCD developed classes 21-24, 31	developed
NLCD-NHD open water	open water
Surface Water	
Rivers and Streams	

Figure 17 Special Biological Resources

- Taconic Mountains Significant Biodiversity Areas, subset of NY Significant Biodiversity Areas, Source: NYSDEC Hudson River Estuary Program: https://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1247
- Sensitive Cold Water Stream Corridors, Source: The Nature Conservancy and New York Natural Heritage Program: Data provided directly from HREP
- Trout Streams, based on (T) and (TS) NYSDEC stream classifications, Source: NYSDEC: http://gis.ny.gov/gisdata/inventories/details.cfm?DSID=1118
- Ancient and Recently Reforested Alluvial Forests, Source: Farmscape Ecology Program: Data provided directly from Hillsdale CAC

Figure 18 Agricultural Resources

- Agricultural Districts, Source: Cornell Institute for Resource Information Sciences: https://cugir.library.cornell.edu/?q=agricultural+districts+iris
- Agricultural Parcels, based on parcels receiving an agricultural exemption and/or coded as agricultural use, Source: Hillsdale Assessor's Office and Columbia County Real Property Data.
- Prime Farmland Soils and Farmland Soils of Statewide Importance, subset of county soil layer, Source: USDA Natural Resources Conservation Service (NRCS): https://datagateway.nrcs.usda.gov/GDGOrder.aspx

Figure 19 Landscape Resiliency to Climate Change

- Climate Resiliency Scores, Source: The Nature Conservancy: https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/resilience/Pages/Downloads.aspx

Figure 20 Scenic Resources

- Hillsdale scenic points and road segments, identified by the Hillsdale CAC and provided as part of this project
- Ridgeline Protection Zone, from the town's zoning which covers areas above 1,100'

Figure 21 Conserved Lands

- Conservation Lands, data from Columbia Land Conservancy and others, provided by HREP, but also available from the USGS Protected Areas Database: https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/protected-areas

- Harlem Valley Rail Trail, data provided by HREP

Figure 22 Priority Agricultural Lands

- Conservation Farmlands, data from Columbia Land Conservancy and others, provided by HREP, but also available from the USGS Protected Areas Database: https://www.usgs.gov/core-science-systems/science-analytics-and-synthesis/gap/science/pad-us-data-download?qt-science_center_objects=0#qt-science_center_objects
- Priority Farmland, subset of the Columbia County Agricultural Land Protection Priority Map, data provided by the Hillsdale CAC, Map Source: https://sites.google.com/a/columbiacountyny.com/columbia-county-agriculture-and-farmland-board/maps

Other documents used in the production of the maps and map data also include:

NYNHP. 2014. Matrix Forest Block Linkages. New York Natural Heritage Program. Metadata.

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Appendices

Fox sparrows feed on the ground, usually under dense cover, where they are less obvious than this one. They mainly eat insects, hopping back and forth in a quick two-step to uncover them in the ground. Photo © 2020 John Piwowarski

A. Glossary

Glossary definitions are from the Natural Resources Inventory for Columbia County, New York.[118]

alluvium Material, such as sand, silt, clay, and gravel, deposited on land by moving water.

"ancient forest" Forest areas that may never have been cleared for agriculture and other purposes, even though they may have been grazed or selectively cut for firewood or timber. These are not equivalent to "old growth" forests.

aquifer A water-bearing formation, e.g., in bedrock fractures or solution cavities, or in unconsolidated surficial material such as sands and gravels.

area-sensitive wildlife Wildlife species that require large contiguous habitat areas to meet their life history needs and maintain local populations. Some of these species have large home ranges; some require a complex of habitats distributed over the landscape; some are especially sensitive to human disturbance or are vulnerable to predators or nest parasites that frequent habitat edges.

bedrock The solid rock either exposed or underlying soil, rock fragments, or other unconsolidated materials.

biodiversity All the variety of plants, animals, and other living things. The term encompasses diversity at all scales, including landscapes, ecosystems, ecological communities, species, and their genes. From a conservation standpoint, ecologists are mainly concerned about native biodiversity—the biota that have established and developed in the region over millennia, but not the recent introductions since European settlement.

calcareous Calcium-rich; containing high concentrations of calcium salts. The term is generally applied to water, soils, and bedrock. The source of calcium in this region is usually calcium carbonate (e.g., limestone). Calcareous environments are generally circumneutral or alkaline.

carbon footprint The amount of greenhouse gases emitted in the course of an activity (e.g., by operation of a vehicle or other equipment, by an industrial plant, by an agricultural operation, by a construction project, by an extractive installation, etc.) during a given period.

carbon sequestration Capture and long-term storage of atmospheric carbon dioxide or other forms of carbon. Carbon sequestration, whether occurring artificially or by natural biological, chemical, and

[118] Stevens and Travis, 2018

physical processes (such as the growth of a tree, or the accumulation of peat in a wetland), is a means of mitigating or deferring global warming.

conservation easement A voluntary legal agreement drawn up by a landowner and a qualified public or private agency (such as a land trust) that ensures permanent protection of the land. The landowner retains ownership with many of its rights and responsibilities (including property taxes), and can live on, use, or sell the land or pass it on to heirs, but the conservation easement remains attached to the land in perpetuity. The easement is designed to serve the conservation goals of the landowner and easement holder (e.g., the land trust), and describes permissible and impermissible land uses and land management.

Critical Environmental Area A geographical area with exceptional character with respect to a benefit or threat to human health; a natural setting; agricultural, social, cultural, historic, archaeological, recreational, or educational values; or inherent ecological, geological or hydrological sensitivity that may be adversely affected by any change in land use. A CEA must be formally delineated, mapped, described, and adopted by the municipal legislative body, and registered with the NYS Department of Environmental Conservation (www.dec.ny.gov/permits/6184.html). The purpose of establishing a CEA is to raise awareness of the unusual resource values (or hazards) that deserve special attention during environmental reviews and land use decisions. The municipality must then ensure important attributes of the CEA are considered in the siting and design of land development projects in those areas.

dolomite The mineral calcium magnesium carbonate ($CaMg[CO_3]_2$).

dolostone A durable sedimentary rock composed primarily of dolomite (calcium magnesium carbonate); like limestone in appearance, hardness, solubility, and human uses.

ecosystem services The resources and services provided by the natural environment that benefit the human community, such as purification of water and air, cycling of nutrients, mitigation of floods, dispersal of seeds, pollination of agricultural crops, control of agricultural pests and human disease organisms, production of timber, fish, wild game, and other wild foods.

edge effects The influences of habitat edges on interior habitats and species. These may include the effects of noise, light (natural or artificial), wandering pets, accessibility to predators and nest parasites, and pollution introduced from human activities at the habitat edges. Certain edge effects occur at the edges between natural habitats as well as those between natural habitats and human-disturbed areas.

edge (habitat) The boundary between two different kinds of habitats or biological communities or between other different landscape elements.

Farmland Soils of Statewide Importance A designation of the Natural Resource Conservation Service for soils that are nearly as productive as "Prime Farmland Soils" and that produce high yields of crops when properly managed.

fen (As used in this NRI) an open, herb- and low shrub-dominated wetland fed by calcareous groundwater seepage. This habitat has a distinctive plant community that, in this region, often includes such species as shrubby cinquefoil, grass-of-parnassus, bog goldenrod, and woolly-fruit sedge.

floodplain The area bordering a stream that is subject to frequent or infrequent flooding.

forb A broad-leaved herbaceous (non-woody) plant. (Compare to "graminoid.")

fragmentation (of habitats) Dividing (by roads, driveways, utility corridors, other developed features) large, continuous habitat areas into smaller, more isolated remnants.

glacial outwash Mineral material (gravel, sand, and silt) deposited by the melting ice of a glacier.

glacial till Mixed mineral material (clay, silt, sand, rocks) transported and deposited by glacial ice, or by streams flowing from a melting glacier.

lacustrine deposits Sand, silt, and clay particles that settled on the bottom of an ancient lake.

gradient (As used in this NRI) slope, or degree of slope (e.g., a steep or gentle gradient).

graminoid A grass-like plant. Graminoids include grasses (Poaceae), sedges (Cyperaceae), and rushes (Juncaceae).

green infrastructure An approach to water management that incorporates natural systems (and mimicry of natural systems), sometimes in combination with engineered systems to protect, restore, or maintain water resources and ecosystem functions. Some examples are protection or restoration of floodplains, wetlands, or forests, or use of urban rain gardens, permeable pavement, green roofs, rainwater barrels, graywater retrieval systems, and vegetated swales.

