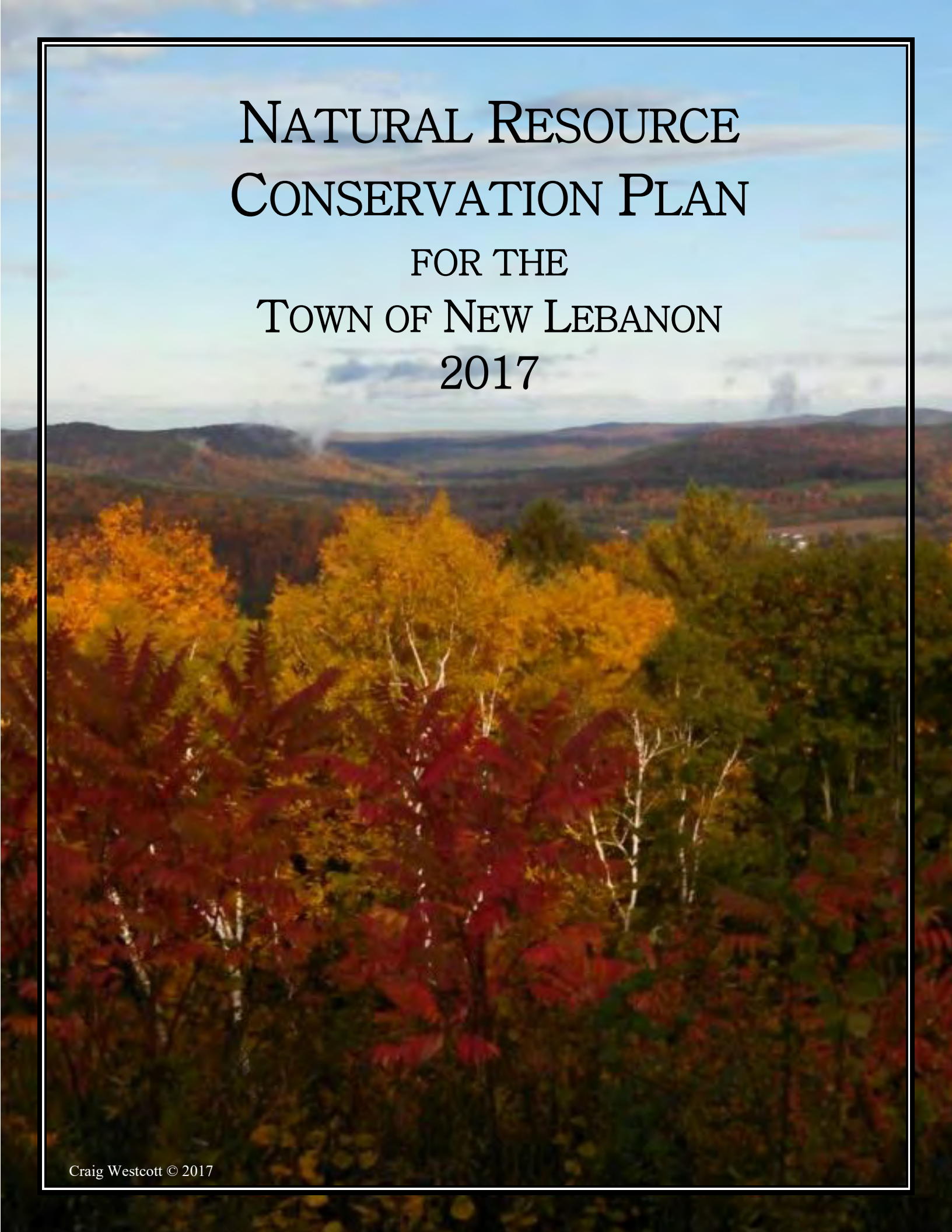
Natural Resource Conservation Plan

for the

Town of New Lebanon

2017



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(Cover photo: Lebanon Valley viewed from the US Route 20 overlook. Craig Westcott © 2017)

How to Use the Natural Resource Conservation Plan

This section describes a few ways that the *NRCP* can be used by landowners, farmers, developers, and town agencies to bring natural resource considerations into decision-making about land management, regulatory reviews, and townwide planning. Many other sections of the *NRCP* are also relevant to these tasks, but the outline below provides a quick introduction to the document.

For Land Management & Site Planning

If you are a farmer who owns and/or leases land, a developer planning a new project, or a landowner considering land uses and land management on your property, here are some ways that the NRCP might be helpful.

- Consult Figure 1 to see which **Conservation Area** your property is located in, and read about some of the significant natural resources in that region of the town (p. 113-116).
- Read about some of the **values of farmland for native plants and animals**, and how agriculture can benefit from **intact surrounding habitats and resources** on p. 67-68.
- Consult Figure 9 to see if your property is in the area of an unconsolidated **aquifer**, and read about the importance and sensitivities of those areas on p. 24.
- If your property has a **stream, pond,** or **lake**, review the General Measures for Water Resource Conservation on p. 29-30.
- If your property is in (or partially in) a **stream corridor** designated as an Area of Known Importance for sensitive coldwater stream organisms (Figure 16) or in an Active River Area (Figure 14), see the discussions of those areas on p. 46-52 and 60-61.
- If your property has **forests** or **meadows**, see Figure 12 or 13 to see if those features are part of a large forest area or large meadow area that may have special ecological importance.
- Read about the values of those areas (as well as smaller forests and meadows) for area-sensitive wildlife, habitat connectivity, or wildlife migration corridors on p. 35-40 and 42-44.
- If your property has other habitats, such as **ledges, shrublands, woodland pools,** or **swamps**, read about some of the ecological attributes of those and other habitats on p.40-60, and see the General Measures for Biological Resource Conservation on p. 65.

For Townwide Planning and Policy-Making

If you are working on revising the New Lebanon *Comprehensive Plan*, the *Zoning Ordinance*, or other parts of the local code related to natural resources, here are some ways that the *NRCP* can be useful.

Mineral Resources

- Consider the distribution and extent of **glacial outwash** or **kame deposits** (Figure 6) in the town. Does the town wish to maintain access to sand and gravel resources for future mining?
- If so, an overlay district could be established to help ensure that adequate areas of sand and gravel are maintained without pavement or buildings that would render the mineral resources permanently unextractable.

Water Resources

- Consider the areas of **unconsolidated aquifers** illustrated in Figure 9.
    - Read (p. 24) about the importance of the aquifers to the public welfare, and the sensitivities of those areas to human activities (e.g., contamination from septic leachate, fertilizers, pesticides, de-icing salts, leaks or disposal of petroleum compounds or other toxic materials, or water depletion due to ineffective stormwater management).
    - Consider the variety of regulatory and non-regulatory ways to protect local aquifers, such as:
        - educating landowners and developers.
        - establishing a Critical Environmental Area (p. 120)
        - establishing an Aquifer Overlay Zone (p. 121)
        - adding protective provisions to the local code (p. 121)
- Consider the **100-year floodplains** (Figure 14) throughout the town, and read about those areas on p. 49-53.
    - If the town wishes to prevent flooding harm to buildings and structures, a Floodplain Overlay District could be established within which only flood-resilient land uses and those that would not create or exacerbate local or downstream hazards would be permitted.
- Consider the **Active River Areas** (Figure 14) identified throughout the town.
    - If the town wishes to maintain the stream flow, water quality, and habitat quality of streams, a Stream Corridor Overlay District could be established to draw attention to the Active River Areas and encourage suitable land uses and suitable setbacks for developed features in the ARA zones.

Biological Resources

- Consider some of the special biological resources in the town, such as:
    - **Significant Biodiversity Areas** and **Areas of Known Importance** (Figure 16)
    - **floodplain forests** (Figure 15)
    - **large forests** (Figure 12)
    - **large meadows** (Figure 13)
- Read about those features on p. 42-56 and 60-62.
- Consider adding measures to the local code to help ensure that new land development and land uses are designed to maintain those areas intact where possible, and to avoid or minimize harm to the most sensitive parts of those areas.
- See the General Conservation Measures for Biological Resources on p.65.

Farmland Resources

- Consider the areas of **active farmland** (Figure 13), the best **farmland soils** (Figure 17), and the **Priority Agricultural Lands** identified by the Columbia County AFPB (Figure 18).
    - If the town wishes to support active farms and maintain the best farmland and farmland soils for future agricultural uses, provisions could be added to the Comprehensive Plan and the local code to ensure that the viability of future farming is considered in the review of land development projects. This could be accomplished by requiring that new development projects be located and designed so that active farmland and good farmland soils remains intact and unfragmented as much as possible, thus preserving possibilities for future agricultural use.

Scenic Resources

- Consider the places identified as areas of scenic importance to the town (Figure 19).
- Initiate a more comprehensive townwide inventory and map of scenic areas.
- Because scenic resources are of prime importance to town residents (according to recent surveys), consider adding provisions to the *Comprehensive Plan* and the local code that would help ensure that new development projects are located and designed to maintain the important scenic values of a site.

Protected Land

- Consider the land areas with formal protected status (Figure 22) throughout the town, e.g., protected by public agency or land trust ownership or by private conservation easement.
    - Consider adding provisions to the *Comprehensive Plan* or local code requiring that new development on lands adjacent to formally protected parcels be designed to maintain broad undeveloped areas well-connected to the protected lands.

For Environmental Reviews

If you are a member of the New Lebanon Planning Board, Zoning Board of Appeals, or Conservation Advisory Council, and are reviewing a proposed land development project, here are some ways that the NRCP can alert you to some natural resource questions, and bring additional information to your review.

Mineral Resources

- Is the property in an area of **glacial outwash** or **kame deposits** (Figure 6)?
    - If so, will the proposed development render the underlying sand and gravel permanently inaccessible due to, e.g., pavement or buildings? Can the new development be designed to maintain future mining access to sand and gravel?

Water Resources

- Is the parcel located in the area of an **unconsolidated aquifer** (Figure 9)?
    - If so, read on p. 24 about the importance of the aquifer to the public welfare, and the sensitivities of aquifer areas to human activities (e.g., contamination from septic leachate, fertilizers, pesticides, de-icing salts, leaks or disposal of petroleum compounds or other toxic materials, or depletion due to ineffective stormwater management).
    - Can the pavement, structures, stormwater management, and other features of the proposed project be designed to protect the water quality of the aquifer and to facilitate ample onsite infiltration of stormwater runoff?

- Are there **streams, ponds,** or **wetlands** on or near the site (figures 9 and 10) that might be directly or indirectly disturbed by the proposed development (e.g., by disrupted water movement overland or through the soils, contaminated runoff, or removal of shade)?
    - If so, can the project be designed to avoid or minimize those harms?

- Is the site in a **100-year floodplain** or an **Active River Area** (Figure 14)?
    - If so, read about those areas on p. 49-53, and consider the following:
        - Will the proposed land uses be **threatened by floods** in future large storms?
        - Will the proposed land uses
            - obstruct, redirect, or concentrate water flows during a flood event, **creating or exacerbating a local or downstream flood hazard**?
            - create a **contaminant or projectile hazard** during a flood event?
            - create new vulnerabilities to **soil loss** (e.g., from unvegetated soils)?
            - result in **elevated stream temperatures** (e.g., from forest clearing or new impervious surfaces)?

- result in **loss of ecological connections** between the floodplain and stream, or reduction of organic material to feed the stream habitat structure and food web?

- Can the project be designed to prevent those effects?

Biological Resources

- Is the property partially or entirely located in any of the following?
  - **Significant Biodiversity Area** or **Area of Known Importance** (Figure 16)?
  - **floodplain forest** (Figure15)?
  - **large forest** (Figure12)?
  - **large meadow** (Figure 13)?
- If so, read about those features on p. 42-56 and 60-62, and see if the new development can be designed to avoid or minimize fragmentation and other harms to the most sensitive areas.
- See the General Conservation Measures for Biological Resources on p. 65.

Farmland Resources

- Does the site contain **active farmland** (Figure 13)?
  - If so, can the new development be located and designed so that active farmland remains intact and unfragmented, thus preserving possibilities for continued or future agricultural use?
- Does the property contain areas of **Prime Farmland Soils** or **Farmland Soils of Statewide Importance** (Figure 17)?
  - If so, can the new development be designed such that large areas of the best soils are maintained intact in large, broad configurations, unfragmented by roads, driveways, or buildings, thus preserving possibilities for future agricultural use?

Scenic Resources

- Has the site been identified as one of the **scenic areas** of the town (Figure 19), or does it possess especially scenic features visible from public roads or other public access sites?
  - If so, can the new development be designed to avoid or minimize impairment of the scenic values of that landscape?

Protected Land

- Is the site adjacent to or near land with formal protected status (Figure 22)?
  - If so, can the new development be designed so that broad undeveloped areas of the site remain well-connected to the protected lands?

Farmland and forests of Lebanon Valley viewed from US Route 20.
Moy Wong © 2017

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False hellebore is a common plant of stream terraces. Peg Munves © 2017.

Acknowledgments

The *Natural Resource Conservation Plan* project was made possible by the support of the New Lebanon Town Board, and by funding from the New York State Environmental Conservation Fund through a grant to the town from the Hudson River Estuary Program of the New York State Department of Environmental Conservation. In addition, the New Lebanon Conservation Advisory Council (CAC) and Hudsonia Ltd. were assisted by many people in the course of preparing this document.

We especially thank Hudsonia research assistant Lea Stickle for conducting literature research, compiling and formatting data, and solving countless technical problems with aplomb. Biologists Conrad Vispo and Claudia Knab-Vispo with the Hawthorne Valley Farmscape Ecology Program generously provided photos and much biological data from their many studies in New Lebanon and other parts of Columbia County. Conrad also helped to train the CAC and Darrow School students in using GIS, remote sensing, and field observations to identify "ancient forests."

We are grateful to the Darrow School for hosting the monthly CAC meetings where the NRCP took shape, and also to Darrow's Hands to Work program in which students worked with the CAC to identify and map small streams, vernal pools, and "ancient forests."

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And finally, we thank all the landowners who graciously allowed the CAC to walk their land to identify and assess habitats and other features, which greatly expanded our knowledge of the town's natural resources.

The Abode of the Message
Ed Barbaro
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The Darrow School
Denise Clayton
Peter Count
Ginger DeLano
Christine Dreyfus
Dale & Linda Dymond
Devin Franklin, Flying Deer Nature Center
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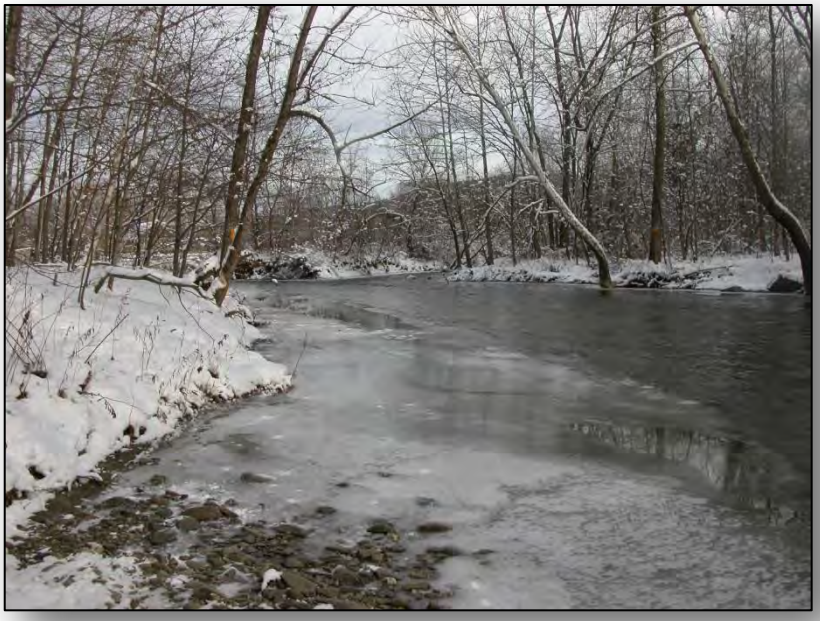
Summary

The Town of New Lebanon is a rural town of approximately 36 square miles on the lower slopes and foothills of the Taconic Mountain range in northeastern Columbia County, New York. It is notable for large forests, clean, coldwater streams, abundant high-quality farmland, and common and rare habitats that support many plant and animal species of conservation concern—those that are rare or declining in the region or the state. This *Natural Resource Conservation Plan* identifies natural resources throughout the town, explains their significance to the New Lebanon community, and provides guidance for land use planning, land development, and conservation.