groundwater The water that resides beneath the soil surface in spaces between sediment particles and in rock fissures and seams.

habitat The place or environment where an organism normally spends all or part of its life. A habitat is defined by both the biological (e.g., plants and animals) and the non-biological (soil, bedrock, water, sunlight, temperatures, etc.) components.

headwaters The upper reaches of a stream, near the stream's origin.

herbaceous Non-woody. Herbaceous plants include, for example, forbs, graminoids, mosses, and liverworts.

hydric soils Soils formed under conditions of saturation for long enough during the growing season to develop anaerobic (oxygen-free) conditions near the ground surface. The presence of hydric soils is one of the three features necessary (along with wetland hydrology and hydrophytic vegetation) for identifying an area as wetland.

hydroperiod The seasonal pattern of inundation or soil saturation.

impervious surface Surfaces such as a roof, pavement, or compacted soil that impedes or prevents the local infiltration of water to the soils or underlying substrate.

intermittent stream A stream that typically flows for only part of the year.

intermittent woodland pool A vernal pool (see below) in a forested setting.

invertebrate An animal that lacks a vertebral column. Invertebrates include insects, mollusks, crustaceans, nematodes, spiders, centipedes, protozoans, and a host of other macroscopic and microscopic organisms.

kame An irregular hill or short ridge composed of mineral material deposited by a glacier.

landform A natural feature on the Earth's surface such as a hill, valley, plain, or ravine.

limestone A fine-grained sedimentary rock composed of calcium carbonate.

liverwort A non-vascular plant, closely related to mosses but differing in leaf characteristics and reproductive structures.

marble A medium-grained metamorphic rock of interlocking calcite crystals derived from limestone.

marsh A wetland that typically has standing water for a prolonged period during the growing season and is dominated by herbaceous (non-woody) vegetation with species such as cattail, bur-reed, pond-lily, and arrowhead.

microclimate The climate of a very localized area; for example, the hot, dry conditions on a rocky barren in summer, or the cool, moist conditions beneath a rotting log on the forest floor.

microhabitat A very localized habitat with characteristics distinct from those of the larger surrounding habitat; for example, a tree cavity within a deciduous forest, or a woody hummock within a swamp.

native species A plant or animal species that is indigenous to the region; that is, a species that arrived here by natural dispersal processes and not by human agency.

non-native species A plant or animal introduced to the region by human agency, intentionally or unintentionally. (See "native species" for comparison.)

nonpoint-source pollution Pollution emanating from a diffuse source such as unchannelized runoff from a paved parking lot or an agricultural field. (See point-source pollution.)

NYNHP New York Natural Heritage Program, an agency that serves as a repository and clearinghouse for information on the occurrence, distribution, and status of plants, animals, and natural communities in the state.

NYSDEC New York State Department of Environmental Conservation.

peat Partially decomposed organic matter that accumulates under conditions of prolonged water saturation.

perennial stream A stream that typically flows year-round.

phyllite A fine-grained metamorphic rock intermediate in grade between slate and schist.[119]

Prime Farmland Soils A designation of the Natural Resources Conservation Service for soils that have the best combination of physical and chemical characteristics for producing crops.

reach (of a stream) A segment of stream or river defined by geographic markers, such as river miles, natural features, or political boundaries.

recharge (groundwater) The process by which water flows or percolates from the ground surface to an aquifer—an underground water-bearing formation in bedrock or unconsolidated material.

remote sensing Detecting the physical or biological characteristics of an area from a distance. Typically, the term refers to interpretation of satellite or aerial photo imagery and map data to analyze the landscape.

[119] Fisher, 2006

resiliency As used in this document, the capacity to withstand, recover from, and adapt to stresses such as those imposed by floods, diseases, climate change, or other catastrophic events.

riparian Within or adjacent to a stream or river.

schist A medium-grained, layered metamorphic rock derived from shale.

seep Diffuse groundwater discharge to the ground surface. (Compare with "spring.")

SGCN Species of Greatest Conservation Need: species that are experiencing a population decline and have known threats that may put them in jeopardy, and are in need of conservation action to restore or maintain stable population levels.

shale A fine-grained thinly layered sedimentary rock derived from silt and clay.

slate A fine-grained metamorphic rock derived from shale.

snag A standing dead tree.

soil Organic or unconsolidated mineral material that has been acted on by weathering and biological processes.

spring Concentrated groundwater discharge to the ground surface. (Compare with "seep.")

sub-basin The watershed of a tributary to a larger stream.

surficial deposits Loose material transported and deposited over bedrock. Material may be transported by glaciers (e.g., glacial till, glacial outwash) or by moving water (alluvium).

swamp A wetland dominated by woody vegetation (trees or shrubs).

talus Loose rock debris that accumulates below an exposed bedrock ledge.

thatch Undecomposed, dead plant material that accumulates on the soil surface of a meadow or lawn.

tributary A stream that flows into a larger stream, river, or lake.

unconsolidated aquifer Groundwater stored in saturated sand and gravel deposits.

upland In this document, "upland" is equivalent to "non-wetland." The term implies nothing about elevation; upland areas can be at any elevation, low or high or anywhere in between.

vernal pool A wetland—usually small—that is isolated from other wetlands or streams, and that typically holds water in winter and spring, but dries up at some time during the growing season. (See "intermittent woodland pool".)

viewshed The entire area visible from a specified location and, conversely, the entire area from which that location is visible.

watershed The entire land area that drains to a particular place such as a stream, wetland, or pond.

wetland "[An area that is] inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances [does] support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (definition of wetlands regulated under the federal Clean Water Act: at 33 CFR 328.3[c][4]).

wet meadow A wetland that typically has little or no standing water for most of the growing season and is dominated by herbaceous (non-woody) vegetation.

B. Columbia County Plants and Animals

Table B-1. Dragonflies and damselflies of Columbia County. Data are from the NYSDEC 2005-2009 statewide survey (White et al. 2010) and from Farmscape Ecology Program (FEP) observations 2003-2017. Habitats are from Vispo (2017) and Abbott (2006-2018). (This table is taken [with permission] from the Columbia County Natural Resources Inventory [Stevens and Travis 2018].)

Common Name	Scientific Name	Habitat	Statewide Status[2]
AESHNIDAE			
darner,[1] black-tipped	*Aeshna tuberculifera*	over fields & along edge of water	
darner, Canada	*Aeshna canadensis*	over fields & along shores of slow-moving water	
darner,[1] comet	*Anax longipes*	around ponds or over fields	S2S3
darner, common green	*Anax junius*	over small ponds, skimming lake edges, or over fields	
darner,[1] fawn	*Boyeria vinosa*	in forested swamps & over shaded streams	
darner,[1] green-striped	*Aeshna verticalis*	over fields	
darner,[1] harlequin	*Gomphaeschna furcillata*	edges of forests	
darner, lance-tipped	*Aeshna constricta*	over fields & ponds	
darner, shadow	*Aeshna umbrosa*	along forest edges, shaded areas	
darner,[1] swamp	*Epiaeschna heros*	wooded ponds & streams (incl. ephemeral pools & ponds)	S3
CALOPTERYGIDAE			
jewelwing, ebony	*Calopteryx maculata*	in shaded areas & along small streams	
jewelwing,[1] river	*Calopteryx aequabilis*	around all types of rivers & streams	
jewelwing,[1] superb	*Calopteryx amata*	by the sides of small, shaded streams	S3
rubyspot,[1] American	*Hetaerina americana*	streams, rivers	S3
COENAGRIONIDAE			
bluet, azure	*Enallagma aspersum*	near most slow-moving water	
bluet, big	*Enallagma durum*	around swampy ponds or slow-moving rivers	S3
bluet, double-striped	*Enallagma basidens*	around edges of still water where vegetation present	S3
bluet, familiar	*Enallagma civile*	around large, slow-moving water bodies	
bluet, Hagen's	*Enallagma hageni*	along edges of ponds	
bluet,[1] marsh	*Enallagma ebrium*	around wetlands & open swamps	
bluet,[1] northern	*Enallagma annexum*	around still water & nearby	
bluet, orange	*Enallagma signatum*	near all types of still water	
bluet, skimming	*Enallagma geminatum*	around edges of most types of water	

Common Name	Scientific Name	Habitat	Statewide Status[2]
COENAGRIONIDAE (cont.)			
bluet, stream	*Enallagma exsulans*	along sides of streams & lakes	
bluet,[1] tule	*Enallagma carunculatum*	slow-moving streams & rivers, occasionally lakes or ponds	
bluet,[1] turquoise	*Enallagma divagans*	slow-moving streams, lakes	S3
bluet,[1] vesper	*Enallagma vesperum*	around ponds & lakes	S4
damsel, aurora	*Chromagrion conditum*	near most water; esp. slow-moving or stagnant ponds	
damselfly,[1] eastern red	*Amphiagrion saucium*	around ponds or other stationary water	
dancer, blue-fronted	*Argia apicalis*	rivers, large streams, esp. deep & muddy	S3
dancer,[1] powdered	*Argia moesta*	around medium to large rivers, ponds, & lakes	
dancer, variable	*Argia fumipennis violacea*	around edges of most slow or still water	
forktail, eastern	*Ischnura verticalis*	wide variety incl. ponds, edges of slow-moving rivers, & fields	
forktail, fragile	*Ischnura posita*	wide variety incl. pond edges, forested swamps, streams, & fields	
sprite, sedge	*Nehalennia irene*	in wet, grassy, mostly open areas	
sprite,[1] sphagnum	*Nehalennia gracilis*	sphagnum bogs, fens	
CORDULEGASTRIDAE			
spiketail,[1] delta-spotted	*Cordulegaster diastatops*	unshaded seeps, small streams	
spiketail,[1] twin-spotted	*Cordulegaster maculata*	around rocky, shaded streams & along field edges	
CORDULIIDAE			
baskettail[1], beaverpond	*Epitheca canis*	bog ponds, slow-moving streams, & marshy lakes	
baskettail, common	*Epitheca cynosura*	around ponds & nearby fields	
baskettail,[1] prince	*Epicordulia princeps*	tree-tops	
emerald, American	*Cordulia shurtleffii*	near still ponds, bogs, fens, marshes, small lakes, & over meadows	
emerald,[1] brush-tipped	*Somatochlora walshii*	slow-moving clear streams through bogs, fens, & marshes	S3
emerald,[1] clamp-tipped	*Somatochlora tenebrosa*	edge of fields & along shady tree lines	
emerald,[1] Kennedy	*Somatochlora kennedyi*	bogs	SNA
emerald,[1] mocha	*Somatochlora linearis*	forested streams	S1
emerald,[1] racket-tailed	*Dorocordulia libera*	over ponds & bogs & along edges of forests	
shadowdragon,[1] umber	*Neurocordulia obsoleta*	small lakes	S1

Common Name	Scientific Name	Habitat	Statewide Status[2]
GOMPHIDAE			
clubtail,[1] arrow	*Stylurus spiniceps*	over sandy streams or on the banks	S3
clubtail,[1] ashy	*Gomphus lividus*	moderately fast-moving streams & sheltered inlets of lakes	
clubtail,[1] dusky	*Gomphus spicatus*	over slow-moving or still water	
clubtail,[1] harpoon	*Gomphus descriptus*	fast-moving streams with sandy bottoms	S3
clubtail, lancet	*Gomphus exilis*	over fields, roads, & on rocks near water	
clubtail, least	*Stylogomphus albistylus*	around rocky streams	
clubtail,[1] lilypad	*Arigomphus furcifer*	around still water & slow-moving streams	
clubtail,[1] mustached	*Gomphus adelphus*	near riffles in clear streams, or along lakeshore	S2S3
clubtail,[1] northern pygmy	*Lanthus parvulus*	over small shaded streams	S3
clubtail,[1] southern	*Lanthus vernalis*	clear streams. forested	S1, SPCN
clubtail,[1] russet-tipped	*Stylurus plagiatus*	rivers	S1
clubtail,[1] spine-crowned	*Gomphus abbreviatus*	rivers, lakes	S1
clubtail,[1] unicorn	*Arigomphus villosipes*	around ponds & lakes	
clubtail,[1] zebra	*Stylurus scudderi*	near streams & small rivers	S3
dragonhunter[1]	*Hagenius brevistylus*	along streams, esp. shaded ones	
snaketail,[1] boreal	*Ophiogomphus colubrinus*	fast-moving streams with gravel or sand bottoms, shaded	S1
snaketail, brook	*Ophiogomphus aspersus*	over clean running water, open sunny streams	S3
snaketail,[1] riffle	*Ophiogomphus carolus*	near swift streams & small rivers	S2S3
snaketail,[1] rusty	*Ophiogomphus rupinsulensis*	near rivers & on nearby rocks	
spinyleg,[1] black-shouldered	*Dromogomphus spinosus*	around clear rocky streams	
LESTIDAE			
spreadwing, amber-winged	*Lestes eurinus*	near still water; esp. boggy or temporary ponds	S3S4
spreadwing,[1] common	*Lestes disjunctus*	slow-moving streams with emergent veg, marshes, swamps, & bogs	
spreadwing,[1] elegant	*Lestes inaequalis*	near still water & in shaded environments	
spreadwing, slender	*Lestes rectangularis*	around forested pools & small clearings	
spreadwing,[1] southern	*Lestes australis*	still or slow-moving water, perm. or intermit. ponds, marshes, & lakes	S2S3, SPCN
spreadwing, spotted	*Lestes congener*	around still, marshy water	

Common Name	Scientific Name	Habitat	Statewide Status[2]
LESTIDAE (cont.)			
spreadwing, swamp	*Lestes vigilax*	near still, swampy bodies of water	
spreadwing, sweetflag	*Lestes forcipatus*	around still, swampy water	
LIBELLULIDAE			
amberwing, eastern	*Perithemis tenera*	around ponds & other still water, or in nearby fields	
corporal, chalk-fronted	*Ladona julia*	near ponds & small lakes	
dasher, blue	*Pachydiplax longipennis*	over still ponds	
glider,[1] spot-winged	*Pantala hymenaea*	open temp. ponds, pools (incl. artificial)	
glider, wandering	*Pantala flavescens*	over fields & wide-open areas	
meadowhawk, band-winged	*Sympetrum semicinctum*	in meadows & fields	
meadowhawk,[1] cherry-faced	*Sympetrum internum*	around small ponds & nearby fields	
meadowhawk, ruby	*Sympetrum rubicundulum*	around swamps, wet meadows, & wetlands	S3
meadowhawk,[1] white-faced	*Sympetrum obtrusum*	in swamps & wet vegetated areas, or fields	
meadowhawk,[1] yellow-legged	*Sympetrum vicinum*	near still water or fields	
pennant[1], banded	*Celithemis fasciata*	marshy ponds	S3
pennant, calico	*Celithemis elisa*	around ponds or in nearby fields	
pennant, Halloween	*Celithemis eponina*	in fields & around ponds	
pondhawk, eastern	*Erythemis simplicicollis*	around ponds or (for females esp.) in fields	
saddlebags, black	*Tramea lacerata*	over fields & meadows	
skimmer,[1] four-spotted	*Libellula quadrimaculata*	around ponds, swamps, & marshy streams	
skimmer, painted	*Libellula semifasciata*	marshy forested seeps, ponds, & slow-moving streams	
skimmer, slaty	*Libellula incesta*	around edges of ponds & lakes	
skimmer, spangled	*Libellula cyanea*	around ponds & streams	
skimmer, twelve-spotted	*Libellula pulchella*	near bodies of water & over fields	
skimmer, widow	*Libellula luctuosa*	near ponds & lakes & in wide variety of fields	
whiteface, dot-tailed	*Leucorrhinia intacta*	around ponds or other small stagnant bodies of water	
whiteface,[1] frosted	*Leucorrhinia frigida*	mud-bottomed lakes & ponds with emergent veg, pools in fens, bogs	
whiteface,[1] red-waisted	*Leucorrhinia proxima*	bogs, fens, acidic ponds	

Common Name	Scientific Name	Habitat	Statewide Status[2]
LIBELLULIDAE (cont.)			
whitetail, common	*Plathemis lydia*	all types of water (except fast-moving) & in fields	
MACROMIIDAE			
cruiser, Illinois River	*Macromia illinoiensis*	over shaded rivers or more open areas	
cruiser,[1] stream	*Didymops transversa*	medium to large streams & rivers	

[1] Species known from five or fewer locations in the county.

[2] New York Natural Heritage Program ranks (S1, S2, S3, SNA) are explained in Appendix C.

SPCN = NYS Species of Potential Conservation Need

Table B-2. Butterflies of Columbia County, New York. Compiled by the Hawthorne Valley Farmscape Ecology Program (FEP) with input from Harry Zirlin and others. Flight time and foods from Cech and Tudor (2005); habitats from Cech and Tudor and FEP observations. (This table is taken [with permission] from the Columbia County Natural Resources Inventory [Stevens and Travis 2018].)