The New Lebanon bedrock is predominantly phyllite, schist, and limestone throughout much of the town, and marble in the valleys of the Wyomanock Creek and the Stony Kill. The materials overlying the bedrock are predominantly glacial till, but significant areas of glacial outwash, kame deposits, and recent alluvium are along the major streams. Soils tend to be shallow at the higher elevations, deep at the lower elevations, and somewhat calcareous (calcium-rich) in much of the town due to the underlying marble and limestone.

The entire town is in the watershed of the Kinderhook Creek, a major tributary to the Hudson River estuary. The eastern half of the town drains to the Wyomanock Creek—a large tributary to the Kinderhook—and much of the western half of town is in the Hollow Brook and Stony Kill drainages. Many small streams, both perennial and intermittent, feed those larger streams, including many that do not appear on publicly available water resource maps.



Kinderhook Creek. Forested stream corridors help to protect stream water quality and habitat quality. Conrad Vispo © 2017.

Prior to European settlement the land was occupied by the Mahican people who had a small village in the vicinity of today's West Lebanon and other small villages in nearby areas of today's Columbia

and Rensselaer counties. They roamed widely over the land, hunting and foraging for food and fiber, for tool-making and construction materials, and for other resources that supported their communities. Although the Mahicans were not farmers, they occasionally cleared forests by fire to attract deer and other game to the openings, but widespread clearing of large areas did not occur here until European settlers began clearing for agriculture.

It was a Mahican who reportedly introduced a European from western Massachusetts to the warm spring in the eastern hills in 1756, an event that led to the European settlement of the area over the next few decades. In 1787 the Shakers established a community on Mount Lebanon that engaged in agriculture, tool-making, and furniture-making for the next 160+ years. Today, the land and buildings of the former Shaker community are owned and stewarded by the Shaker Museum/Mount Lebanon, the Abode of the Message, the Darrow School, and other private landowners.

The land area of the town was split off from Canaan and became New Lebanon in 1818, by which time the several hamlets were well-established—West Lebanon, New Lebanon Center, New Lebanon, Lebanon Springs. By 1826 the Mahicans had left the region.

By 1835 much of the formerly forested landscape was in pasture or cropland, even many of the high-elevation areas. Agriculture continued to be prominent in the town for the next 100+ years, but with its gradual decline in the 20th century, many of the open areas reverted to oldfield, shrubland, and forest. Today, over 70 percent of the New Lebanon landscape is again forested. Small farms keep agriculture alive in the town, however, raising beef cattle, dairy heifers, sheep, pigs, and poultry, and producing feed crops, fruits, vegetables, honey, and maple syrup. In addition, many households have gardens, fruit trees, and chickens and other small livestock for domestic use.

Active farmland and good farmland soil are widespread in the town but are most concentrated in the valleys of the Wyomanock and Kinderhook creeks. Maintaining viable farmland and active farms will preserve the town's ability to produce food locally, contribute to the town's economy, and carry on the long tradition of a working landscape that has built and sustained the town for over two centuries.

Mining of sand and gravel and harvesting of timber and firewood are local uses older than the town itself. Three commercial gravel mines were active in the Wyomanock Valley in 2017. In addition, some farms excavate sand and gravel from their own borrow pits for onsite uses. Sand and gravel are widely used in construction industries but are expensive to transport long distances, so maintaining local sources can be important to local construction interests and the town's local self-sufficiency. In addition to their commercial value, gravel mines have significant habitat value for native plants and animals. Inactive areas and abandoned mines are used by many kinds of wildlife (e.g., nesting turtles, snakes, and songbirds) and support communities of pioneering plant species that sometimes include rarities.

Groundwater is the source of most of the town's drinking water, so a continuing supply of ample and clean groundwater is of paramount importance to New Lebanon residents and businesses. The areas with highest well yields and the shallowest wells are in the glacial deposits of sands and gravels of the Wyomanock and Kinderhook valleys. These "unconsolidated aquifers" are also the places where groundwater is most vulnerable to contamination from our activities on the ground surface, such as petroleum products from leaks, spills, and stormwater runoff, or applications of pesticides and fertilizers to cropfields and gardens. Maintaining the groundwater recharge potential of these areas, as well as protecting the ground from contamination, will help to ensure the town's abundant supply of high-quality groundwater long into the future.

Some of New Lebanon's large forests are part of much larger forest areas that extend beyond the town and have been identified by The Nature Conservancy as regionally significant for wildlife and plants due to their large size and relative lack of fragmentation. Large forests are especially valuable for maintaining high-quality surface and groundwater supplies, for area-sensitive wildlife—those that require large habitat areas to maintain local populations (e.g., red-shouldered hawk, Kentucky warbler, scarlet tanager, bobcat, black bear)—and for local and regional climate moderation. Forests and other intact habitats in floodplains and adjacent areas help to accommodate floodwaters and reduce downstream flood hazards. Forests of any size, if kept intact, can provide long-term storage of large amounts of carbon in above-ground and below-ground biomass, and can thus help to offset some of the carbon emissions from human activities.

Lebanon Valley from the US Route 20 overlook. Craig Westcott © 2017.

New Lebanon has many other habitats of value to wildlife and plants of conservation concern, and to the ecosystem as a whole. Oldfields and shrublands that develop after abandonment of agriculture provide food for butterflies, moths, bees, other pollinators, and a host of other important insects, homes for small mammals, hunting grounds for their predators such as foxes, coyote, and raptors, and habitat for other kinds of wildlife. Shrublands also offer nesting habitat for habitat-specialized birds such as blue-winged warbler and golden-winged warbler, and large shrublands with dense shrub thickets may be used by the rare New England cottontail.

Meadows of any size can be valuable to wildlife, but large meadows (e.g., 10+ acres) are especially important for grassland breeding birds such as bobolink and eastern meadowlark whose populations have been declining in the Northeast for several decades. The size of the meadow, kinds of meadow vegetation, and the kinds of management (e.g., mowing schedule, grazing intensity, etc.) will determine the actual value of any particular meadow for species of grassland birds.

New Lebanon has wetlands such as forested swamps, shrub swamps, vernal pools, marshes, and wet meadows, and perennial and intermittent streams well-distributed throughout the town. Many of the small wetlands and streams do not appear on publicly available maps, however, so need to be identified on a site-by-site basis. The New Lebanon CAC has embarked on a project to find and map small streams and wetlands so that the town will have a more comprehensive inventory of these important resources, and will be better able to protect them by means of voluntary actions by landowners and through local regulations.

Cool ravines may act as refuges for wildlife in a warming climate. Claudia Knab-Vispo © 2017.

New Lebanon also has some unusual habitats, such as cool ravines, calcareous ledges, and a circumneutral bog lake, that, because of their unusual microclimate or the chemistry of the rock, soil, or water, support plants and animals that are uncommon or rare elsewhere in the town or the region.

To draw attention to important resources in different parts of the town, we divided the town into four "conservation areas"— the **High Taconics**, the **Wyomanock and Kinderhook Valleys**, the **Rocky Foothills**, and the **Western Hills**—based on factors such as topography, geology, and the prominence of certain natural resource features (Figure 1).

The eastern edge of town encompasses the lower slopes of the **High Taconics**, part of the Taconic Mountain range which has been recognized by the DEC as a Significant Biodiversity Area due to the large forests, species of conservation concern, and importance as a water source feeding the wetlands, streams, and groundwater of the adjacent valleys. The Taconic slopes have ledge and talus habitats, cool ravines, many seeps and intermittent streams, and several perennial streams, one of which has been designated by the New York Natural Heritage Program as an important area for sensitive coldwater stream habitats, including wild native brook trout. New Lebanon's famed warm spring, the only such feature known to occur in New York, emerges at the summit of Spring Hill Road. The Taconics are a prominent scenic feature visible from places along and westward of NYS Routes 20 and 22, and represent one of the "enduring features" of fundamental conservation importance to the region. The lands and buildings of the former Shaker community on Mount Lebanon are a renowned and treasured historic landmark.

The **Wyomanock and Kinderhook Valleys** hold the largest glacial outwash and kame deposits and thus the three commercial gravel mines, and the town's major unconsolidated aquifers. These aquifers are where groundwater yields and accessibility are likely to be much greater than elsewhere in the town, but where the groundwater is also the most vulnerable to contamination. There are broad floodplains in some places along these streams, including areas of floodplain forests, which are especially important for maintaining high-quality stream habitats. The mainstems and major tributaries of the Wyomanock and Kinderhook are identified by the New York Natural Heritage Program as sensitive coldwater stream habitat areas. The valleys contain numerous wetlands—including the large Shaker Swamp complex, known to support rare and uncommon species of plants and animals. Prime Farmland Soils, much of the active farmland, and many of the large meadows are concentrated in these valleys. The Wyomanock valley is part of the especially scenic vistas along County Route 5A and US Route 20. The Corkscrew Rail Trail parallels the northern reach of the Wyomanock in New

Snapping turtles inhabit marshes and ponds for much of the year, but the females migrate to upland nesting areas in the spring or early summer. Moy Wong © 2017.

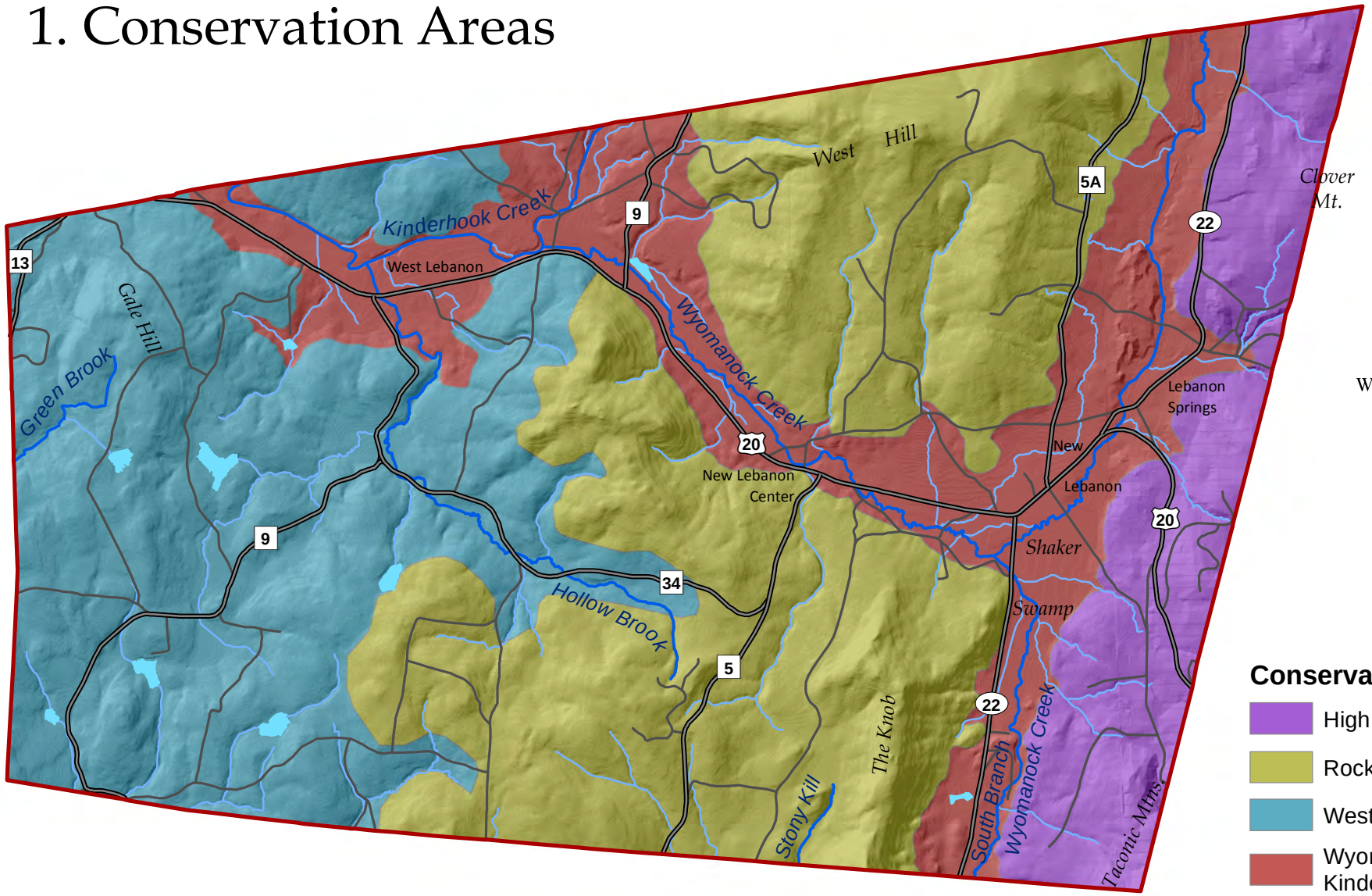
Lebanon, and the banks of the Kinderhook and the lower reach of the Wyomanock are designated for public fishing access.

The **Rocky Foothills** encompass the hilly area in the central part of New Lebanon with many of the high-elevation areas including West Hill and The Knob. The Knob has been identified by the New York Natural Heritage Program as an "Known Important Area" for biodiversity because of the high-quality mesic beech-maple forest on the summit and slopes. The adjacent "Little Knob" has a community of calcicolous (calcium-associated) plants, including many that are rare or uncommon in the county. The nearby wetland called "The Bog" may be the town's only occurrence of a circumneutral bog lake, an uncommon habitat type in the region that is known to support rare plants and animals. The Rocky Foothills also have some of the largest contiguous forests (1000+ acres) internal to New Lebanon. The northern forests of the Rocky Foothills and The Knob have been identified as part of regionally significant forest areas connecting large forest blocks with special value for supporting area-sensitive and interior-forest wildlife and providing landscape connectivity between habitat areas. The Rocky Foothills contain the headwaters of Hollow Brook and another small perennial stream that have been designated as "Known Important Areas" for coldwater stream organisms, and many other small, intermittent streams. The corridor along County Route 5a and West Hill Road has large areas of Statewide Important and Prime Farmland Soils, and contains several parcels identified as priority agricultural lands in the Columbia County *Farmland Protection Plan*. Areas along County Route 5 have exceptional scenic views of the Lebanon Valley and the Taconic hills.

Spring beauty, an uncommon spring-flowering forest wildflower of calcium-rich soils. Conrad Vispo © 2017.

The **Western Hills** contain the lower-elevation hills, much of the Hollow Brook mainstem and tributaries, most of the large open waterbodies in the town, and small areas of bedrock types that occur nowhere else in the town. Hollow Brook and several other streams have been identified as "Known Important Areas" for sensitive coldwater stream organisms. The Western Hills have large areas of good farmland soils, and a few parcels identified as priority agricultural lands in a county-wide study. The Hand Hollow Public Conservation Area (PCA) and the Hand Hollow State Forest are the two largest areas for public recreation in the town, and the PCA has been recognized as a place of special scenic importance. The PCA and State Forest together with adjacent private properties with conservation easements create a very large block of formally protected land, augmenting the conservation value of any one piece.

1. Conservation Areas



Environmental Research and Education
Science for Conservation
Hudsonia Ltd.

Figure 1. Conservation areas in the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCES

Conservation areas delineated by Hudsonia according to physiography, water, and biological features. Political boundaries and roads: New York State GIS Clearinghouse. Streams and waterbodies: USGS National Hydrography Dataset. Map created by Hudsonia Ltd., Annandale, NY.

Spiegelberg Lake, a scenic gem at the Hand Hollow Public Conservation Area.
Peg Munves © 2017

The climate has been changing measurably in the northeastern US for decades, and the effects are likely to be felt more acutely in the coming years—larger and more frequent storms and floods, higher temperatures, droughts, and wildfires, as well as some less dramatic symptoms such as increases in invasive pests and in pathogens affecting humans, livestock, and wildlife, and depletion of native biological diversity. The future effects on local biological and water resources could be large, but the specific nature and magnitude of those effects are still difficult to predict. Planning for expected changes will help to reduce the risks to structures, property, and human safety.

This *NRCP* offers many recommendations for sustainable uses and conservation of the town's natural resources, and lists specific actions that can be undertaken by landowners, other citizens, town agencies, and conservation organizations to help ensure that important resources are maintained intact for present and future generations.