Common name	Statewide Status[1,2]	Apparent Status in County	Flight Time	Caterpillar Food	Habitat
HESPERIIDAE					
broken-dash, northern		rare	early June-mid Aug	panic grasses	oldfield
cloudywing, northern		occasional	late May-early July	clovers & other legumes	"scrubby field"
cloudywing,[3] southern		rare	early June-mid July	legumes	open habitats
dash, black		occasional	late April-early June	sedges	sedgy wetlands
dash, long		occasional	early June-early July; Aug	grasses	open grassy meadow, often moist
duskywing, columbine		unseen but possible	May-June, July	columbine	calcareous ledge
duskywing,[3] dreamy		rare	mid-May-June	willows, aspen, black locust	open forest & edges
duskywing,[3] Horace's		rare	May, June, Sept	oaks	dry, open oak woods
duskywing, Juvenal's		common	late April-early June	oaks	open upland habitats, usually not disturbed
duskywing,[3] mottled	S1, SGCN[HP]	rare	May-June, July-August	New Jersey tea	open, dry forest
duskywing, sleepy		unseen but possible	May	scrub oak	balds, barrens
duskywing, wild indigo		occasional	May-Aug	wild indigo, vetches	in or near alfalfa fields
edge,[3] hoary		rare	June-July	legumes, e.g., tick trefoil	oldfield & field edges
glassywing, little		occasional	late June-July	purple top & other grasses	oldfield & pasture
sachem		rare	vagrant; observed once in Sept	grasses	in & near disturbed grassy areas
skipper, arctic		rare	late May to mid-June	grasses	grasses near forest
skipper, broadwing	S3	occasional	mid-July-Aug	reeds, sedges, wild rice	wet areas with
skipper, cobweb		rare	May-June	bluestems	dry fields
skipper, common checkered		occasional	mid May-Sept	mallows	short, sparse meadows &
skipper, crossline		occasional	late June-early Aug	grasses	dry and moist fields
skipper, Delaware		rare	mainly July	little bluestem, switchgrass, other grasses	open habitats, dry to wet

Common name	Statewide Status[1,2]	Apparent Status in County	Flight Time	Caterpillar Food	Habitat
HESPERIIDAE (cont.)					
skipper, Dion		rare	July	sedges	wetlands
skipper, dun		occasional	July-Aug	sedges, maybe grasses	oldfield
skipper, dusted	S2S3	unseen but possible	May - June	bluestems	dry open habitats
skipper, European		common	June-July	timothy & other introduced grasses	meadow
skipper, fiery		rare	Sept-Oct	grasses	open uplands
skipper, Hobomok		common	late May-early July	grasses	oldfield
skipper, Indian		rare	May-June	grasses, e.g., bluestem	dry, often shrubby,
skipper, least		common	June-Oct	grasses	wet meadow, grassy
skipper, Leonard's		rare	lsyr Aug/early Sept	native grasses, e.g., little bluestem	dry upland grassland near wet area
skipper, Ocola		rare migrant	Sept-Oct	rice cutgrass?	around flowers
skipper, Peck's		common	late May-Sept	grasses	meadow
skipper, pepper & salt		rare	May-June	grasses	forest openings
skipper,[3] roadside		rare	late May-mid June	grasses	forest openings
skipper, silver-spotted		common	June-Aug	black locust	shrubby fields
skipper, tawny-edged		common	late May-mid July; early Aug-Sept	grasses	grassy, often moist
skipper, two spotted		unseen but possible	late June-July	sedges, especially hairy-fruited sedge	wetlands
skipper, Zabulon		rare	late May-mid June; mid Aug-mid Sept	grasses	shrubby fields, roadside
sootywing, common		common	mid-May-mid June; late July-Aug	lamb's quarters & others	open habitats
wing, mulberry		rare	mid July-early Aug	sedges	sedgy wetlands
LYCAENIDAE					
azure, spring-summer		common	April-Sept	(various)	mainly meadows
blue, eastern tailed		common	May-Sept	legumes	open, disturbed, low
blue, silvery		rare	April-June	legumes	openings in moist forest
copper, American		common	May-Sept	*Rumex* (docks)	drier meadows

Common name	Statewide Status[1,2]	Apparent Status in County	Flight Time	Caterpillar Food	Habitat
LYCAENIDAE (cont.)					
copper, bog		unseen but possible	late June-July	cranberries	acidic wet meadows
copper, bronze		occasional	mid-June-mid July; early Aug-mid Sept	*Rumex* (docks)	wetlands around ponds or streams
elfin, brown		rare	May	heaths	barrens, dry forest
elfin, eastern pine		rare	May-June	pines	near pine woods
hairstreak, Acadian		unseen but possible	July	willows	shrubby wet meadows & swamps
hairstreak, banded		occasional	May-Aug	oaks, hickories	edges, open habitats
hairstreak, coral		rare	June	cherries, plums	oldfield, second growth
hairstreak, early		unseen but possible	May-June, July-August	beechnuts	beech forest
hairstreak, Edward's	S3S4	unseen but possible	July	scrub oak	scrub oak forest, rocky
hairstreak, grey		occasional	early May-mid June	various meadow & shrubland plants	open, weedy, disturbed
hairstreak, hickory		occasional	late June-early Aug	hardwood trees	edges of rich, deciduous
hairstreak, juniper		rare	mid May-June; Aug	eastern red cedar	open uplands with red
hairstreak, northern oak	S2S4,SGCN[HP]	unseen but possible	June-July	oaks	oak forest
hairstreak, red-banded		rare	May-June; Aug-Sept	rotting leaves	open habitats
hairstreak, striped		rare	late June-mid July	roses, cherries, hawthorns, heaths, American hornbeam	forest openings & edges
hairstreak, white M	SU	rare	May, Sept	oaks	oak forest
harvester		rare	May-Sept	alder aphids	alder swamp
NYMPHALIDAE					
admiral, red		occasional	May-Oct	nettles	moist forest & meadow, esp. floodplain forests
admiral, white		rare	mid-June-early Aug; mid Aug-mid Sept	cherries	forests, edges, shrubland
brown, Appalachian		occasional	late June-Aug	sedges	forested wet areas, near
brown, eyed		rare	late June-early Aug	sedges	sedgy habitats
buckeye, common		occasional migrant	July-Sept	plantains, figworts, vervains	open habitats with some bare ground

Common name	Statewide Status[1,2]	Apparent Status in County	Flight Time	Caterpillar Food	Habitat
NYMPHALIDAE (cont.)					
checkerspot, Baltimore		common	mid-June-mid July	turtlehead, English plantain	meadow
checkerspot,[3] Harris'		rare	June-July	flat-topped white aster	wet, open habitats
checkerspot, silvery		unseen but possible	July	sunflowers	edges, stream banks
cloak, mourning		common	year around; most common in summer	willows, other trees	wanders among many habitats
comma, eastern		common	3 flights, April-Sept?	gooseberries, currants, elms and nettles	woods, especially floodplain forests
comma, green		unseen but possible	3 flights, April-Sept?	gooseberry, currant, elm	"boreal woodlands"
comma, gray		rare	3 flights, April-Sept	gooseberry, currant, elm	forest clearings
crescent, pearl		common	mid May-early Sept	asters	meadow
crescent, tawny	SH, SC	regionally extinct?	June-July	certain asters	rocky, scrubby areas
emperor, hackberry		rare	July-Aug	hackberry	floodplains with
emperor, tawny	S2S4	unseen but possible	July-Aug	hackberry	hackberry habitats
fritillary, Aphrodite		rare	late June-early Sept	violets	upland habitats on acidic soils, moist grasslands
fritillary,[3] Atlantis		rare	mid-June-mid Sept	northern blue violet	forest openings
fritillary, great spangled		common	late June-early Sept	violets	forest edges
fritillary, meadow		common	May-Sept	violets	moist fields
fritillary,[3] regal		regionally extinct?	late June-mid Sept	violets	extensive open areas with some wetness
fritillary,[3] silver-bordered		rare	June-Sept	wetland violets	overgrowing wet habitats, marshes, bogs
fritillary, variegated		rare	July-Oct	violets, thyme, plantain, purslane	open habitats
lady, American		occasional	mid May-late Oct	composites (asters, goldenrods, etc.)	(various)
lady, painted		common	May-Oct	various meadow plants	open habitats
mark, question		occasional	late June-Oct	elms	forests and edges
monarch	SPCN	common	mid-June-Sept	milkweeds	oldfield, edges

Common name	Statewide Status[1,2]	Apparent Status in County	Flight Time	Caterpillar Food	Habitat
NYMPHALIDAE (cont.)					
nymph, common wood		common	July-early Sept	grasses	meadow with shrubs or other tall vegetation
pearly-eye, northern		common	late June-early Aug	grasses	forest, often near water
purple, red-spotted		occasional	mid-June-early Aug; mid Aug-mid Sept	cherries	near deciduous, often moist forest
ringlet, common		common	late May-early July; late July-Aug	grasses	oldfields
satyr, little wood		common	late May-early Aug	grasses	edges, forest openings
snout, American		rare migrant	late June-mid Oct	hackberry	forested stream edges
tortoiseshell, Compton		occasional	March-fall	birches, willows	forest openings and
tortoiseshell, Milbert's		occasional	mid-June-Oct?	nettles	wet or moist habitats near forest
viceroy		common	late May-early Oct	willow	moist, shrubby habitats
PAPILIONIDAE					
swallowtail, black		common	May-Sept	parsley, carrot, & related plants	mainly open meadows
swallowtail, Canada		unseen but possible	May-early June?	birch, aspen, cherry	near deciduous trees
swallowtail, eastern tiger		common	late May-Oct	black cherry, tulip tree, ashes	near deciduous trees
swallowtail, giant		rare	May-Sept	plants in the rue family	various habitats, often semi-open
swallowtail, pipevine		rare	June-early Oct	pipevine	gardens, rocky forested uplands
swallowtail, spicebush		occasional	May-Aug	spicebush	various open habitats, usually near forest
PIERIDAE					
sulphur, clouded		common	May-mid Oct	legumes	open habitats
orange-tip, falcate		unseen but possible	May	mustards, rock cresses, two-leaved toothwort	"trap rock hills"
sulphur, cloudless		unseen but possible	Aug-Oct migrant	legumes	open habitats

Common name	Statewide Status[1,2]	Apparent Status in County	Flight Time	Caterpillar Food	Habitat
PIERIDAE (Cont.)					
sulphur, orange		common	mid May-early Oct	alfalfa & other legumes	open habitats, weedy, alfalfa meadows
white, cabbage		common	May-Oct	mustards	pastures or cultivated
white, checkered	S1, SC	unseen but possible	late Aug-Sept	mustards	weedy, open habitats
white, mustard		unseen but possible	as early as late April-Aug	mustards, e.g., *Dentaria*, *Arabis*, *Cardamine*	edges, streamside habitats, oldfields
white, West Virginia	S3	rare	early April-late May	mainly *Dentaria* & *Cardamine diphylla*	rich moist woods
yellow, little		rare	mid Aug-early Sept	legumes	meadows and waste
RIONIDAE					
metalmark, northern	S1, SGCN	unseen but possible	July	round-leaved ragwort	limestone outcrops

[1] New York Natural Heritage Program ranks (S1, S2, S3, SC, etc.) are explained in Appendix C.

[2] NY State Ranks:

SC = Special Concern (Environmental Conservation Law 6NYCRR Part 182.[g]

SGCN = Species of Greatest Conservation Need

SGCN^{HP} = Highest Priority Species of Greatest Conservation Need (http://www.dec.ny.gov/animals/9406.html)

SPCN = Species of Potential Conservation Need

[3] Indicates those that are listed at the Butterflies and Moths of North America website (www.butterfliesandmoths.org) as recorded from Columbia County, but have not been observed by FEP and colleagues. All other butterflies listed here have been observed by FEP or their collaborators, except for those marked as "unseen but possible" or "regionally extinct" or "rare."

Table B-3. Breeding birds of Hillsdale. Data are from the NYS Breeding Bird Atlas 2000-2005, from survey blocks lying entirely or partially within the town.

Species	Statewide Status[1]	Nesting Habitat
Swans, Geese, & Ducks (Anatidae)		
Canada goose (*Branta canadensis*)		marsh, marsh edge
wood duck (*Aix sponsa*)		forest, near water
mallard (*Anas platyrhynchos*)		marsh, pond shore
common merganser (*Mergus merganser*)		forest, near water
mute swan (*Cygnus olor*)		marsh, pond shore
Partridges, Grouse, & Turkeys (Phasianidae)		
wild turkey (*Meleagris gallopavo*)		forest, shrubland, meadow
ruffed grouse (*Bonasa umbellus*)	SGCN	forest, shrubland
Bitterns, Herons, & Allies (Ardeidae)		
great blue heron (*Ardea herodias*)		beaver pond
green heron (*Butorides virescens*)		marsh
least bittern (*Ixobrychus exilis*)	T, SGCN	marsh
Vultures (Cathartidae)		
turkey vulture (*Cathartes aura*)		forest, ledge
Kites, Eagles, Hawks, & Allies (Accipitridae)		
sharp-shinned hawk (*Accipiter striatus*)	SC	forest
broad-winged hawk (*Buteo platypterus*)		forest
red-tailed hawk (*Buteo jamaicensis*)		forest
Caracaras & Falcons (Falconidae)		
American kestrel (*Falco sparverius*)	SGCN	meadow, hedgerow
Rails, Gallinules, & Coots (Rallidae)		
Virginia rail (*Rallus limicola*)[2]		marsh

Species	Statewide Status[1]	Nesting Habitat
Plovers & Lapwings (Charidriidae)		
killdeer (*Charadrius vociferus*)		meadow
Sandpipers, Phalaropes, & Allies (Scolopacidae)		
American woodcock (*Scolopax minor*)	SGCN	forest, forest edge, shrubland
spotted sandpiper (*Actitis macularius*)		streamside
Pigeons & Doves (Columbidae)		
mourning dove (*Zenaida macroura*)		forest edge
rock pigeon (*Columba livia*)		ledge, human-built structure
Cuckoos, Roadrunners, & Anis (Cuculidae)		
yellow-billed cuckoo (*Coccyzus americanus*)		forest
black-billed cuckoo (*Coccyzus erythropthalmus*)	SGCN	forest
Typical Owls(Strigidae)		
barred owl (*Strix varia*)		forest
eastern screech-owl (*Megascops asio*)		tree in various settings
Goatsuckers (Caprimulgidae)		
whip-poor-will (*Caprimulgus vociferus*)	SC, SGCN[HP]	forest
Swifts (Apodidae)		
chimney swift (*Chaetura pelagica*)[2]		chimney, silo, other human-built structure
Hummingbirds (Trochilidae)		
ruby-throated hummingbird (*Archilochus colubris*)		forest edge
Kingfishers (Alcedinidae)		
belted kingfisher (*Megaceryle alcyon*)		steamside

Species	Statewide Status[1]	Nesting Habitat
Woodpeckers & Allies (Picidae)		
yellow-bellied sapsucker (*Sphyrapicus varius*)		forest
red-bellied woodpecker (*Melanerpes carolinus*)		forest, forest edge
downy woodpecker (*Picoides pubescens*)		forest
hairy woodpecker (*Picoides villosus*)		forest
northern flicker (*Colaptes auratus*)		forest
pileated woodpecker (*Dryocopus pileatus*)		forest
Tyrant Flycatchers (Tyrannidae)		
alder flycatcher (*Empidonax alnorum*)[3]		wet thicket
least flycatcher (*Empidonax minimus*)		forest, forest edge, thicket
willow flycatcher (*Empidonax trailli*)		wet thicket
great-crested flycatcher (*Myiarchus crinitus*)		forest, forest edge
eastern phoebe (*Sayornis phoebe*)		forest edge, human-built structures
eastern wood-pewee (*Contopus virens*)		forest
eastern kingbird (*Tyrannus tyrannus*)		meadow
Vireos (Vireonidae)		
yellow-throated vireo (*Vireo flavifrons*)		forest, forest edge
blue-headed vireo (*Vireo solitarius*)[3]		forest
warbling vireo (*Vireo gilvus*)		forest
red-eyed vireo (*Vireo olivaceus*)		forest
Jays, Magpies, & Crows (Corvidae)		
blue jay (*Cyanocitta cristata*)		forest, forest edge
American crow (*Corvus brachyrhynchos*)		forest
common raven (*Corvus corax*)[3]		cliff, human-built structure