Some of the action items include, for example:

- voluntary actions by landowners for protection of streams and other sensitive resources on their own lands;
- a citizens' survey of scenic locations and vistas, so that those places and landscapes can be considered in future townwide planning and site-specific land use decisions;
- expansion of public recreational opportunities;
- establishment of performance standards for stormwater management;
- adoption of new procedural measures for environmental reviews of land development projects, to improve the knowledge base for land use decisions;
- establishment of Critical Environmental Areas and conservation overlay districts to help protect resources such as aquifers, sand and gravel deposits, or unusual habitat areas from harm or misuse; and
- adoption of regulatory measures to better protect wetlands and streams.

Superb jewelwing is a damselfly associated with swift-flowing forested streams.
Conrad Vispo © 2017

Introduction

This *Natural Resource Conservation Plan* (henceforth the "*NRCP*" or "*Plan*") was developed to guide the town's stewardship of the land and water that supports the people, farms, businesses, and natural areas of New Lebanon. The *NRCP* helps to carry out the goals of the *Town of New Lebanon Comprehensive Plan* (2005) and the New Lebanon *Open Space Inventory* (2014), and is consistent with the recommendations of the *Columbia County Farmland Protection Plan* (2013). The *NRCP* also builds on a *Habitat Summary* prepared for the town by the Hudson River Estuary Program of the DEC (Strong 2010).

The Town of New Lebanon is within the Hudson River Valley National Heritage Area—one of 49 such areas designated by the US Congress as a place where natural, cultural, and historic resources form a nationally important landscape (National Park Service 2014). New Lebanon's physical and biological attributes, and the history of mining, manufacturing, timber harvest, and agriculture, have all helped to shape the present-day hamlets, the working landscapes of fields and forest, and the less-trammeled wildlands.

This document describes some of the natural resources throughout the town—with special attention to resources of conservation concern—and illustrates their distribution, discusses principles and measures for effective stewardship, and sets forth means of accomplishing the town's conservation goals. Recognizing that human uses of the land will continue to expand, and that all parts of the landscape cannot be formally protected in their current uses or their natural state, the *Plan* provides general conservation guidelines for the town, and identifies some of the features of highest priority for special care and stewardship.

Starry Solomon's seal (regionally uncommon) in a forested swamp. Claudia Knab-Vispo © 2017

Throughout the *NRCP* we use the term and concept of "**protection**" in both an informal and a legal sense. Informally, for example, any landowner can "protect" the stream running through their property by voluntarily maintaining a broad, forested buffer zone along the stream corridor, or by installing a fence to keep livestock from trampling the streambank. The formal or legal protections for land can be from local or state regulations, or the conditions of

conservation easements or site plan approvals, or the formally-stated purposes of publicly-owned lands such as parks and reserves. The town, for example, could adopt land use legislation to prevent contamination of the shallow aquifer. Or, a conservation easement on a particular parcel could specify that a pasture area be fenced away from the stream to protect the stream from contamination from manure and from streambank disturbance. Both formal and informal protections are equally important to the overall maintenance and restoration of environmental quality in New Lebanon.

President Theodore Roosevelt said, "*Of all the questions which can come before this nation, …there is none which compares in importance with the great central task of leaving this land even a better land for our descendants than it is for us…"* (August 31, 1910, Osawatomie, Kansas). We intend that the *NRCP* will bring aspects of New Lebanon's natural wealth to the attention of citizens, businesses, visitors, and town officials, and inform land management decisions by individual landowners, as well as the town's policies and practices, so that we can leave this land even a better land for those who come next.

The common but non-native eastern cottontail (above) looks very similar to the rare New England cottontail, whose populations have declined precipitously in recent decades. Moy Wong © 2017

Appendix A contains a glossary of terms used in the *NRCP*; throughout the document, terms included in the Glossary are in **bold green** type on their first mention in each major section. Appendix B has lists of plants and animals of the town and Columbia County, including species of conservation concern, and a list of common and scientific names of plants mentioned in the *NRCP*. Appendix C explains the rarity ranks of plants and animals (e.g., Endangered, Threatened, Special Concern) referred to in the *Plan*. Appendix D has a summary of the General Conservation Measures given for natural resources throughout the *Plan*.

This *Natural Resource Conservation Plan* was prepared by Hudsonia biologists, with information from the Hawthorne Valley Farmscape Ecology Program, members of the New Lebanon Conservation Advisory Council, and a variety of other public and private sources. The work was funded by a grant to the town from the New York State Environmental Protection Fund through the Hudson River Estuary Program of the New York State Department of Environmental Conservation.

Physical Setting

The Town of New Lebanon is a rural town of approximately 36 square miles (Figure 2) in the northeast corner of Columbia County, New York, bordered on the north by the Rensselaer County Town of Stephentown, on the west and south by the Columbia County towns of Chatham and Canaan, and on the east by the Berkshire County Town of Hancock, Massachusetts.

The New Lebanon population was 2305 at the time of the 2010 US Census, not including part-time and weekend residents. Residences are somewhat clustered in the four hamlets—West Lebanon, New Lebanon Center, New Lebanon, and Lebanon Springs—and are also widely distributed along roads throughout the town. The overall population density is approximately 36 people per square mile.

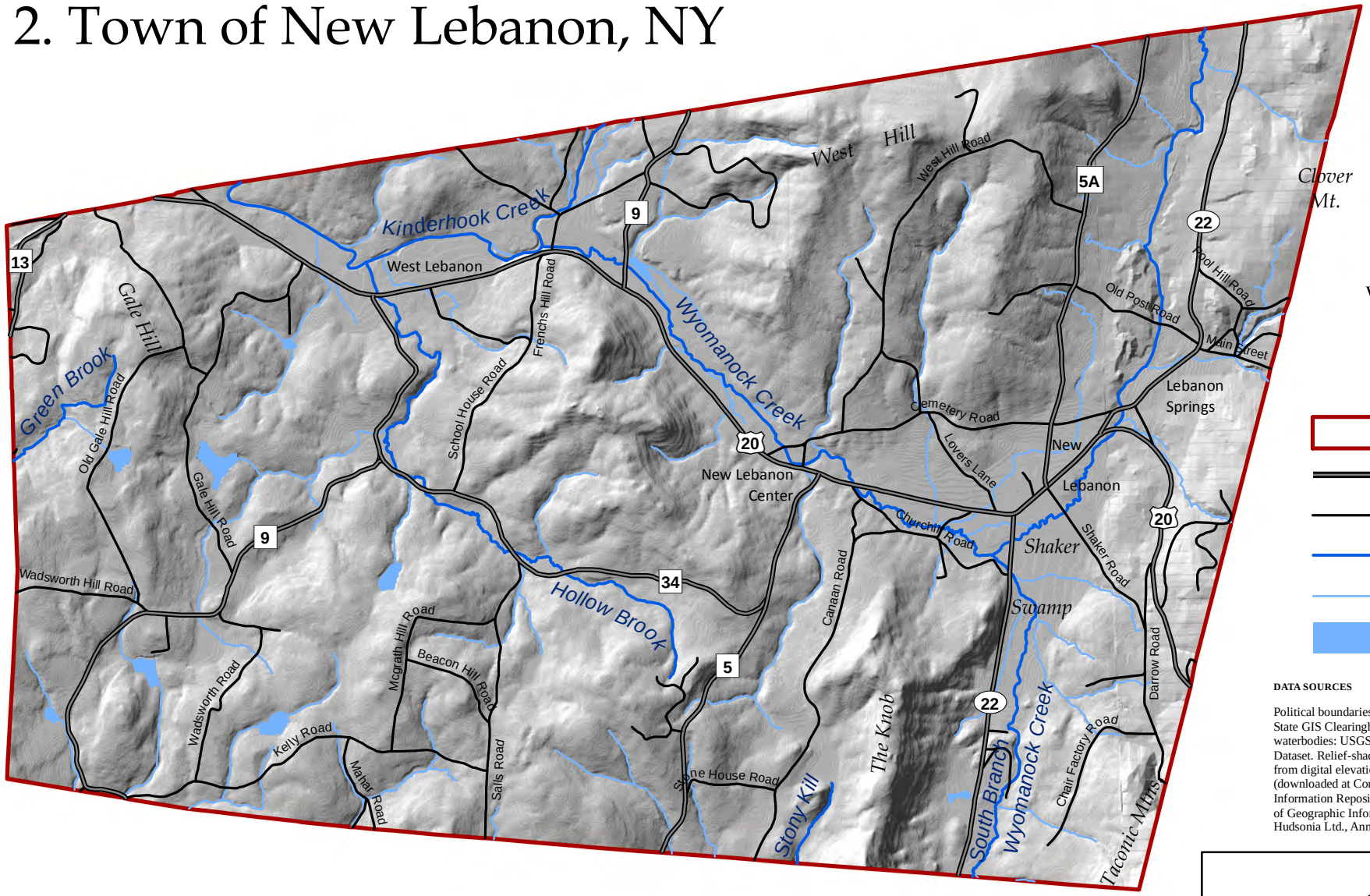
Much of New Lebanon is within the Taconic Mountains and foothills (figures 3 and 4), a range of hills straddling the eastern New York State boundary with Connecticut, Massachusetts, and Vermont, and stretching from the Hudson Highlands in southern Dutchess County, NY, to the Green Mountains in west-central Vermont. The Taconics are in the "New England Province" physiographic region and are part of the Appalachian Mountain range.

The Nature Conservancy considers the Berkshire-Taconic region to be one of the "Last Great Places" in the world, and describes it as "more than 155,000 acres [that] contains one of the most spectacular, healthiest, and most diverse blocks of intact forest in southern New England. It is home to more than 150 rare and endangered species, and its globally rare calcareous wetlands provide clean drinking water for thousands of citizens" (The Nature Conservancy 2017).

The New Lebanon landscape is dominated by high hills interspersed with lower rolling hills and the broad valleys of the Wyomanock and Kinderhook creeks. Elevations range from ca. 590 ft above sea level (asl) where Kinderhook Creek crosses the boundary with Stephentown, up to ca. 1771 ft asl at the extreme southeast corner of town. Other high elevations are on The Knob (1614 ft), West Hill (1594 ft), and Clover Mountain (1457 ft) (Figure 4).

The bedrock was mapped by Fisher (1970) as largely **phyllite** in some of the high eastern hills, **marble** in the Wyomanock and Stony Kill valleys, a combination of phyllite, **schist**, and **limestone** throughout much of the town, and **shale**, **argillite**, **quartzite**, and **graywacke** in the northwestern corner (Figure 5). The **surficial geology** is dominated by glacial **till** throughout much of the town, but with **outwash** and **kame** deposits in the major valleys, and large areas of recent **alluvium** along parts of Wyomanock and Kinderhook creeks (Cadwell et al. 1986) (Figure 6).

2. Town of New Lebanon, NY



DATA SOURCES

Political boundaries and roads: New York State GIS Clearinghouse. Streams and waterbodies: USGS National Hydrography Dataset. Relief-shaded topography generated from digital elevation models by the USGS (downloaded at Cornell University Geospatial Information Repository) and by the MA Office of Geographic Information. Map created by Hudsonia Ltd., Annandale, NY.

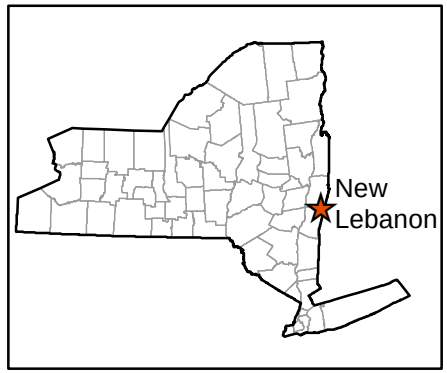


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Figure 2. Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

3. Topography

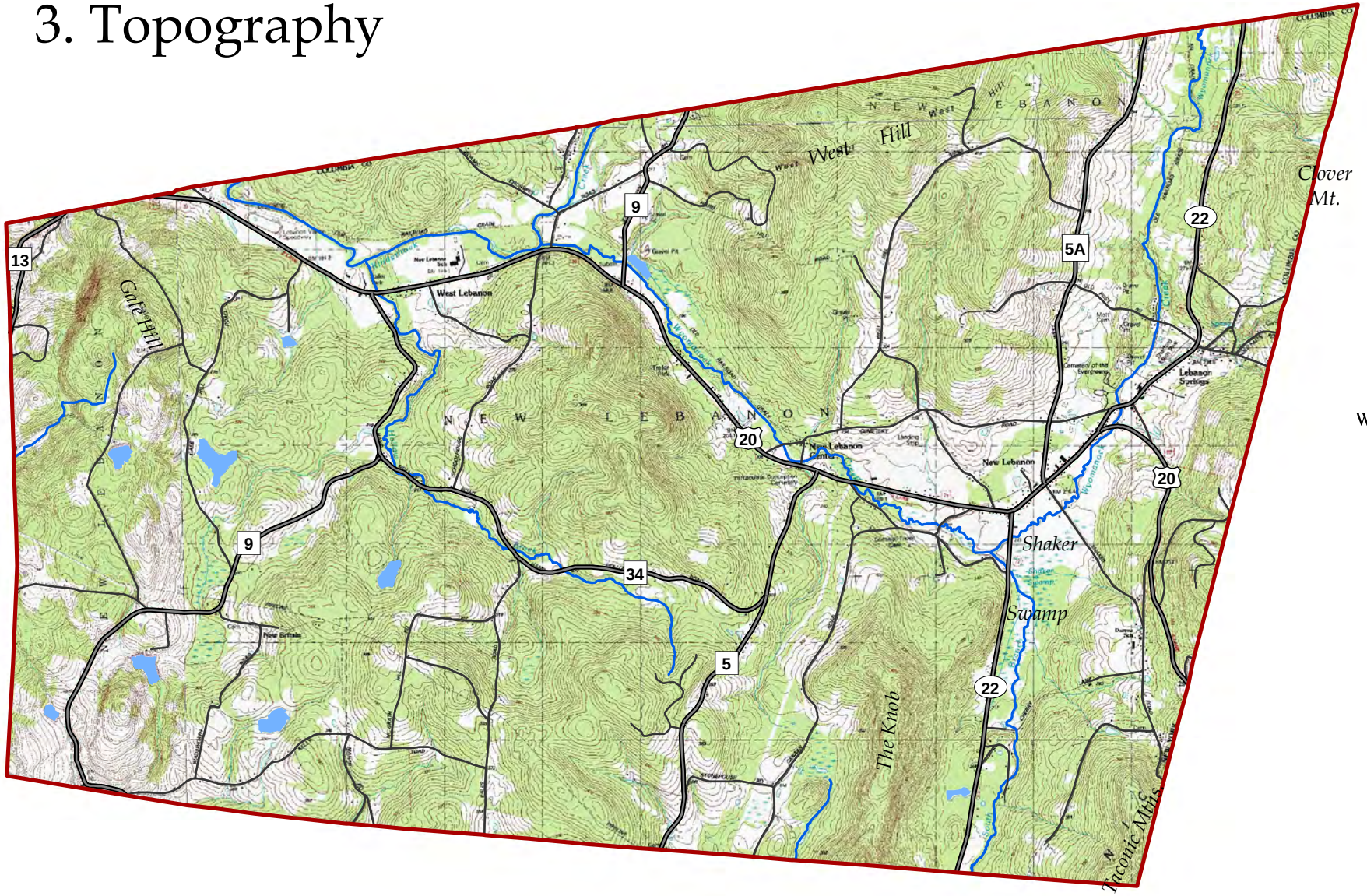

Figure 3. USGS 7.5-minute topographic maps in the Town of New Lebanon, Columbia County, New York, overlain with roads, streams, and waterbodies. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCE

USGS 7.5-minute topographic maps (Stephentown Center, Hancock MA-NY, East Chatham, Canaan, and Pittsfield West quadrangles) obtained from Cornell University Geospatial Information Repository (http://cugir.mannlib.cornell.edu). See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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4. Elevation Zones

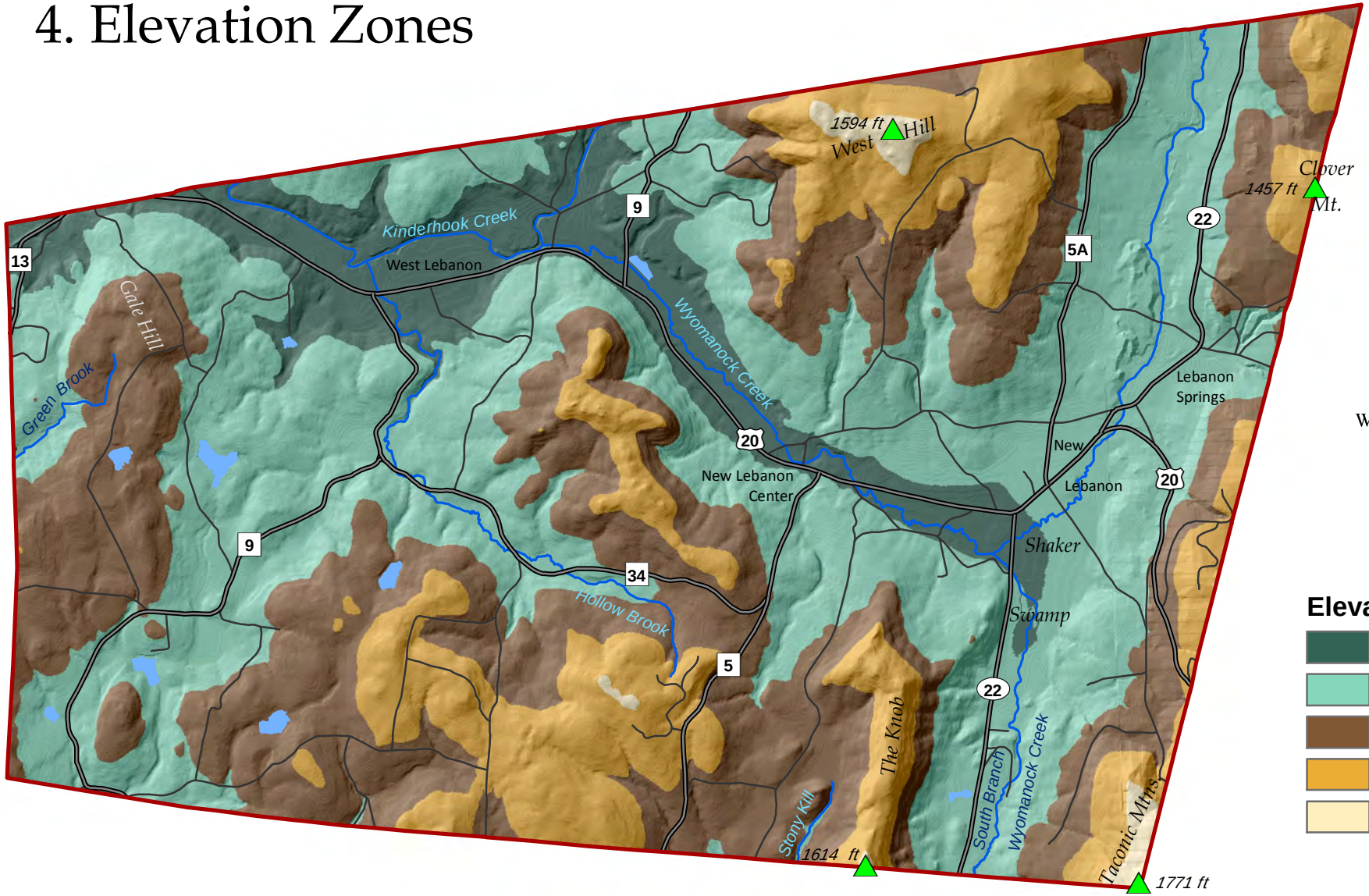

Figure 4. Relief-shaded elevation zones in the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCES

See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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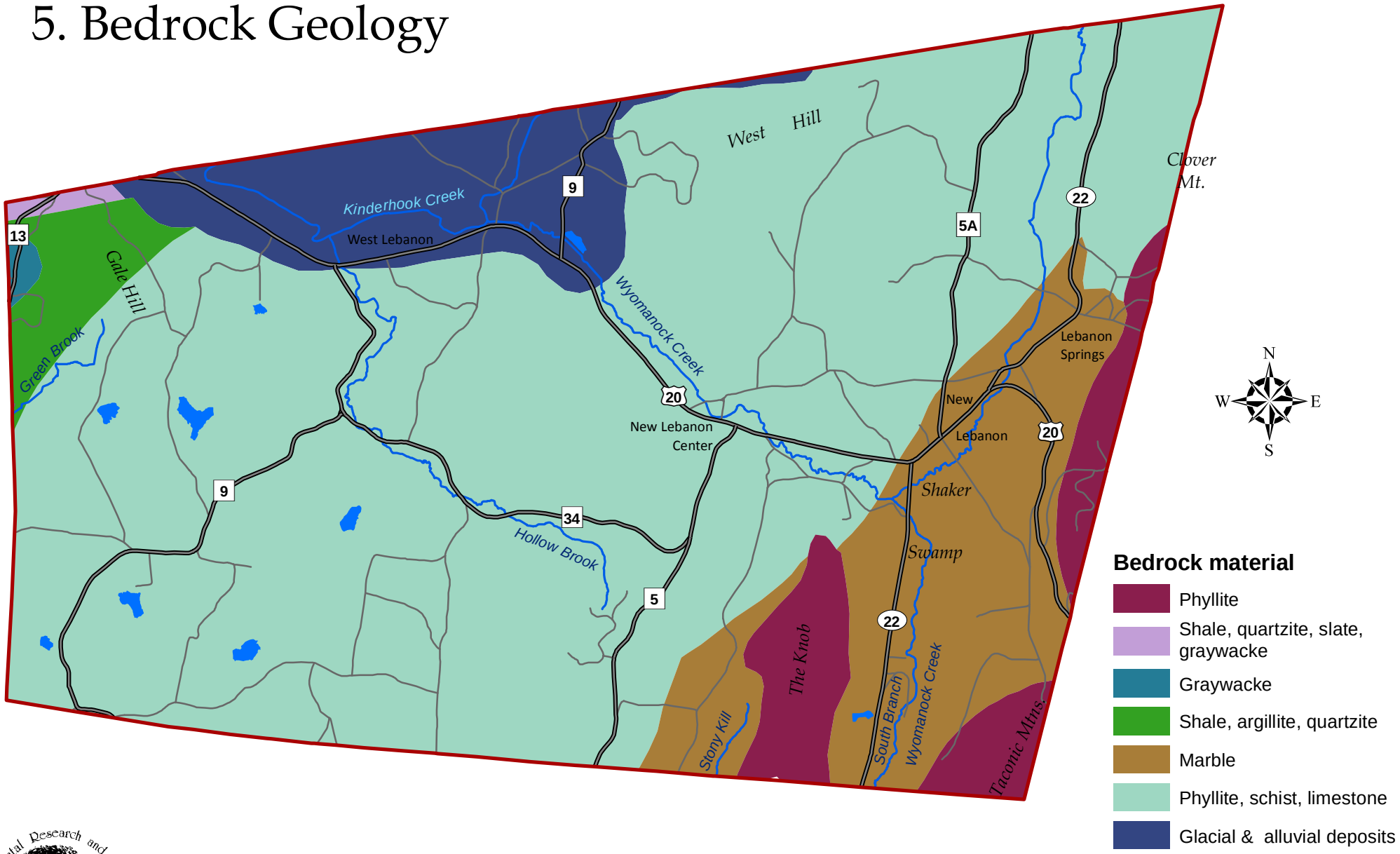
5. Bedrock Geology



Hudsonia Ltd.

Figure 5. Generalized bedrock geology of the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCES

Bedrock geology from Fisher et al. (1970). GIS data modified in 1999; obtained from New York State Museum (http://www.nysm.nysed.gov/gis/). Map created by Hudsonia Ltd., Annandale, NY.

6. Surficial Geology

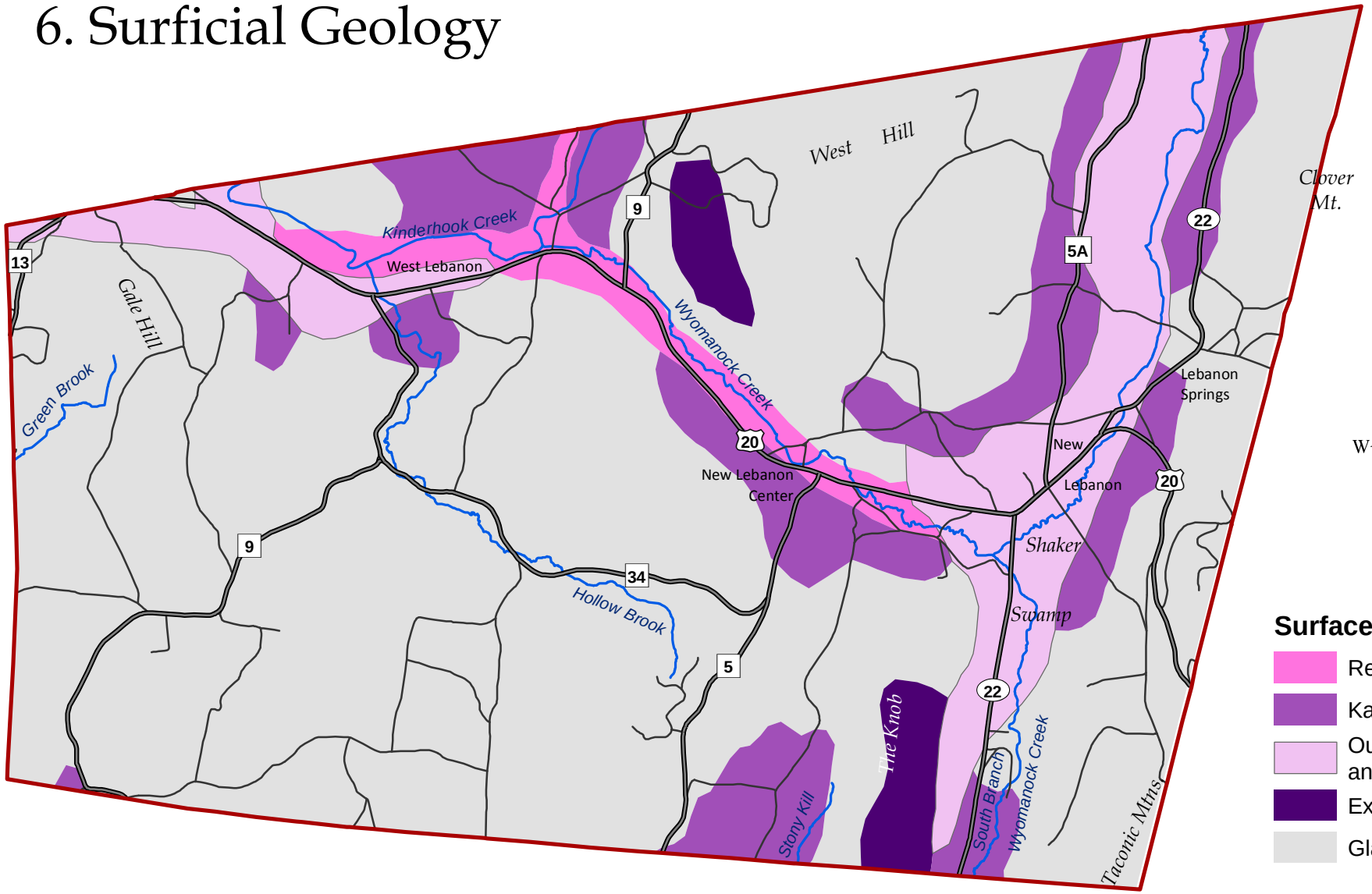


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Figure 6. Surficial geology of the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCES

Surficial geology from Cadwell et al. (1986). GIS data modified in 2000; obtained from New York State Museum (http://www.nysm.nysed.gov/gis/). Map created by Hudsonia Ltd., Annandale, NY.

Due to the limestone and marble bedrock underlying large areas, many of the soils in New Lebanon are **calcareous** (calcium-rich) (Figure 7), and this helps to explain the presence of some of the distinctive habitats in the town. The soils on all but the lowest elevations tend to be shallow (less than 20 inches depth over bedrock), and some of the hill summits and steep slopes have exposed bedrock ledges (Figure 8).

The calcium-rich bedrock and soils explain the presence of some of New Lebanon's unusual habitats.

The entire town is in the **watershed** of Kinderhook Creek, which rises in Hancock, Massachusetts, flows generally west and southwest through Stephentown, dips briefly into New Lebanon and runs southwesterly through Columbia County, ultimately reaching the Hudson River via Stockport Creek north of the City of Hudson, New York. The major New Lebanon tributaries to the Kinderhook are Wyomanock Creek, which drains most of the eastern half of town, and Hollow Brook the center west. Smaller basins include the Stony Kill along the southern edge of town, Green Brook at the western edge, and Black River at the northern edge (Figure 9).

The broad valleys of the Wyomanock and Kinderhook creeks hold several large **wetlands** (Figure 10), and other wetlands, large and small, are distributed throughout the town, including many not shown in Figure 10.

Agriculture was prominent in New Lebanon's economic and cultural history since European settlement, but declined precipitously in the latter half of the 20th century. Today over 70% of the land area is forested (Vispo 2014) (figures 11 and 12), but a resurgence of small farm enterprises is helping to carry on the agricultural tradition in ways that fit the local and regional markets of the early 21st century.

Hayfield, oldfield, and shrubland. Claudia Knab-Vispo © 2017

Summer daytime temperatures usually range from the upper 70s to mid-80s °F in Columbia County (NCEI 2017). On a few days from late May to mid-September, highs are only in the 60s °F or reach into the 90s °F. The average length of the frost-free season in New York State is approximately 145 days in New Lebanon, with the first frost typically in early October and the last frost in mid-May (NRCC 2017).

Precipitation in Columbia County is fairly uniformly distributed throughout the year—there are no distinctly dry or wet seasons on a regular annual basis. The least precipitation is typically in winter, but any month has the potential for the lightest or heaviest monthly precipitation within a calendar year at a given location (NCDC 2017). Average monthly precipitation in summer is approximately four inches in Columbia County, but the amount can vary widely from one place to another. Table 1 gives the normal monthly precipitation and temperatures for a weather station in the Village of Valatie, the nearest NOAA station to the Town of New Lebanon.

Table 1. Approximate climate normals (30-year averages) for the Town of New Lebanon, 1981-2010. Data are from the NOAA National Centers for Environmental Information weather station at the Village of Valatie, Columbia County, NY, the closest NCEI station to the Town of New Lebanon.

Month	Precipitation (in)	Minimum Temperature (°F)	Average Temperature (°F)	Maximum Temperature (°F)
Jan	2.10	14.6	23.8	33.1
Feb	1.88	17.4	27.2	36.9
Mar	2.90	25.8	35.8	45.7
Apr	3.63	37.0	48.0	59.0
May	3.95	47.2	58.9	70.5
Jun	4.35	56.7	67.8	78.8
Jul	3.95	61.0	72.3	83.5
Aug	4.13	59.6	70.7	81.8
Sep	3.88	51.3	62.7	74.2
Oct	4.05	39.5	50.9	62.2
Nov	3.26	32.2	41.4	50.6
Dec	2.55	21.6	30.1	38.6

Rainfall is usually adequate during the growing season for commercial crops, lawns, gardens, and natural habitats. Severe droughts are rare, but minor droughts are not uncommon, 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 usually occurring in February. Nor'easter storms occur in most winters, and snow yields of 12-24 inches or more from such storms are not uncommon (NCDC 2017). 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.

Major floods can happen in any season and, although they have been relatively infrequent in the past, we have seen several in the last decade associated with large storms. The greatest potential and frequency for floods is typically in the early spring when substantial rains combine with rapid snowmelt to produce large volumes of runoff. Recent hurricanes and tropical storms (Irene, Lee, and Sandy), however, have produced record-making floods in the late summer and fall.