Species	Statewide Status[1]	Nesting Habitat
Swallows (Hirudinidae)		
tree swallow (*Tachycineta bicolor*)		marsh, beaver pond, meadow
barn swallow (*Hirundo rustica*)		human-built structure, cliff
northern rough-winged swallow (*Stelgidopteryx serripennis*)[3]		streamside
bank swallow (*Riparia riparia*)[3]		streamside
cliff swallow (*Petrochelidon pyrrhonota*)[3]		cliff, cave, human-built structure
Chickadees & Titmice (Paridae)		
black-capped chickadee (*Poecile atricapillus*)		forest, forest edge
tufted titmouse (*Baeolophus bicolor*)		forest
Nuthatches (Sittidae)		
white-breasted nuthatch (*Sitta carolinensis*)		forest
red-breasted nuthatch (*Sitta canadensis*)		forest
Creepers (Certhiidae)		
brown creeper (*Certhia americana*)[2]		forest
Wrens (Troglodytidae)		
Carolina wren (*Thryothorus ludovicianus*)		shrub thicket, forest edge
house wren (*Troglodytes aedon*)		human-built structure, forest opening
winter wren (*Troglodytes troglodytes*)		forest
Old World Warblers & Gnatcatchers (Sylviidae)		
blue-gray gnatcatcher (*Polioptila caerulea*)		forest edge, forest opening
Thrushes (Turdidae)		
eastern bluebird (*Sialia sialis*)		meadow
veery (*Catharus fuscescens*)		forest
hermit thrush (*Catharus guttatus*)		forest
wood thrush (*Hylocichla mustelina*)	SGCN	forest

Species	Statewide Status[1]	Nesting Habitat
Thrushes (cont.)		
American robin (*Turdus migratorius*)		forest edge, human-built structure
Mockingbirds, Thrashers, & Allies (Mimidae)		
gray catbird (*Dumetella carolinensis*)		shrubland, forest edge, hedgerow
northern mockingbird (*Mimus polyglottos*)		hedgerow, thicket
brown thrasher (*Toxostoma rufum*)	SGCN[HP]	shrubland
Starlings & Allies (Sturnidae)		
European starling (*Sturnus vulgaris*)		forest edge, cliff, human-built structure
Waxwings (Bombycillidae)		
cedar waxwing (*Bombycilla cedrorum*)		forest, forest edge
Wood Warblers (Parulidae)		
blue-winged warbler (*Vermivora pinus*)	SGCN	forest
yellow warbler (*Setophaga petechia*)		forest
chestnut-sided warbler (*Setophaga pensylvanica*)		forest
magnolia warbler (*Setophaga magnolia*)[3]		forest
Nashville warbler (*Setophaga ruficapilla*)		forest
black-throated blue warbler (*Setophaga caerulescens*)	SGCN	forest
yellow-rumped warbler (*Setophaga coronata*)[3]		forest
black-throated green warbler (*Setophaga virens*)		forest
prairie warbler (*Setophaga discolor*)	SGCN	meadow
blackburnian warbler (*Setophaga fusca*)		forest
pine warbler (*Setophaga pinus*)		forest
black-and-white warbler (*Mniotilta varia*)		forest

Species	Statewide Status[1]	Nesting Habitat
Wood Warblers (cont.)		
American redstart (*Setophaga ruticilla*)		forest
worm-eating warbler (*Helmitheros vermivorum*)	SGCN	forest
ovenbird (*Seiurus aurocapilla*)		forest
Louisiana waterthrush (*Seiurus aurocapilla*)	SGCN	streamside
common yellowthroat (*Geothlypis trichas*)		wet thicket
Tanagers (Thraupidae)		
scarlet tanager (*Piranga olivacea*)	SGCN	forest
Towhees, Buntings, Sparrows, & Allies (Emberizidae)		
eastern towhee (*Pipilo erythrophthalmus*)		forest
chipping sparrow (*Spizella passerina*)		forest, forest edge
field sparrow (*Spizella pusilla*)		meadow
savannah sparrow (*Passerculus sandwichensis*)		meadow
song sparrow (*Melospiza melodia*)		open area, forest edge
swamp sparrow (*Melospiza georgiana*)		marsh, shrub swamp
white-throated sparrow (*Zonotrichia albicollis*)		forest opening
dark-eyed junco (*Junco hyemalis*)[3]		forest
Grosbeaks & Buntings (Cardinalidae)		
northern cardinal (*Cardinalis cardinalis*)		shrubland, forest edge
rose-breasted grosbeak (*Pheucticus ludovicianus*)		forest
indigo bunting (*Passerina cyanea*)		shrub thicket, forest edge
Blackbirds (Icteridae)		
bobolink (*Dolichonyx oryzivorus*)	SGCN[HP]	meadow

Species	Statewide Status[1]	Nesting Habitat
Blackbirds (Icteridae) (cont)		
red-winged blackbird (*Agelaius phoeniceus*)		marsh, wet meadow, shrub swamp
eastern meadowlark (*Sturnella magna*)	$SGCN^{HP}$	meadow
common grackle (*Quiscalus quiscula*)		open area, forest edge, forest opening
brown-headed cowbird (*Molothrus ater*)		open area, forest edge
Baltimore oriole (*Icterus galbula*)		forest edge
Finches (Fringillidae)		
house finch (*Carpodacus mexicanus*)		human-built structure, ledge
purple finch (*Carpodacus purpureus*)		forest
American goldfinch (*Carduelis tristis*)		forest edge, forest opening, shrubland
Old World Sparrows (Passeridae)		
house sparrow (*Passer domesticus*)		human-built structure, forest edge

[1] Statewide Status:
T = NYS Threatened
SC = NYS Special Concern
$SGCN^{HP}$ = NYS High Priority Species of Greatest Conservation Need

[2] This species only recorded in blocks straddling the Massachusetts border.

[3] This species only recorded in blocks lying mostly in an adjacent town.

Table B-4. Prominent non-native invasive plants of the Columbia County region, listed and ranked for management priority (tiers) by the Capital-Mohawk Partnership for Invasive Species Management (PRISM). (The table is taken [with permission] from the Columbia County Natural Resources Inventory.) Not all these plants are known to occur in Hillsdale. Updated lists of invasive species are at http://www.capitalmohawkprism.org/uploads/8/1/4/0/81407728/capmo_is_tiersystem.pdf.

A. Non-native invasive plant species known to occur in Columbia County.

Common Name (*Scientific Name*)	Tier 2[1]	Tier 3[1]	Tier 4[1]	Tier 5[1]	Habitat
alder, black (*Alnus glutinosa*)			X		wetland, shoreline
autumn-olive (*Elaeagnus umbellata*)			X		forest edge, meadow
barberry, European (*Berberis vulgaris*)		X			forest, meadow
barberry, Japanese (*Berberis thunbergii*)			X		forest, shrubland, meadow, floodplain
bittercress, narrowleaf (*Cardamine impatiens*)			X		forest
bittersweet, Asian (*Celastrus orbiculatus*)			X		forest, shrubland, waste ground
bower, Japanese virgin's (*Clematis terniflora*)	X				forest, shrubland, meadow
buckthorn, common (*Rhamnus cathartica*)			X		forest, shrubland, meadow
buckthorn, glossy (*Frangula alnus*)			X		forest, shrubland, meadow, swamp
bush, burning (*Euonymus alatus*)			X		forest, shrubland
canary-grass, reed (*Phalaris arundinacea*)			X		wetland, shoreline, meadow
celandine, lesser (*Ficaria verna*)	X				forest, floodplain, shoreline
chervil, wild (*Anthriscus sylvestris*)			X		forest edge, meadow
crabapple, Toringo (*Malus toringo*)	X				forest, shrubland
didymo (*Didymosphenia geminata*)				X	stream
elm, Siberian (*Ulmus pumila*)	X				forest edge, meadow, shoreline
floating-heart, yellow (*Nymphoides peltata*)	X				lake, pond, stream
garlic-mustard (*Alliaria petiolata*)			X		forest, floodplain
helmet, policeman's (*Impatiens glandulifera*)	X				meadow
honeysuckle, Amur (*Lonicera maackii*)	X				forest, shrubland
honeysuckle, Bell's (*Lonicera* x *bella*)			X		forest, shrubland, meadow
honeysuckle, Japanese (*Lonicera japonica*)			X		forest, shrubland, meadow
honeysuckle, Morrow's (*Lonicera morrowii*)			X		forest, shrubland
honeysuckle, Tartarian (*Lonicera tatarica*)			X		forest, shrubland, meadow
hops, Japanese (*Humulus japonicus*)	X				meadow, waste ground