Small stream in a forested wetland, DeLano property. Peg Munves © 2017

7. Potentially Calcareous Soils

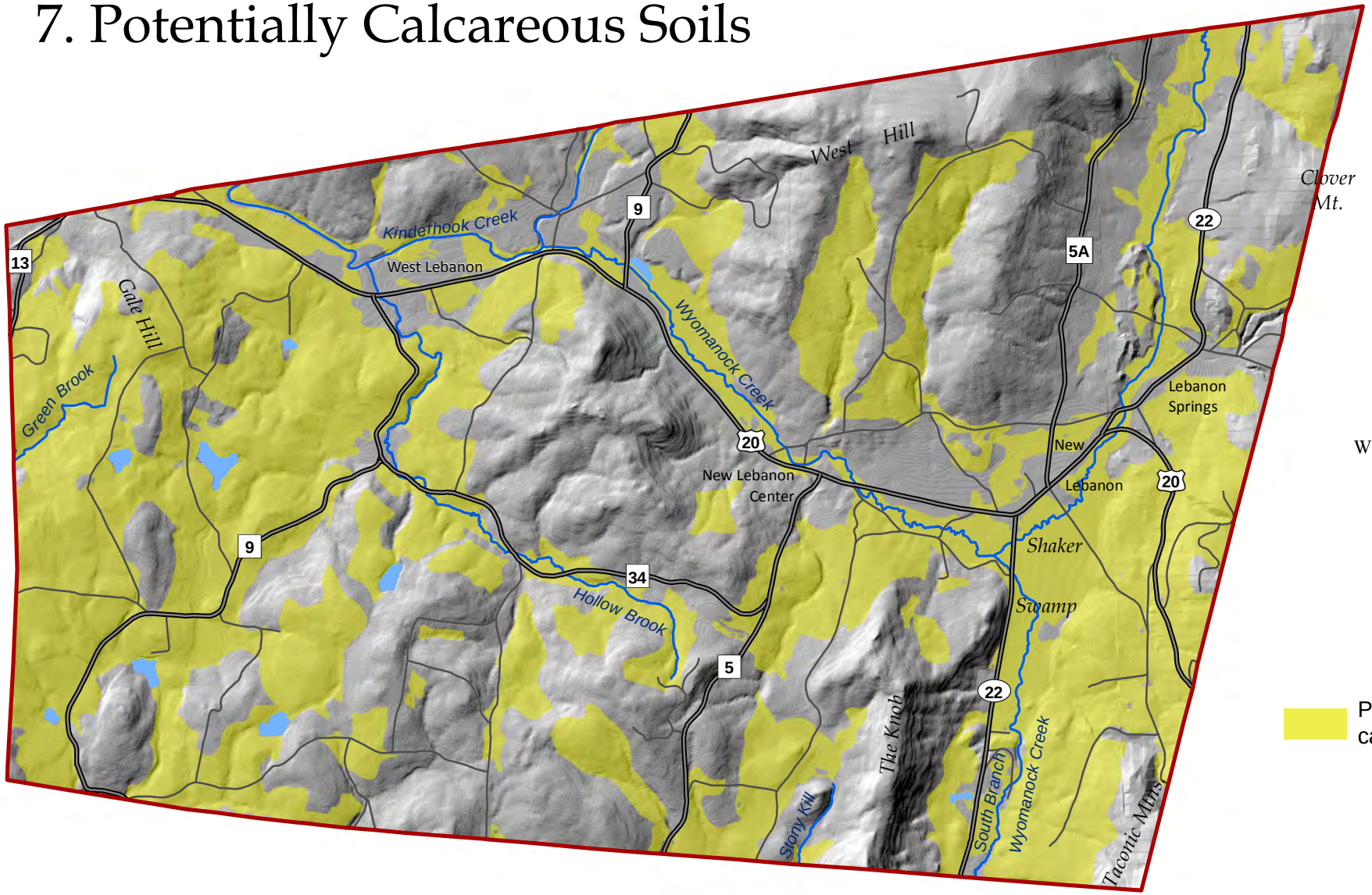

Figure 7. Potentially calcareous soils in the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCES

Soils data acquired from USDA Natural Resources Conservation Service and categorized as potentially calcareous (soil units with reaction [pH] of greater than 6.5 in the surface, topsoil, or substratum layers) by Nava Tabak (Scenic Hudson). See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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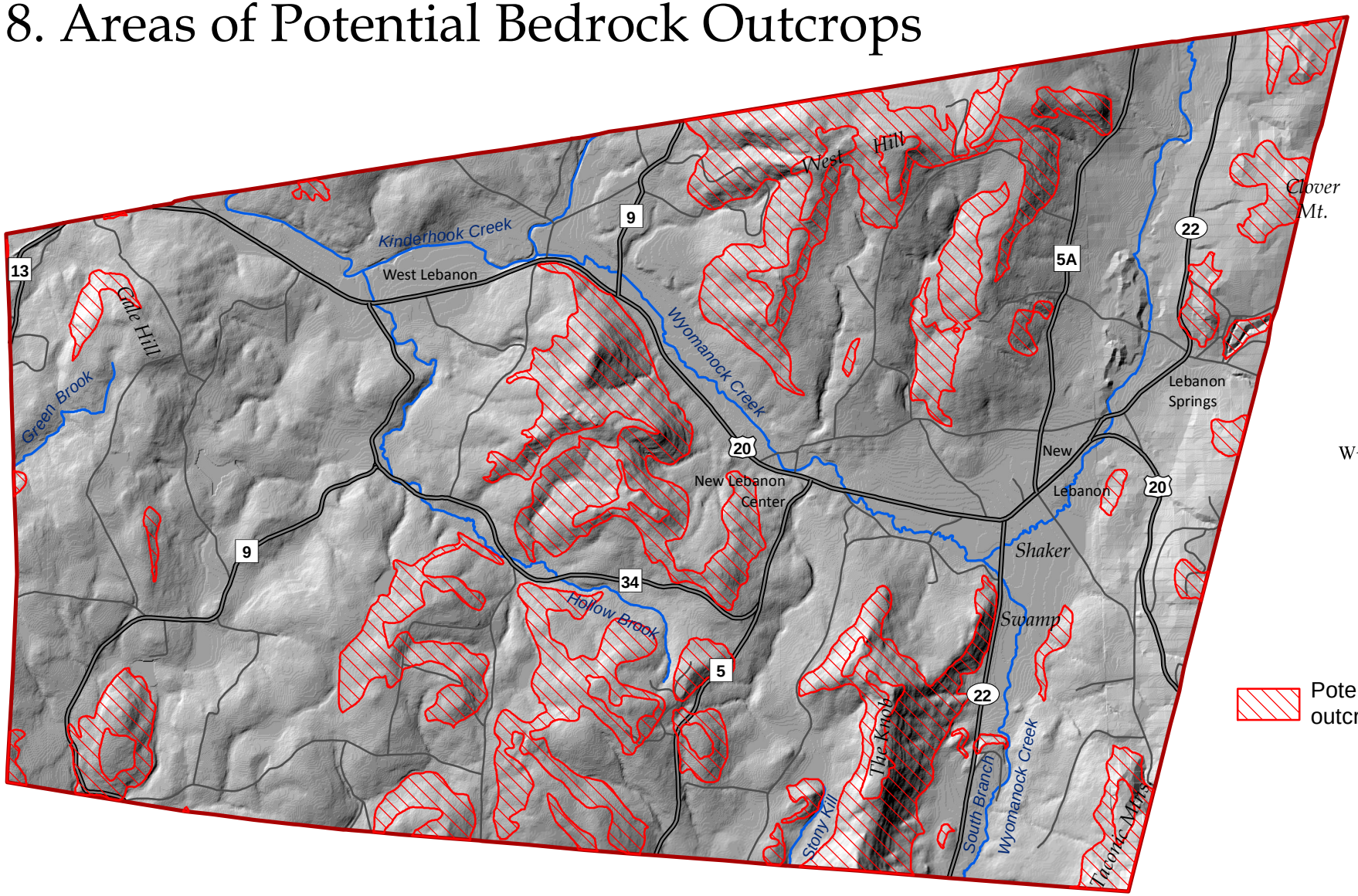
8. Areas of Potential Bedrock Outcrops



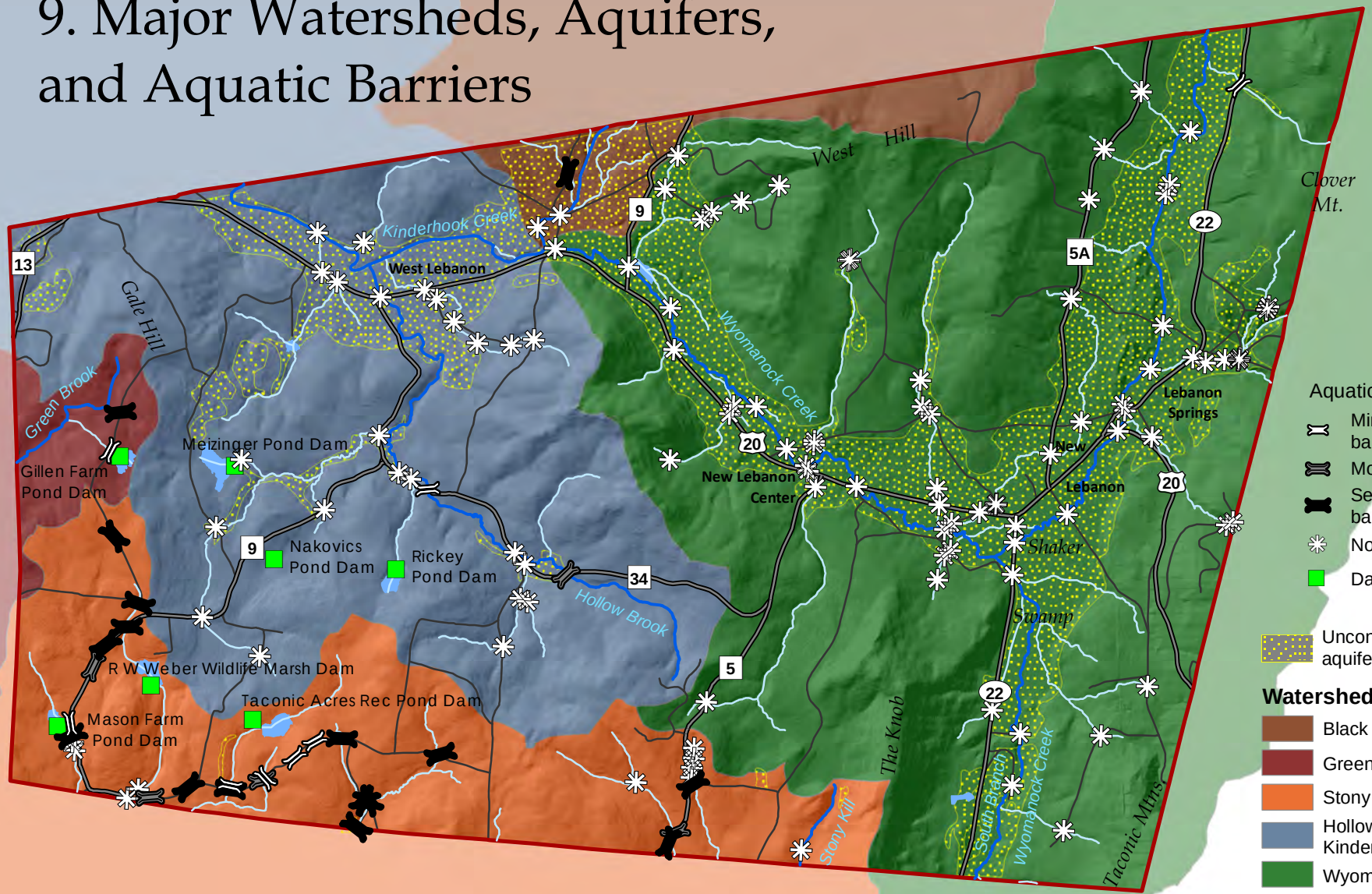
Hudsonia Ltd.

Figure 8. Areas of both steep slopes and shallow soils in the Town of New Lebanon, Columbia County, New York. These are the places most likely to have areas of exposed bedrock. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Soils data acquired from USDA Natural Resources Conservation Service; categorized as steep (soil units with suffixes of D, E, or F: slopes greater than [10-]15%) and shallow (depth to bedrock of ≤ 20 inches) by Nava Tabak (Scenic Hudson). See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

9. Major Watersheds, Aquifers, and Aquatic Barriers



Aquatic barriers
- Minor or insignificant barrier
- Moderate barrier
- Severe or significant barrier
- Not yet evaluated
- Dam

Unconsolidated aquifer

Watersheds
- Black River
- Green Brook
- Stony Kill
- Hollow Brook-Kinderhook Creek
- Wyomanock Creek

0 0.5 1 2 Miles

Figure 9. Major watersheds, unconsolidated aquifers, and aquatic barriers in the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Watersheds from the USGS National Hydrography Dataset. Unconsolidated aquifers from LaFleur and DeSimone (1991). Aquatic barriers from the North Atlantic Aquatic Connectivity Collaborative (NAACC) and the UMass Stream Continuity Project; acquired from NAACC. See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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Land Use History

The Mahican people had a village in the area that is now West Lebanon and other small villages in nearby areas of today's Columbia and Rensselaer counties (Kevin Fuerst, pers. comm.). They roamed widely over the land, hunting and foraging for food and fiber, for materials for tool-making and construction, and for other resources that supported their communities: ash trees for basket weaving; dogbane, stinging nettle, milkweeds for making twine, rope, and nets; tendons for bow strings; rawhide for lacing and burden straps; sinew for sewing and beading; bone for fish hooks, awls, knife handles, and dart heads; deer hide for clothing and shelter; and stone for a variety of tools (Kevin Fuerst, pers. comm.). Although the Mahicans were not primarily farmers, they occasionally cleared forests by fire to attract deer and other game to the openings, and perhaps for small-scale agriculture, but widespread clearing of large areas did not occur here until European settlers began clearing for agriculture.

A Mahican is said to have introduced Europeans to the warm spring in the mid-1700s (Ellis 1878). The first Europeans settled in New Lebanon in the mid-1700s, and initially occupied the hills which were "originally covered with a light growth of the common hard timber, birch, and occasional evergreens…[T]he valleys, and especially along the streams, were more densely wooded, there being in some localities heavy forests of pine" (Ellis 1878). Subsistence and commercial production from the land soon included timber, grains, vegetables, fruits, and livestock. Water-powered grist mills and saw mills were established on streams throughout the area to turn the timber and grains into lumber, meal, and flour for local use and for export to other regions. The Shakers arrived in the late 1700s and established a community on Mount Lebanon where they engaged in furniture-making and agriculture, producing milk, meat, and wool from domestic livestock, and fruits, vegetables, herbs, grains, and seeds (NLCAC 2014). At its height, the Shaker community had 550 members (Stott 2007), employed many non-Shaker workers, and worked 2000 acres of field and forest.

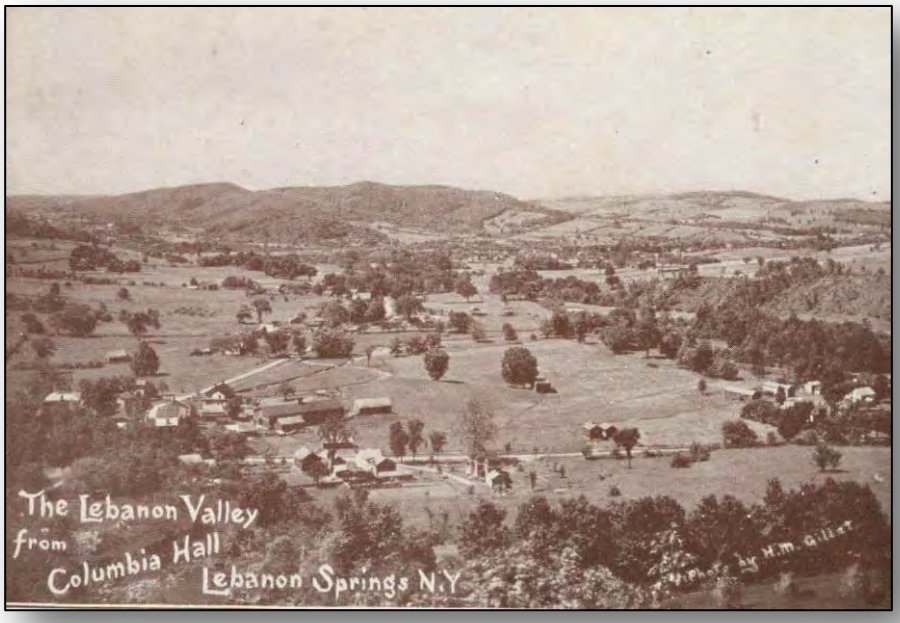
MAHICAN VS. MOHICAN

"Mahican" and "Mohican" are interchangeable anglicized names for the Eastern Algonquian Native American tribe that occupied the northern Hudson Valley, western Massachusetts and southern Vermont prior to European settlement of the region. The Mahicans called themselves *Muheconneok*, their name for the Hudson River. They co-existed here with Europeans for many decades, but were forcibly relocated to reservations in Wisconsin in the early 19th century. The Mahicans/Mohicans are distinct from the Mohegans, an Eastern Algonquian tribe of Connecticut.