Common Name (*Scientific Name*)	Tier 2[1]	Tier 3[1]	Tier 4[1]	Tier 5[1]	Habitat
iris, yellow (*Iris pseudacorus*)			X		wetland, shoreline
ivy, English (*Hedera helix*)	X				forest
knapweed, spotted (*Centaurea stoebe* ssp. *micranthos*)			X		meadow
knotweed, Japanese (*Reynoutria japonica* var. *japonica*)			X		forest, shoreline, floodplain, waste ground
lilac, Japanese tree (*Syringa reticulata*)	X				forest, meadow
locust, black (*Robinia pseudoacacia*)			X		forest, floodplain, meadow
loosestrife, purple (*Lythrum salicaria*)			X		wetland, shoreline, meadow
maple, Norway (*Acer platanoides*)			X		forest
maple, sycamore (A*cer pseudoplatanus*)	X				forest, floodplain
mugwort (*Artemisia vulgaris* var. *vulgaris*)			X		forest, meadow, waste ground
mulberry, white (*Morus alba*)			X		forest edge, meadow
naiad, brittle (*Najas minor*)			X		lake, pond, stream, river
parsnip, wild (*Pastinaca sativa*)			X		meadow
periwinkle (*Vinca minor*)			X		forest, meadow
pondweed, curly leaf (*Potamogeton crispus*)			X		lake, pond, stream, river
privet, border (*Ligustrum obtusifolium*)			X		forest, shrubland, meadow
reed, common (*Phragmites australis*)			X		wetland, shoreline
rose, multiflora (*Rosa multiflora*)			X		forest, shrubland, meadow, shoreline
spurge, cypress (*Euphorbia cyparissias*)			X		meadow
spurge, leafy (*Euphorbia virgata*)		X			forest edge, meadow, waste ground
stiltgrass, Japanese (*Microstegium vimineum*)			X		forest, meadow, shoreline, floodplain
swallow-wort, black (*Vincetoxicum nigrum*)			X		forest, meadow, shoreline
teasel, cut-leaf (*Dipsacus laciniatus*)			X		meadow, waste ground
thistle, bull (*Cirsium vulgare*)			X		meadow
thistle, Canada (*Cirsium arvense*)			X		meadow
tree, wayfaring (*Viburnum lantana*)	X				forest, meadow
tree-of-heaven (*Ailanthus altissima*)			X		forest, shrubland, waste ground
viburnum, European cranberry (*Viburnum opulus* var. *opulus*)	X				meadow, wetland, shoreline
water-chestnut (*Trapa natans*)			X		lake, pond, stream, river
watermilfoil, Eurasian (*Myriophyllum spicatum*)			X		lake, pond, stream
wineberry (*Rubus phoenicolasius*)	X				forest, meadow, rocky slope

B. Non-native invasive plant species not yet known to occur in Columbia County, but occurring elsewhere in the region.

Common Name (*Scientific Name*)	Tier 2[1]	Tier 3[1]	Tier 4[1]	Tier 5[1]	Habitat
aralia, five-leaf (*Eleutherococcus sieboldianus*)	X				swamp
berry, porcelain (*Ampelopsis glandulosa*)	X				forest, meadow
carpetgrass, small (*Arthraxon hispidus*)	X				forest, floodplain, swamp
cup-plant (*Silphium perfoliatum* var. *perfoliatum*)	X				shrubland
elodea, Brazilian (*Egeria densa*)	X				lake, pond, stream
frogbit, European (*Hydrocharis morsus-ranae*)	X				lake, pond, stream
goutweed, bishops (*Aegopodium podagraria*)	X				forest, floodplain, meadow
grass, Chinese silver (*Miscanthus sinensis*)	X				meadow
jetbead, black (*Rhodotypos scandens*)	X				forest edge
Johnsongrass (*Sorghum halepense*)				X	meadow
knotweed, bohemian (*Reynoutria* x *bohemica*)			X		shoreline, floodplain, waste ground
knotweed, giant (*Reynoutria sachalinensis*)				X	meadow, shoreline, waste ground
loosestrife, yellow garden (*Lysimachia vulgaris*)	X				meadow
maple, Japanese (*Acer palmatum*)	X				forest, meadow
hogweed, giant (*Heracleum mantegazzianum*)	X				road bank, forest, oldfield
swallow-wort, pale (*Vincetoxicum rossicum*)			X		forest, meadow, shoreline
thistle, carline (*Carlina vulgaris*)				X	meadow
rush, flowering (*Butomus umbellatus*)		X			shoreline, marsh
vine, China fleece (*Fallopia baldschuanica*)				X	forest edge
vine, mile-a-minute (*Persicaria perfoliata*)	X				forest, meadow
waterwheel (*Aldrovanda vesiculosa*)				X	lake, pond
willow, rusty (*Salix cinerea* ssp. *oleifolia)*	X				forest edge, meadow, shoreline
wisteria (*Wisteria* spp.)	X				forest

[1]**Tier 2: Eradication is recommended**. High and very high impact species with low enough abundance to make eradication feasible within the Mohawk-Hudson PRISM region. Highest level of response efforts.

Tier 3: Containment is recommended. High and very high impact species that are likely too widespread for eradication, but low enough abundance to think about regional containment. Target strategic management to slow the spread since many surrounding regions could be at risk if left unattended.

Tier 4: Local control is recommended. Well-established species with high and very high impacts. Eradication efforts not feasible; only localized management over time to contain, exclude, or suppress, if justified to meet local management goals.

Tier 5: More research is needed. Species in or surrounding the PRISM region that need more research, mapping, and monitoring to understand invasiveness and impacts.

C. Explanation of Rarity Ranks

1. ANIMALS

The explanation below is from the New York Natural Heritage Program Rare Animal Status List[120] Explanation of all NYNHP ranks are given here, but the NRI lists none of the global (G) ranks, and considers only species in the S1, S2, and S3 categories to be of current conservation concern.

STATE & FEDERAL LISTINGS

NY Natural Heritage tracks a selected subset of New York's animals. The species we track are chosen based on their degree of rarity or imperilment within the state, and as new information comes in, new species are sometimes added while others are discontinued. Information on the species and communities tracked by NY Natural Heritage are used for conservation, research, and regulatory purposes.

Many of the species tracked by NY Natural Heritage are listed as "endangered" or "threatened" under the state Environmental Conservation Law (E.C.L.). Listing is a legal process that is conducted by the state agency with authority over the species in question, and for animals confers important protection requirements. See http://www.dec.ny.gov/animals/7494.html for all state-listed animals.

The NYSDEC Division of Fish, Wildlife, and Marine Resources has jurisdiction over rare animal species listed as "endangered," "threatened," or "special concern" under E.C.L. §11-0535. Animals listed as endangered or threatened receive notable legal protection, as it is illegal to take or possess any of these species or their parts without a permit from NYSDEC. Species of special concern warrant attention and consideration but current information does not justify listing them as either endangered or threatened.

A subset of the animal species listed under New York state law is also recognized under federal law. These species are so seriously imperiled across their entire range that they face the very real prospect of extinction. Species are listed as federally endangered or threatened by the U.S. Fish & Wildlife Service in consultation with state agencies and other experts, and the Service works closely with DEC on the protection of federally listed species in New York.

Ultimately, protection of New York's biodiversity lies with landowners and land managers regardless of state or federal listings. How private and public landowners manage their properties will determine what species and natural communities persist into the future. This situation is both a great opportunity and a serious challenge.

[120] Schlesinger, 2014

State legal listings are identified with the following codes:

E Endangered
T Threatened
SC Special Concern

Federal legal listings are identified with the following codes:

E Listed Endangered
T Listed Threatened
C Candidate

NY Natural Heritage tracks all species listed as endangered and threatened. While we track many of the species listed as being of special concern, a subset of special concern species is currently not rare or imperiled enough to merit tracking at our precise scale. In addition, we track many species that are biologically rare and imperiled, but that have not gone through the review process necessary for state listing.

ACTIVE INVENTORY AND WATCH LIST

The NY Natural Heritage Program keeps two lists of rare animal species: The Active Inventory List and the Watch List. Species on the Active Inventory List are ones we currently track in our database; for the most part these are the rarest or most imperiled species in the state. Species on the Watch List are those that could become imperiled enough in the future to warrant being actively inventoried, or are ones for which we do not have enough data to determine whether they should be actively inventoried. Species are moved between lists, or off the lists entirely, as available information warrants.