Sources: http://www.native-languages.org/mohicans_words.htm; https://en.wikipedia.org/wiki/Mahican; http://pequotmuseumlibrary.blogspot.com/2009/06/frequently-confused-tribal-designations.html

In 1818 the town was split off from Canaan and officially established as New Lebanon (Ellis 1878). In 1823 John Gilbert, who had learned to prepare medicinal extracts while working with the Shakers, partnered with Elam Tilden to establish the Tilden Pharmaceutical Company. The company initially purchased medicinal herbs grown or gathered by the Shaker community (Ellis 1878), but they also grew herbs on their own land, and reportedly employed local farmers and other residents to gather material from the New Lebanon landscape. "All the herbs, barks, and roots of indigenous growth are gathered by those who have experience and each and every article is brought into the laboratory at the season when it contains most of medicinal value. A large amount of these materials are gathered by the farmers and others over a large section of country around the laboratory, and, in addition to such supplies, the Messrs. Tilden have under cultivation some 40 acres near their premises" (source unknown; quoted in Ellis [1878]). The company reduced its use of local and "indigenous growth" over time, but continued operating until 1961 (Stott 2007).

By 1826 the Mahicans had left the region (Kevin Fuerst, pers. comm.), and by 1835 much of the forested land had been cleared for agriculture, including large areas for sheep pasture which could exploit the steeper terrain and higher elevations that were impractical for other uses. In 1878 Franklin Ellis wrote "The hills are generally cultivated to the summit, and those having a southern exposure are very fertile." Beef, dairy, sheep, fruit, and vegetable farming and associated businesses were prominent through the mid-20th century (NLCAC 2014), keeping the landscape largely open—in pasture, hayfield, cropfield, or orchard—but the sharp decline in local agriculture since then has led to gradual reversion to forest, and some former farmland has been converted to residential or other human uses.



Former open landscape of Lebanon Valley, early 1900s. Photo courtesy of Lebanon Valley Historical Society.

The former stage route between Albany and Boston passed through the town, generally following the Wyomanock Creek (Ellis 1878), but long-distance travel and commerce were much expanded by the railroad which began operating through New Lebanon in 1852, initially connecting westward to the Hudson port via Chatham, and by 1901 extending east to Bennington, Vermont. The winding route was the source of the local name for this line—the Corkscrew Division of the Rutland Railroad (Flansburg 2002).

There are many farms operating in the town today, but the kinds and scale of farming have changed much over the last 2.5 centuries. Dairy farming was prominent in the late 19th and 20th centuries, but today no commercial dairy farms remain. Commercial livestock farms include beef cattle, dairy heifers (raised for a Copake farm), sheep, pigs, and poultry. Pastures and cropfields of hay, corn, and soybeans feed those livestock and out-of-town farms. A number of small vegetable farms serve local and distant farm markets, restaurants, and other outlets, as well as on-farm vegetable stands and Community Supported Agriculture members (see below).

Open landscape, 1942 (top) and same area largely forested in 2010 (bottom) in the McGrath Hill-Beacon Hill Road vicinity.

Natural Resources

Enduring Features

The term "**enduring features**" refers to features such as bedrock, hills, ravines, and valleys that are substantially unaffected by human land uses and ordinary natural events such as floods, wildfires, hurricanes, and even climate change. These are the foundations upon which our streams, ponds, forests, and other habitats have developed. For conservation planning, and in the absence of more detailed information, we can use enduring features as "surrogates" for the species, communities, and processes that sustain our ecosystems (Austin et al. 2013).

Protecting representative intact areas of these features connected across the landscape will help preserve a host of natural communities, interactions, and ecological services. This *Plan* considers three kinds of enduring features to be especially significant for conservation:

- bedrock—the variety of bedrock types throughout New Lebanon
- surficial materials—the gravel, sand, silt, clay, and peat that sits on top of the bedrock
- landforms—mountaintops, hillsides, and valleys.

Certain ecological communities or rare species occur only in certain landscape and geological settings—such as a north-facing slope, or a ravine, or a marble valley. We may not know all the places where that rare species occurs in the town, but protecting representative intact areas with suitable slopes, topography, or bedrock will help to ensure that those species can continue to persist.

There are seven major bedrock formations in the town (Figure 5) represented by the following rock types and combinations:

- phyllite (southeastern hills)
- marble (southeastern valleys)
- shale, argillite, quartzite (northwest)
- slate, graywacke (very small areas in northwest)
- phyllite, schist, limestone (most of the rest of town)

This *Plan* calls for protecting significant areas of the landscape encompassing each of these bedrock types, preferably connected by substantially undeveloped corridors. Bedrock types can be combined with other resources of concern—such as intact mountaintops, glacial outwash deposits, large forests, good farmland soils, aquifer areas, and wetland complexes—to help identify the areas of highest conservation priority throughout the town.

Mineral Resources

Sand and gravel materials were deposited here during the melting of glaciers in the Wisconsin ice sheet 11,000 – 17,000 year ago, and large deposits occur in only limited areas in the region. Sand and gravel are widely used in construction industries but, because of their great weight, are expensive to transport long distances. Maintaining local sources of sand and gravel can be important to local construction interests, but mining sometimes competes with other land development and land conservation interests for areas with outwash deposits. These areas typically have well-drained soils on flat or gently-sloped terrain, and thus may be attractive areas for residential or commercial development. They also may support uncommon or rare species of plants and animals.

Once an area of sand and gravel has been developed for residential, commercial, or industrial uses it is generally no longer available for mining or for habitat conservation. Some municipalities that wish to promote local economic self-sufficiency have designated certain sand and gravel deposits as reserves for local mining uses (Kelly 2011). New Lebanon may want to consider this kind of proactive designation to preserve the capability for future mining of sand and gravel. Figure 6 shows the areas of major glacial outwash and kames—the main areas of sand and gravel deposits. Three commercial gravel mines were active along the mainstem Wyomanock Creek in 2017. In addition, some farms excavate sand and gravel from their own **borrow pits** for onsite uses.

Protecting sand and gravel areas from pavement or structures will preserve the potential for future mining.

Gray fox, a common but secretive mammal, is an important predator on small mammals. Moy Wong © 2017

While actively mined areas of sand and gravel mines tend to have low habitat value for native plants and animals, inactive areas and abandoned mines are used by many kinds of wildlife, and support communities of **pioneering plant species** that sometimes include rarities. The habitat values of gravel mines are discussed in the Biological Resources section below. We have little information on past uses of other mineral resources in the town. The Shakers used limestone in construction of building foundations, but we do not know if it was mined locally.

Conservation of Mineral Resources

New Lebanon has long benefited from local sand and gravel deposits, and those materials remain a valuable resource for domestic use and commercial sale. Sand and gravel are limited resources, however, and have become scarce or inaccessible in other parts of Columbia County (Mark Barbato, pers. comm.), so may deserve some conservation attention from the town. Once land is developed with pavement, structures, and other more-or-less irreversible land uses, the underlying mineral deposits become unavailable for future mining. The town may wish to adopt measures that will help reserve local sources of sand and gravel to ensure their continuing availability.

When available sand and gravel became scarce in parts of California, the state established "natural resource districts" that serve as reserves for mining. Once the resource is played out and the land reclaimed, the land then becomes available for other kinds of land uses including residential or commercial development (Kelly 2011). For similar reasons, when reviewing new land uses the Province of Ontario (Canada) considers impacts on mining potential along with other matters before final regulatory decisions are made (Ontario Province 2005).

In reviews of development proposals for lands in the vicinity of glacial outwash (Figure 6), New Lebanon may want to consider mineral resource availability, and determine whether some projects can be located and designed in ways that will preserve the possibilities for mining. Should uses and markets for other kinds of mineral resources develop in the future, similar considerations could be incorporated into project reviews, to help ensure that opportunities for future mining are not eliminated by land uses that would render them unavailable.

Waterfall on the Dymond property, Gale Hill. Dale Dymond © 2017

Water Resources

The term "water resources" refers both to surface water— i.e., streams, **springs**, lakes, ponds, and **wetlands—**and to **groundwater,** the water that resides beneath the soil surface in spaces between sediment particles and in rock fissures and seams.

Stream water quality and habitat quality depend on the condition of the land in the entire watershed.

The quantity and quality of water available to natural habitats and humans depends on much more than the footprints of the streams, ponds, and **aquifers**. The water quality, flow volumes, and flow patterns of a stream, for example, as well as the types and quality of instream habitats, depend to a large extent on characteristics of the stream's watershed—the entire land area that drains to the stream. The depths and textures of the soils in the watershed, the depth and quality of **organic duff** at the soil surface, the kinds of vegetation, the extent of **impervious surfaces** (e.g., roads, parking lots, roofs), and the configuration of surface water channelization throughout the watershed all influence the volumes and patterns of surface runoff during precipitation and snowmelt events, the degree of water infiltration to the soils, and the amount and quality of water reaching streams, wetlands, ponds, and groundwater reserves throughout the year.

Because clean and abundant water is critical both to ecosystems and to the New Lebanon human community, a major goal of this *Plan* is the conservation of the volumes, accessibility, and quality of surface water and groundwater resources.

Figure 10 shows many of New Lebanon's streams, ponds, and wetlands, but does not show most of the intermittent streams and small wetlands in the town. (See Figure 10a for a sample of additional streams identified by the New Lebanon CAC.) Small streams and wetlands have great ecological value (see discussion below) and should not be overlooked in conservation planning, but most do not appear on publicly available maps.

Groundwater

Groundwater supplies nearly all the drinking water for New Lebanon's residents and businesses, and also feeds our upland habitats, springs, ponds, and wetlands, and is the source of **base flow** for most of our perennial streams. Those surface water resources in turn support farms, fish and wildlife, and recreation, and are important components of some of the town's scenic landscapes.

Drinking water wells in New Lebanon tap into groundwater from a variety of shallow and deep sources. Most of the shallow wells—tens of feet deep— are in the coarse glacial outwash deposits (sand and gravel), and the deep wells—tens to hundreds of feet deep—are in the finer glacial till material or in bedrock fractures, seams, and solution cavities.

10. Wetlands (and Potential Wetland Areas)

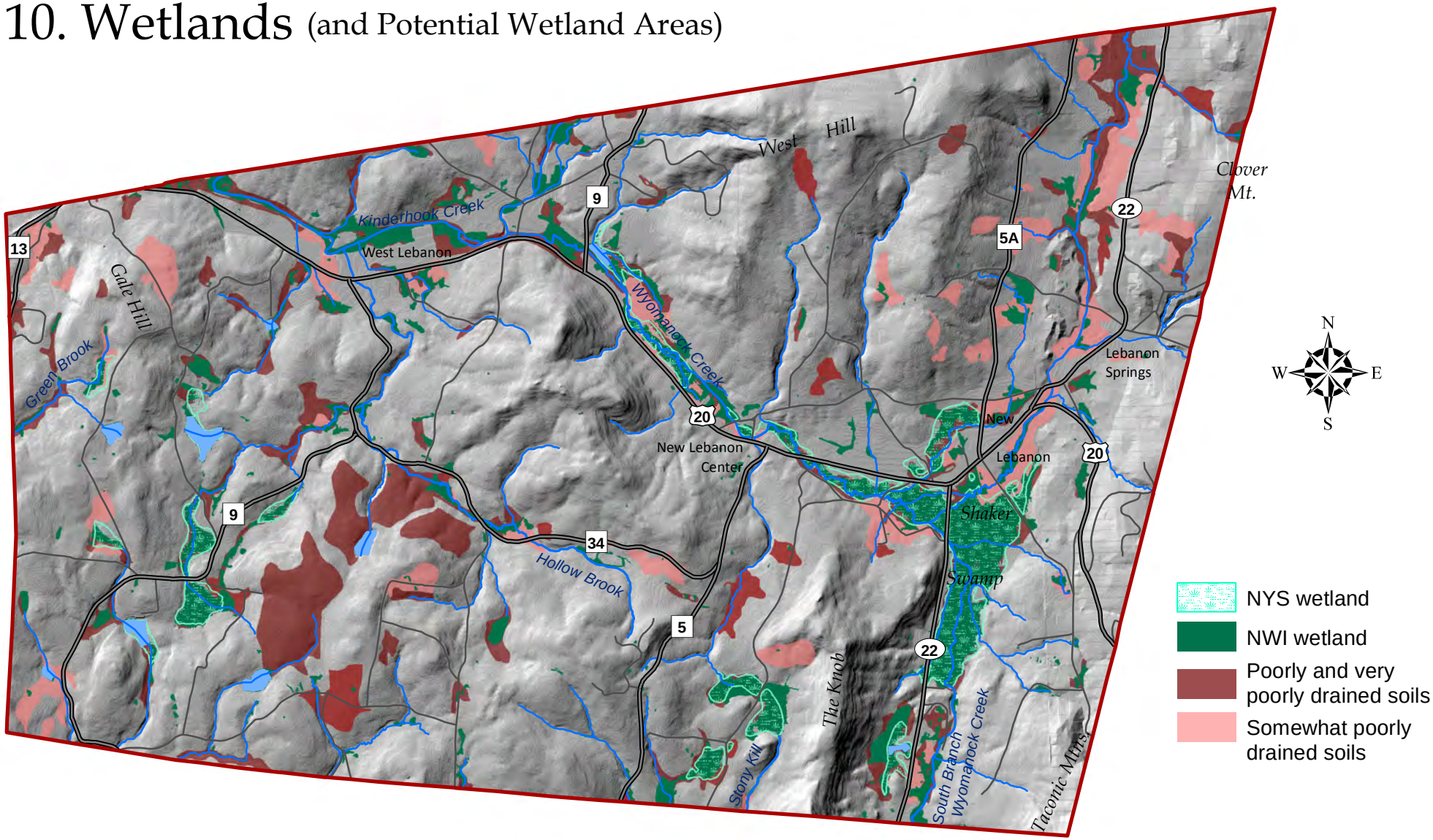


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Figure 10. Wetlands on the New York State (NYS) and federal (NWI) wetland maps and other potential wetland areas, based on soil drainage, in the Town of New Lebanon, Columbia County, New York. Potential wetland soils are shown only where they occur outside the mapped NYS and NWI wetlands. Many other wetlands are omitted on the state and federal wetland maps. All wetland jurisdictional determinations should be made on the basis of field observations. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

State-regulated wetlands from NYS Department of Environmental Conservation. National Wetland Inventory (NWI) Wetlands from US Fish and Wildlife Service. Soils data from USDA Natural Resources Conservation Service. See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

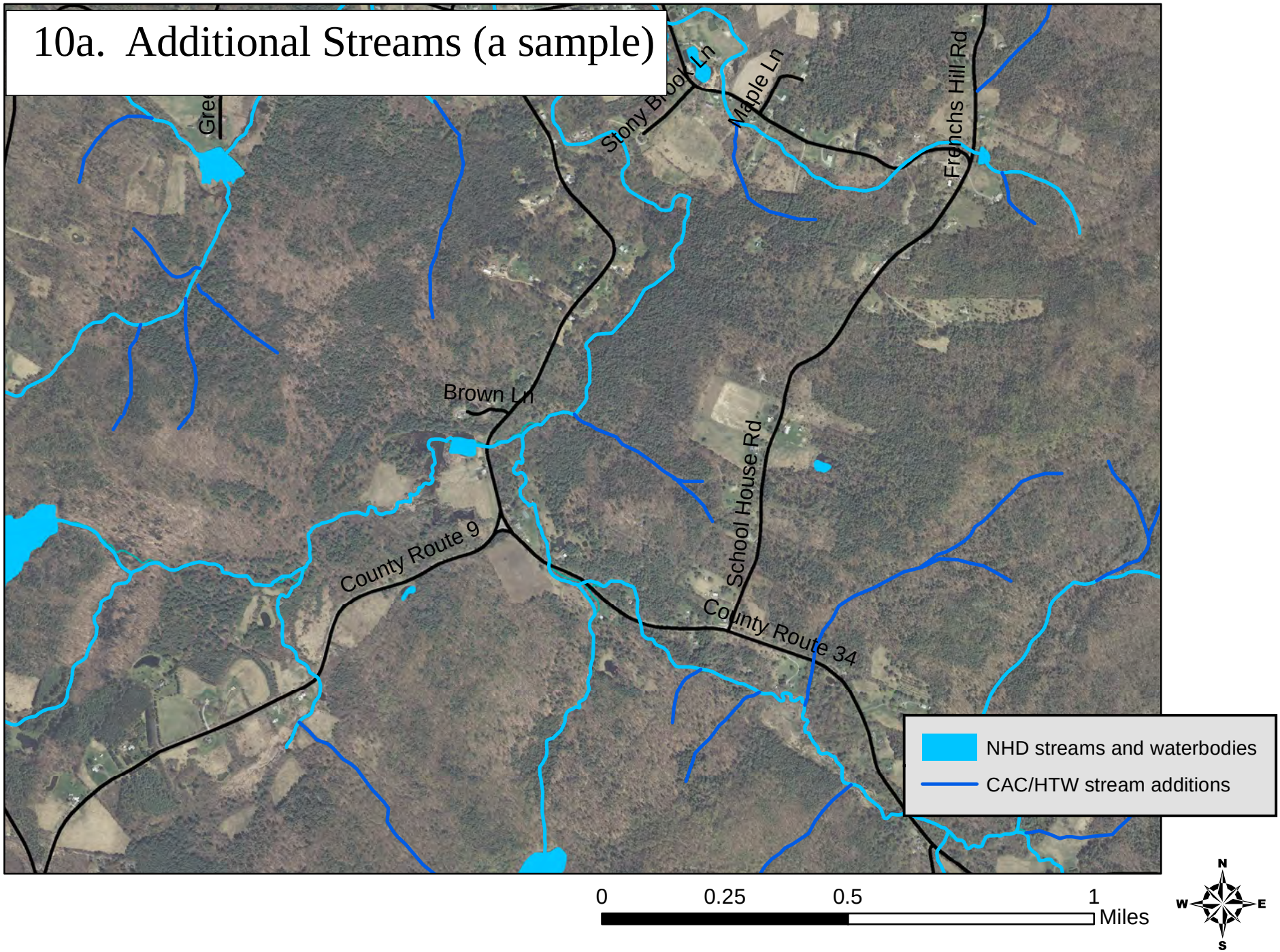

Figure 10a. A sample of streams in the National Hydrography Dataset (NHD, light blue), and additional streams (dark blue) identified by remote sensing by the New Lebanon Conservation Advisory Council and Darrow School students. New Lebanon Natural Resource Conservation Plan, 2017.

A preliminary groundwater study for New Lebanon was undertaken in 1990-91 to determine the presence, extent, and yields of the groundwater in bedrock and **surficial deposits** in the town (LaFleur and DeSimone 1991). The study examined publicly available information on bedrock and surficial geology, along with data from 177 well sites.

Figure 9 shows an approximation of the **unconsolidated aquifers** in the town, based on data from that study. An unconsolidated aquifer is a place where groundwater is stored in saturated sand and gravel deposits. These areas represent the largest and most accessible potential water sources for shallow wells, but are also the most vulnerable to contamination due to the permeability of the overlying material (sands and gravels) that can be efficient conduits for contaminants introduced by above-ground human activities. Groundwater contamination can occur from, for example, nitrates and bacteria from septic systems, fertilizers and pesticides from lawns and farm fields, de-icing salts from roads and driveways, and volatile organic compounds from leaks and improper disposal of petroleum and other fluids (Winkley 2009). Wherever possible, higher-risk land uses should be steered away from unconsolidated aquifer areas. Avoiding contamination of the aquifer is of particular importance for protecting well water sources in the New Lebanon valleys.

Water in an unconsolidated aquifer is typically abundant and accessible, but also vulnerable to contamination.

Quantity and quality of groundwater will best be protected by maintaining forested landscapes wherever possible, using agricultural fertilizers judiciously, avoiding or minimizing use of pesticides and other toxins as much as possible, and carefully designing stormwater management systems to reduce surface runoff and ensure that ample volumes of precipitation and snowmelt infiltrate the soils.

Springs and Seeps

Springs and seeps are places where groundwater discharges to the ground surface, either at a single point (a spring) or diffusely (a seep). They are often conspicuous where they discharge into **upland** habitats, but they also may discharge unseen into streams, ponds, and wetlands, and are sometimes critical water sources for those habitats. Springs and seeps are common throughout New Lebanon, occurring here and there at all elevations. The habitat values of spring and seeps are discussed in

Many of our streams originate at forested seep like this one. Claudia Knab-Vispo © 2017

the Biological Resources section below. In addition to their ecological importance, springs are important drinking water sources for humans and livestock, and have often been modified with constructed or excavated basins and, sometimes, spring houses.

Springs have particular significance for the Town of New Lebanon. The western slopes of the Taconic Hills on the east edge of town are riddled with the springs and seeps that gave the name to the Lebanon Springs hamlet. Reportedly the springs were long used by the Mahicans for bathing and medicinal purposes, and are the feature that attracted some of the earliest European settlers to this area in the mid-to-late 1700s. The reputed curative powers of the warm spring at the upper end of Spring Hill Road were the centerpiece of a summer hotel and resort that was active ca. 1794– 1925 (Stott 2007).

> "The buildings erected comprise a large bath-house, summer cottages, and spacious hotels. In the court-yard of one of these—the Columbia Hall—is the spring. It is on the south slope of the hill, three hundred feet above the valley and twelve hundred feet above tidewater. The water bubbles up from the bottom of a basin twelve feet in diameter and four deep, and has an unvarying temperature of 73° Fahrenheit the year around" (Ellis 1878).

While many springs in the region emerge from the ground at temperatures of 45-55^{0}F—much warmer than surface water streams and ponds in winter—this is the only true "warm spring" in New York State (Bakewell and Silliman 1829, Peale 1886, Waring 1983), with measured temperatures in the range of 65.7 – 79.9 ^{0}F (Hobba et al. 1979) year-round. The flow from this spring is copious, emerging at the rate of 500 gallons per minute (not recently verified [Dunn 1981]), and has long furnished many nearby dwellings with their household water supply. Today, the spring water is still piped to 40 households in Lebanon Springs, and is also available to the public at a piped outlet below the spring on Pool Hill Rd. Since 1940 it was also piped to the Indian's Blessing Fountain on NYS Route 22 in Lebanon Springs, but has since been shut off due to accumulation of bacteria in the conduit.

Water issues from the warm spring at 65.7 – 79.9 °F year-round.

The water at the warm spring issues from **dolomite** bedrock. "The most usual interpretation of such thermal springs in non-volcanic areas is that they are caused by normal groundwater circulating deeply enough into the Earth's crust to be warmed by normal geothermal heat and then rising to the surface under artesian pressure. This would be the situation at Lebanon Springs" (Dunn 1981).

A study was undertaken for the NYS Energy Research and Development Authority (NYSERDA) to determine the feasibility of using thermal groundwater in New York's Capitol Region as an energy source (Dunn 1981). The investigators studied New Lebanon's warm spring and data from other active and abandoned wells along the Taconic thrust fault between Lebanon Springs and Williamstown, Massachusetts. They found no other warm springs in New York, but two on the west

side of the Hoosic River valley northwest of Williamstown, with water issuing at 67° and 68° F. They determined that a system combining groundwater heat pumps and a microhydroelectric plant could be used to heat the New Lebanon Town Hall, town garage, and high school, and would achieve significant savings on energy costs for the town. We do not know if this idea has been explored further since 1991.

Streams

Figure 9 shows most of the perennial streams in New Lebanon but few of the smaller streams that flow only intermittently. (See Figure 10a for an example of additional streams.) **Perennial streams** flow continuously throughout years with normal precipitation, although some may dry up during severe droughts. 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 for many months during the year, but ordinarily dry up at some time during years of normal precipitation.

Intermittent streams are significant water sources for larger streams and for lakes, ponds and wetlands. This stream in the Darrow forest feeds Shaker Swamp. Claudia Knab-Vispo © 2017

Although often ignored in conservation planning and environmental reviews, intermittent streams possess ecological importance disproportionate to their size. They constitute the headwaters of most perennial streams, and are also significant water sources for lakes, ponds, and wetlands of all kinds. They provide important habitat in their own right, and strongly influence the water quantity and quality of the larger water bodies and wetlands that they feed. The habitat values of perennial and intermittent streams are discussed in the Biological Resources section below.

All the streams that the DEC has classified in New Lebanon are Class C, except for a small Class B segment on a **tributary** to the Wyomanock along Chair Factory Road (Figure 16). Class B waters are suitable for swimming and other contact recreation, but not for drinking. Class C waters support fisheries and are suitable for non-contact activities. The Wyomanock (mainstem and South Branch) and Kinderhook creeks, Black River, Tackawasick Creek, and several tributaries are classified as **trout streams**, and most of those **reaches** are also classified as **trout spawning streams** (Figure

16). Many other streams, however, have the cool water and high oxygen environments that are likely to support trout. Figure 16 shows other stream segments where wild native trout have been found in DEC fish surveys.

A DEC waterbody inventory program was conducted through 2007 to monitor water quality and trends, and identify impaired streams, lakes, and ponds most in need of improvement. The inventory found that the New Lebanon reaches of Wyomanock Creek and Kinderhook Creek, Green Brook, Black River, and their tributaries have "no known impact"—that is, "monitoring data and information indicate that there are no use restrictions or other water quality impacts, threats or issues" (NYSDEC 2008). (The Stony Kill and its tributaries were not sampled, nor were any of New Lebanon's lakes or ponds.) A study in 2000 found minor nutrient enrichment at a Kinderhook Creek sampling station in West Lebanon, but that impairment was not reflected in the stream macroinvertebrate community (Bode 2001), and was not expected to interfere with the fishery or recreational uses.

The Nature Conservancy developed the concept of the "Active River Areas" to describe those areas within stream corridors that contribute most directly to the physical and ecological processes that drive and sustain a stream. The Active River Areas in New Lebanon are shown in Figure 14 and described below in the Biological Resources section.

Water is directly withdrawn from some streams for irrigating commercial crops, watering livestock, and watering domestic gardens, and streams are also an essential source for recharging groundwater and for feeding lakes and ponds. During the wetter times of year, streams receive surface runoff from their watersheds, and a portion of the water infiltrates the streambank and substrate and reaches the groundwater. During the drier times of year, the process is reversed and the groundwater provides the base flow of many streams. Many of our lakes and ponds also rely on intermittent and/or perennial streams for a significant part of their water supply.

There may be opportunities for microhydropower development on some of New Lebanon's other streams, and this could contribute measurably to local energy production and a reduced carbon footprint. Such projects should be undertaken only after thorough studies of the stream ecology and hydrodynamic capacity to ensure that the stream, the site, and the technology are suitable.

The scenic and recreational values of New Lebanon streams are described in sections below.

Ponds and Lakes

Ponds in New Lebanon include small ornamental ponds on residential lots, and larger ponds and lakes up to ca. 21 acres. In addition there are woodland pools, open water areas within larger wetlands, and at least one waterbody that falls under the circumneutral bog lake classification. That habitat is described below (Biological Resources section), but here we describe some of the more ordinary natural and artificial waterbodies that are largely unvegetated.

These include ponds constructed by excavation in upland or wetland areas, and/or by damming of streams. Many of these ponds are created for fishing, watering livestock, irrigation, swimming, or boating, or for their visual appeal. Some are constructed near houses or other structures to serve as a source of water in the event of a fire, and some were excavated during mining. If constructed ponds are not intensively managed by humans, they can become important habitats for many of the common and rare species that are associated with naturally formed open water habitats (see below), but more typically the management (e.g., weed control, introduced fish) reduces the habitat values for native communities of plants and animals. All of the large ponds and lakes in New Lebanon were created in part by installing dams in small streams.

Although the DEC Waterbody Inventory surveys some lakes and ponds in addition to streams, none of the New Lebanon lakes and ponds have been included in that program to date. Biological resource values of ponds and lakes are discussed below

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Constructed ponds with emergent vegetation (such as the cattails, above) and unmanicured edges are likely to have greater habitat value for wildlife than those without emergents and with closely-mowed edges. David Farren © 2017

Conservation of Water Resources

Clean and ample surface water and groundwater are essential to New Lebanon's residents, farms, and businesses, as well as the natural habitats and communities of the undeveloped landscape. The town is fortunate to have abundant and high-quality streams, lakes, ponds, and groundwater, and recognizes the importance of protecting them long into the future.

The general measures for water conservation (next page) are based on some basic principles for water conservation:

- The water quality, flow volumes, and flow patterns of a stream, as well as the types and quality of in-stream habitats depend on characteristics of the stream's watershed.
- Forests with intact canopies, understories, ground vegetation, and forest floors are extremely effective at promoting infiltration of precipitation to the soils.
- Maintaining intact forests throughout a stream's watershed may be the best insurance for maintaining ample groundwater volumes, as well as flow volumes, cool temperatures, water quality, bank stability, and habitat quality in streams and ponds.
- Undisturbed vegetation and soils, minimum impervious surfaces, and careful management of stormwater runoff along roadways and on developed lots can help to protect the water quality and habitat quality of groundwater, streams, and ponds.
- Well-vegetated floodplains without structures help to stabilize streambanks, absorb floodwater, slow water velocities during flood events, attenuate downstream flooding, and maintain high-quality instream and stream corridor habitats.
- Springs and seeps in the headwaters and along stream corridors are important for maintaining the cool stream temperature that are critical to sensitive stream and pond invertebrates, fishes, and amphibians.
- Unconsolidated aquifers—generally the most accessible and high-yielding water sources for well withdrawals—are also the most vulnerable to contamination from above-ground human activities.
- Free-flowing streams unobstructed by dams or inadequate culverts are more likely to support the full complement of invertebrates, fishes, and other organisms of an intact stream ecosystem.

Intermittent stream bed on DeLano property.
Peg Munves © 2017

GENERAL MEASURES FOR WATER RESOURCE CONSERVATION

FOR LANDOWNERS

- M**aintain forests** with intact vegetation and undisturbed forest floors wherever possible to promote infiltration of rainwater and snowmelt to the soils.
- **Minimize applications of polluting substance**s, such as de-icing salts to driveways, and pesticides and fertilizers to lawns, gardens, and agricultural fields. Any of those substances might end up in streams, ponds, or groundwater.
- On land development sites, **minimize impervious surfaces and manage stormwater** in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.
- **Direct runoff from agricultural fields into basins and well-vegetated swales**, instead of directly into streams or wetlands, to maximize infiltration to the soils, and prevent the introduction of excess nutrients and toxins to streams and wetlands.
- **Consider the 100-year floodplain** when considering land management and land uses along streams. (Consider the 500-year floodplain once the data become available from FEMA.)
- **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.
- In floodplains, **shift to resilient land use**s that can withstand moderate to severe flooding; for example, pastures, hayfields, or forests.

FOR MUNICIPAL AGENCIES

- Adopt local legislation to **protect small and isolated wetlands** that are unprotected by state and federal wetland regulatory programs.
- Adopt local legislation to **protect streams (including intermittent streams)** from direct disturbance, and establish **broad buffer zones** of undisturbed vegetation and soils along streams.
- Adopt local legislation to **protect unconsolidated aquifers**.
- **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.

(continued)

Measures for Water Resource Conservation (cont.)

For Municipal Agencies (cont.)

- Design any new culverts and bridges and retrofit existing ones to **accommodate storms of 100-year intensity** or greater, 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**.
- In floodplains, **shift to resilient land uses**; i.e., uses that can withstand moderate to severe flooding, such as parks, ballfields, hiking trails, picnic areas, fishing access sites, pastures, hayfields, or undisturbed buffer zones.
- **Prohibit the building of new structures in 100-year floodplains**. (Upgrade this to 500-year floodplains when the FEMA data becomes available.)
- On land development sites, **minimize impervious surfaces and manage stormwater** in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.
- **Minimize applications of polluting substance**s, such as de-icing salts to roads and parking lots and pesticides and fertilizers to lawns. Any of those substances might end up in streams, ponds, or groundwater.
- In areas of coarse glacial deposits (sand and gravel) or carbonate bedrock (marble or limestone), **avoid siting land uses with potential for contaminating soils and water.** Educate landowners in those areas about the vulnerability of groundwater resources.
- **Regulate and monitor extractive commercial uses of water** to ensure that water withdrawals from groundwater or surface water sources do not exceed sustainable levels.

Biological Resources

The term "biological resources" covers plants, animals, habitats, ecosystems, and landscapes, and includes the interactions with each other and the non-biological components of the environment. Both the biological and physical aspects (climate, sunlight, water, soils, bedrock, etc.) are essential to the habitats and ecosystems that support human communities and the natural world.