GLOBAL AND STATE STATUS RANKS

NY Natural Heritage's statewide inventory efforts revolve around lists of rare species and all types of natural communities known to occur, or to have historically occurred, in the state. These lists are based on a variety of sources including museum collections, scientific literature, information from state and local government agencies, regional and local experts, and data from neighboring states.

Each rare species is assigned a rank based on its rarity, population trends, and threats. Like those in all state Natural Heritage Programs, NY Natural Heritage's ranking system assesses rarity at two geographic scales: global and state. The global rank (G-rank) reflects the status of a species or community throughout its range, whereas the state rank (S-rank) indicates its status within New York. Global ranks are maintained and updated by NatureServe, which coordinates the network of Natural Heritage programs. Both global and state ranks are usually based on the range of the species or community, the number of occurrences, the viability of the occurrences, and the vulnerability of the species or community around the globe or across the state. As new data become available, the ranks may be revised to reflect the most current information. Subspecific taxa are also assigned a taxon rank which indicates the subspecies' rarity rank throughout its range.

For the most part, global and state ranks follow a straightforward scale of 1 (rarest/most imperiled) to 5 (common/secure). The Hillsdale NRI refers only to the three ranks—S1, S2, S3—that indicate rarity or limited occurrence in the state, as follows:

- **S1** Critically imperiled because of rarity (5 or fewer occurrences, or few remaining acres or miles of stream) or factors making it especially vulnerable to extinction range-wide (global) or in New York (state)
- **S2** Imperiled because of rarity (6-20 occurrences, or few remaining acres or miles of stream) or factors demonstrably making it very vulnerable to extinction (global) or extirpation from New York (state)
- **S3** Either uncommon or local, typically with 21 to 100 occurrences, limited acreage, or miles of stream range-wide (global) or in New York (state)

Additional species lists and codes are at https://www.acris.nynhp.org/.
Codes sometimes have qualifiers attached:

- **T1**, **T2**, etc. These ranks, which like global and state ranks run from 1 (rarest/most imperiled) to 5 (common/secure), are attached to global ranks to indicate the status of a subspecies or variety
- **Q** Indicates that the species, subspecies, or variety is in taxonomic dispute
- **?** Indicates that the state or global rank is uncertain, and more information is needed
- **N** Indicates the migratory status of a migratory species when it is not breeding in NY (for example, populations that are overwintering in the state)
- **B** Indicates the state status of a migratory species when it has breeding populations in NY

SPECIES OF GREATEST CONSERVATION NEED

The list of Species of Greatest Conservation Need was developed for the *New York State Wildlife Action Plan* (NYSDEC 2015).

High-Priority Species of Greatest Conservation Need
The status of these species is known, and conservation action is needed in the next ten years. These species are experiencing a population decline or have identified threats that may put them in jeopardy, and are in need of timely management intervention, or they are likely to reach critical population levels in New York.

Species of Greatest Conservation Need
The status of these species is known, and conservation action is needed. These species are experiencing some level of population decline, have identified threats that may put them in jeopardy, and need conservation actions to maintain stable population levels or sustain recovery.

Species of Potential Conservation Need

A species whose status is poorly known, but there is an identified threat to the species or features of its life history that make it particularly vulnerable to threats. The species may be declining or begin to experience declines within the next ten years, and studies are needed to determine their actual status.

2. PLANTS

The explanation below is from the New York Natural Heritage Program Rare Plant Status Lists (Young 2019). The Hillsdale NRI refers only to the three ranks —S1, S2, S3—that indicate rarity or limited occurrence in the state, as follows:

S1 = Critically imperiled in New York State because of extreme rarity (5 or fewer sites or very few remaining individuals) or extremely vulnerable to extirpation from New York State due to biological or human factors.

S2 = Imperiled in New York State because of rarity (6 - 20 sites or few remaining individuals) or highly vulnerable to extirpation from New York State due to biological or human factors.

S3 = Vulnerable in New York State. At moderate risk of extinction or elimination due to very restricted range, very few populations (usually 21 - 35 extant sites), steep declines, or other factors.

TAXON RANK

The T-ranks are defined in the same way as the Global ranks, but the T-rank only refers to the rarity of the subspecific taxon, not the rarity of the species as a whole**.** If a species has a subspecific name that is the same as the species name it means there is also another subspecies of that species which we do not consider rare in New York or it does not occur in New York.

DOUBLE RANKS (*i.e.,* S1S2, S2S3, S1S3)

The first rank indicates rarity based upon current documentation. The second rank indicates the probable rarity after all historical records and likely habitat have been checked. **DOUBLE RANKS DENOTE**

SPECIES THAT NEED ADDITIONAL FIELD SURVEYS.

- A "Q" indicates a question exists whether or not the taxon is a good taxonomic entity.
- A "?" indicates that an identification question exists about known occurrences. It also indicates the rank presumably corresponds to actual occurrences even though the information has not yet been documented in heritage files or historical records. It serves to flag species that need more field studies or specimen identification.

D. Relevant Local and Regional Plans

- **Town of Hillsdale Comprehensive Plan** – This plan was originally written in 1972, reviewed and found to be sound in 1988, and then amended in 2012. The purpose of this comprehensive plan is to provide a coherent vision of the future based upon the desires of the people of the Town. The most important part of this vision is a statement of goals describing the types of development that are needed and the natural, scenic, and cultural resources that should be preserved.

- **Town of Hillsdale Groundwater Resources Study and Protection Plan** – Prepared by Steven Winkley of the New York Rural Water Association in September 2009. This document includes chapters on groundwater utilization and occurrence; an inventory of potential contaminant sources; hydrogeologic analyses, and groundwater protection strategies.

- **Columbia County Agricultural and Farmland Protection Plan –** The Columbia County Agricultural and Farmland Protection Board (CC AFPB) developed this county-wide plan focused on agricultural, economic development and farmland protection to help guide sustainability of agriculture on a county-wide basis.

- **Master Plan for Taconic State Park: Columbia and Dutchess Counties, Towns of Copake, Ancram, and Northeast, NY, June 27, 2018** – This document is published by the Office of Parks, Recreation and Historic Preservation, with input from the NYS Department of Environmental Conservation, the NY Natural Heritage Program, the Friends of Taconic State Park, and the New York-New Jersey Trail Conference. It also includes a Final Environmental Impact Statement. (The Taconic State Park encompasses the Taconic Ridge in North East, Ancram, and Copake, but does not reach as far north as Hillsdale.)

- **Capital Region Sustainability Plan** – This document provides a framework for projects and programs that will reduce, air, land, and water pollution and improve our quality of life through smart growth and sustainable development. The eight counties represented in the Capital Region include Columbia.

- **Hudson River Valley National Heritage Area** – Designated by Congress in 1996, this is one of 55 federally recognized Heritage Areas. Through partnership with the National Park Service, this Heritage Area collaborates with government agencies, non-profit groups, private partners, and residents to celebrate, interpret, and preserve the nationally significant cultural and natural resources of the Hudson River Valley. In March 2019 this Area was officially renamed the Maurice D. Hinchey Hudson River Valley National Heritage Area.

- **Hudson River Estuary Action Agenda** – The 2015-2020 version of this document is a conservation and restoration blueprint that guides the work of the Hudson River Estuary Program and its partners. The

Action Agenda defines the challenges faced and identifies practical solutions that can be carried out by citizens, civic leaders, and policy makers working together. Preparation of this NRI, funded by the Hudson River Estuary Program, is in partial fulfillment of the Action Agenda.

- **Hudson River Greenway Trail System** – In 1991 the Hudson River Valley Greenway was created in part to establish a network of multi-use trails along both sides of the Hudson River. This trail system consists of two main components: a land trail and a water trail for paddling and boating.

- **Columbia County Natural Resource Inventory** - Authored by scientists with Hudsonia Ltd, this document summarizes existing data and analyses the biological, cultural and physical aspects of the Columbia County landscape. It identifies features and areas that warrant attention in land use decision-making.

- **New York State Open Space Plan** - The 2016 version of this plan, written by the New York State Department of Environmental Conservation, serves as a blueprint for the State's land conservation efforts.[121] The plan provides four overarching objectives to direct our actions, policies and priorities; and to promote outdoor recreation.

- **New York State Wildlife Action Plan** – The NYS Department of Environmental Conservation's 2015 version of this plan was approved by the U.S. Fish and Wildlife Service. The plan is an update of the original 2005 plan. This plan guides efforts to protect Species of Greatest Conservation Need in the state and includes assessment of 597 species.

[121] NYSDEC and OPRHP, 2016