Darrow School students Marshal and Abe studying small streams, small wetlands, and ancient forests. Peg Munves © 2017

There is no detailed map of habitats in New Lebanon, but Figure 11, which shows "land cover" identified from satellite imagery, provides a general picture of the forested and open lands, and some of the wetlands and other land cover features. In 2016-17, the New Lebanon Conservation Advisory Council and students at the Darrow School undertook a project to identify old forests that may never have been cleared for agriculture, and small streams and small wetlands that do not appear on publicly available maps. They used remote analysis of maps and aerial photos along with field visits to identify, verify, and correct their maps. They have not yet covered the whole town, but Figure 10a—a sample of their work—shows some of the many streams that are omitted from public maps. The CAC's work will alert town agencies to water resources and biological resources that might otherwise be ignored.

Many of the habitats of the Town of New Lebanon—e.g., deciduous and conifer forests, ledges, ravines, shrublands, meadows, swamps, marshes—are similar in character to those of other parts of Columbia County. General descriptions of these habitat types are in Kiviat and Stevens (2001), and below are some notes on their occurrence in New Lebanon, their ecological significance, and their services to the human community. Some of the plants and animals of these habitats, including rarities, are listed in Appendix B, as well as scientific names of plants mentioned throughout this document. The Research section (http://hvfarmscape.org/our-research) of the Hawthorne Valley Farmscape Ecology Program (FEP) website has lists of plants and animals found in their biological studies conducted throughout Columbia County, and an engaging blog describing and illustrating many plants and animals of the region (https://hvfarmscape.wordpress.com/).

The habitat profiles below are grouped into "upland habitats" and "streams, ponds, and wetland habitats." In this context the term "upland" simply means "non-wetland;" it does not refer to elevation. Upland habitats can occur at high and low elevations, including along lowland stream corridors. The term "**wetland**" is used here in the technical sense as defined in the Code of Federal Regulations: "[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 do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3[c][4]. Like upland habitats, wetlands can occur at any elevation, including hillsides and summits as well as lowland floodplains and basins and anywhere in between.

In the discussions below, plants and animals of statewide or regional conservation concern that have a formal designation as NYS Endangered, NYS Threatened, NYS Species of Special Concern, NYS Species of Greatest Conservation Need, or an Audubon Priority Bird are denoted with a superscript † symbol. The specific rarity ranks are given in Appendix B and explained in Appendix C. Appendix tables B-1, B-3, B-6, and B-8 list some of the rare species of Columbia County and New Lebanon. Scientific names of plants mentioned in the *NRCP* are given in Table B-9.

The black and white warbler nests on the floor of upland deciduous or mixed forests. Moy Wong © 2017

11. Land Cover

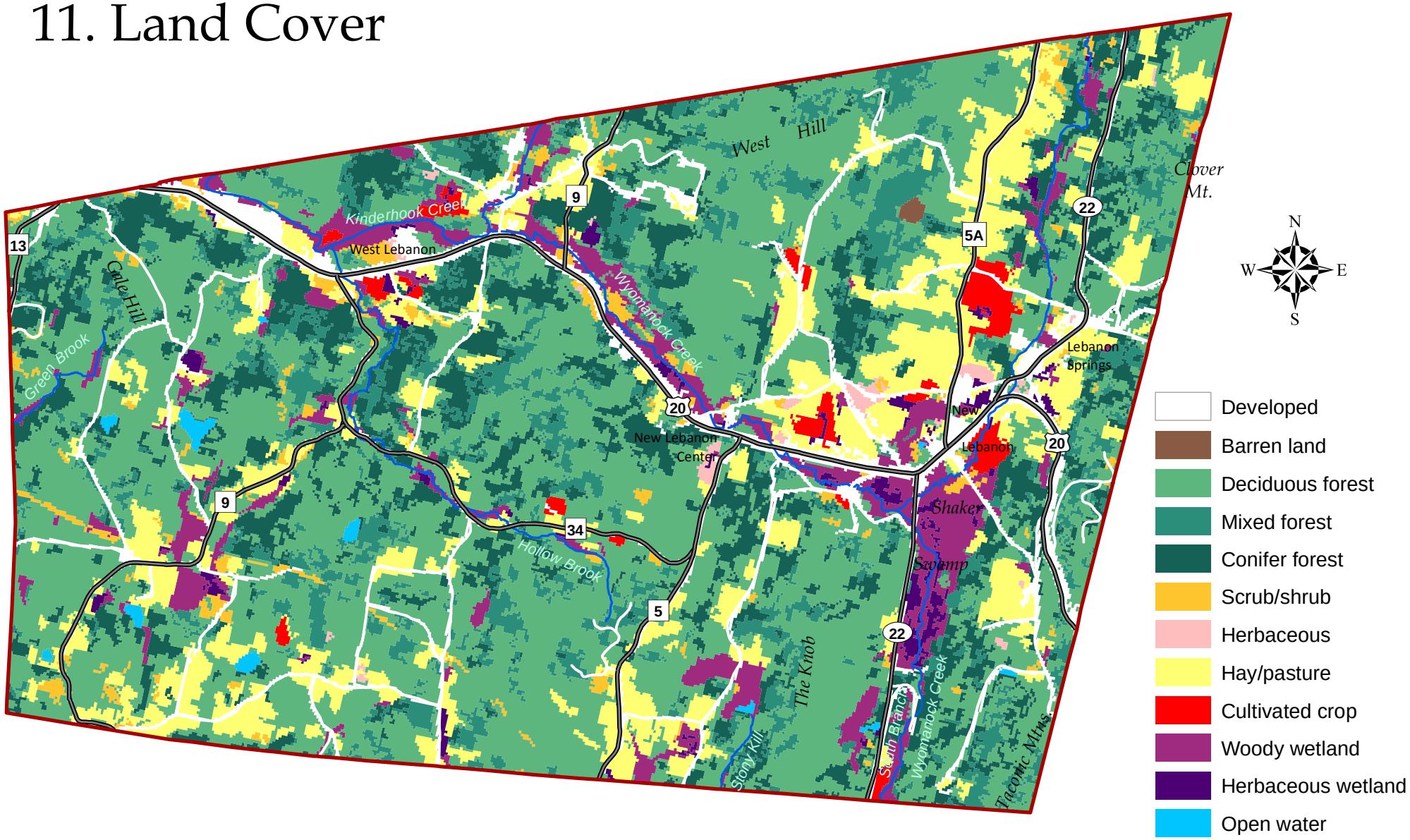

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Figure 11. Land cover in the Town of New Lebanon, Columbia County, New York. See Figure 13 for more accurate depiction of non-forested, undeveloped land cover. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCE

Land cover data modified from the 2011 National Land Cover Database (NLCD), a 21-class land cover classification scheme based primarily on Landsat data and mapped at 30-meter resolution. NLCD created by the Multi-Resolution Land Characteristics Consortium (Homer et al. 2015) and available at www.mrlc.gov/nlcd2011.php. Map created by Hudsonia Ltd., Annandale, NY.

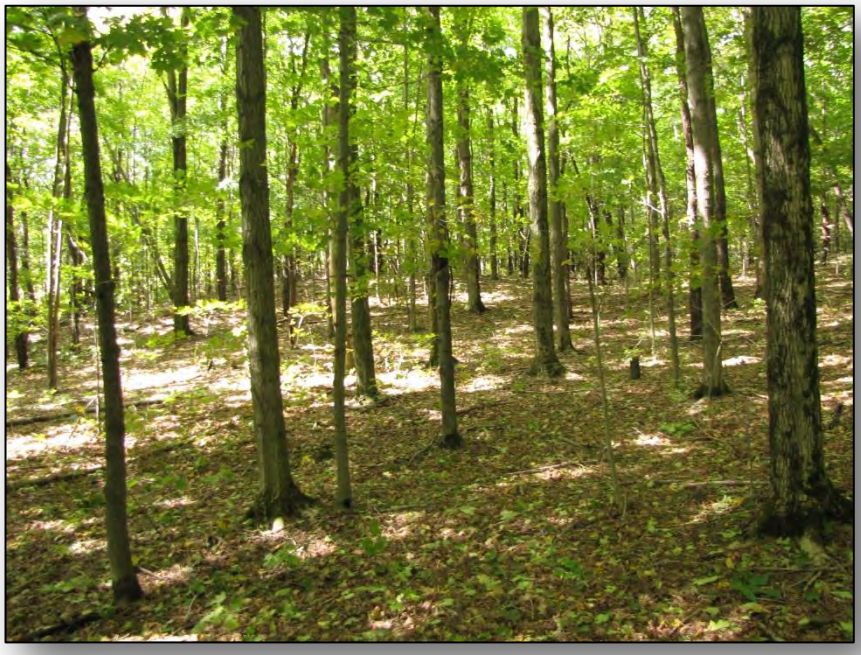
Upland Habitats

Upland Forests

Upland forests have provided timber resources to Native Americans and European settlers, and supplied the raw material for construction of most of the early houses, barns, mills, bridges, and other structures in the town. Ensuing generations have continued to manage and harvest timber for domestic and commercial uses.

Upland forests of all kinds provide habitat for a large array of wildlife, including many species of conservation concern. The particular characteristics of the forest—the size and shape of the forest patch, the plant community, the age and sizes of trees, the soil texture and chemistry, the proximity to other habitats, the kinds of past and current human disturbance—will determine how it is used by plants and animals.

Upland hardwood forests provide important nesting habitat for raptors, including red-shouldered hawk,† Cooper's hawk † sharp-shinned hawk,† broad-winged hawk,† great horned owl, and barred owl, and many species of songbirds, including warblers, vireos, thrushes, and flycatchers. American woodcock† forages and nests in young hardwood forests and shrublands. Acadian flycatcher, wood thrush,† cerulean warbler,† and scarlet tanager† are some of the birds that may require large forest-interior areas to nest successfully and maintain local populations in the long term.



Young sugar maple forest. Claudia Knab-Vispo © 2017

Conifer forests and groves are used by many species of owls for roosting and sometimes nesting. Pine siskin, red-breasted nuthatch, evening grosbeak, purple finch,† black-throated green warbler,† and blackburnian warbler† nest in conifer stands. American woodcock† sometimes uses conifer stands for nesting and foraging. Conifer stands also provide important habitat for a variety of mammals, including eastern cottontail, red squirrel, and eastern chipmunk (Bailey and Alexander 1960). Conifer stands provide winter shelter for white-tailed deer and can be especially important for them during periods of deep snow cover.

Mammals such as black bear, bobcat, and fisher require large expanses of forest, even though those animals hunt in, forage in, and travel through many other kinds of habitats. Hardwood trees larger than 5 inches diameter at breast height (dbh)—especially those with loose, platy bark such as shagbark hickory or sugar maple, deeply furrowed bark such as black locust, or dead snags with peeling bark—can be used by Indiana bat and other bats for summer roosting and nursery colonies. Such trees near good foraging sites such as stream corridors or meadows may be especially favorable. Many other small mammals are associated with upland hardwood forests, including eastern chipmunk, southern flying squirrel, and white-footed mouse. Higher densities of small mammals occur in forest areas with abundant logs and other woody debris, and these features are also favored by snakes such as black rat snake and black racer, which hunt widely in upland forests.

Questionmark, a butterfly of forests and forest edges. Conrad Vispo © 2017

While forests of any size can provide important wildlife habitat and ecological services, large forests are especially valuable for **area-sensitive wildlife** species, for maintaining high-quality surface and groundwater supplies, and for local and regional climate moderation. The subdivision of large forested tracts into residential lots acts to fragment the forests, especially when houses are set far apart from one another with long, separate driveways leading deep into the forest interior. This pattern of development divides forests into smaller blocks that are unsuitable for many area-sensitive wildlife species that require large habitat areas and are sensitive to human contact or disturbances.

Fragmentation of forests into smaller blocks increases the area of forest "edge" habitat with higher light and noise levels and often facilitates invasion by non-native plant species and by predators such as raccoons and domestic cats. Fragmentation makes the deep interior forest areas newly accessible to nest predators and to nest parasites (such as the brown-headed cowbird) whose activities are

ordinarily confined to forest edges. Roads and other developed areas dividing forests can furthermore act as significant barriers to wildlife movement, and many animals avoid breeding near human activities. The various "edge effects" of human disturbance (from roads, residential areas, and other development) may reach well over 330 feet into forest patches. Fragmentation likewise reduces the habitat value of large meadows and many other habitat types.

Area-sensitive wildlife need large, unfragmented forests to sustain local populations.

Figure 12 shows the large forest areas in New Lebanon, and the "**matrix forest**" and "**linkage zones**" identified by models developed by The Nature Conservancy and the New York Natural Heritage Program. Matrix forests are contiguous forest areas whose large size and intact condition allow them to support ecological processes and viable large-forest communities of plants and animals that cannot necessarily persist in smaller or poorer-quality forests. The linkage zones contain the forest blocks that may provide the best avenue of connectivity for the populations of plants and animals of the matrix forests; that is, the parts of the landscape that are most permeable to safe and efficient movement of migrating organisms between forest blocks. Some of these zones may be "stepping stone" patches, or stream corridors, and others may be broad areas of undeveloped land (NYNHP 2017). The matrix forests and linkage zones may become even more important with the warming climate, as plants and wildlife are forced to shift their ranges northward.

The forest patches shown in Figure 12 are classified by size to indicate one aspect of their potential significance. While small forests may also have significant value for biodiversity, water resources, and climate moderation, large forest patches are more likely to support an array of area-sensitive plants and animals whose populations cannot necessarily persist in smaller patches where they are subject to more disturbance from edge effects and human activities. Large forests are also likely to contain an array of forest communities as well as other embedded habitat types such as swamps, intermittent woodland pools, seeps, and ledges. Maintaining intact large forests will help to maintain the landscape connectivity between these communities and habitats, allowing safe movement of wildlife for their daily, seasonal, and longer-term migrations. For purposes of townwide planning and policy-making, as well as land management decisions on single land parcels, knowledge of the relative forest size can help prioritize areas for conservation.

In addition to their tremendous value for wildlife, forests are the most effective type of land cover for sustaining clean and abundant surface water (streams, lakes, ponds, and wetlands) and groundwater. Forests with intact canopy, understory, ground vegetation, and floors promote infiltration of precipitation to the organic duff and soils (Bormann et al. 1969, Likens et al. 1970, Bormann et al. 1974, Wilder and Kiviat 2008), and may be the best insurance for maintaining groundwater quality and quantity, for reducing rapid runoff and soil erosion, and for maintaining flow volumes, temperatures, water quality, and habitat quality in streams.

Because forests also provide long-term storage of large amounts of carbon in above-ground and below-ground biomass, maintaining and restoring forests can help to offset some of the carbon emissions of human activities. Forests help to moderate local and regional air temperatures and the water temperatures of streams and wetlands. Forests and other intact habitats in floodplains and adjacent areas help to accommodate the increasing frequency and magnitude of flood events. Carbon sequestration, wildlife habitats, local temperature moderation, water conservation, and flood resiliency, as well as biodiversity, should be among the factors considered when the town is assessing sites, landscapes, and potential conservation actions.

Hardwood deciduous trees predominate in the upland forests of New Lebanon, but forests of eastern hemlock and eastern white pine and mixed conifer and deciduous forests are well-represented throughout the town. Some of the large stands of white pine along parts of the Wyomanock and smaller streams may even be remnants of the "heavy forests of pine" that greeted the early European settlers (Ellis 1878). But most of the now-forested areas were cleared for agriculture in the late 1700s and early 1800s, and remained open well into the 20th century. Forests of very old trees are rare in the town, but large old trees are still common along old stonewalls, old hedgerows, and old roadways. Today over 70% of the town is forested, several patches of unfragmented forests exceed 1000 acres, and one patch that extends beyond the town boundaries exceeds 5000 acres (Figure 12).

Common tree species in New Lebanon upland forests include oaks (red, black, white, chestnut), maples (red, sugar), hickories (shagbark, pignut, bitternut), white ash, hop-hornbeam, American beech, black cherry, black birch, basswood, white pine, and eastern hemlock; less common are striped maple, white birch, yellow birch, and others. Common shrubs are witch-hazel, maple-leaf viburnum, spicebush, and serviceberry; and herbaceous plants on the forest floor are trout-lily,

Squirrel-corn, Dutchman's breeches, and yellow lady's-slipper are three uncommon plants of rich forests. Conrad Vispo © 2017

12. Large Forests

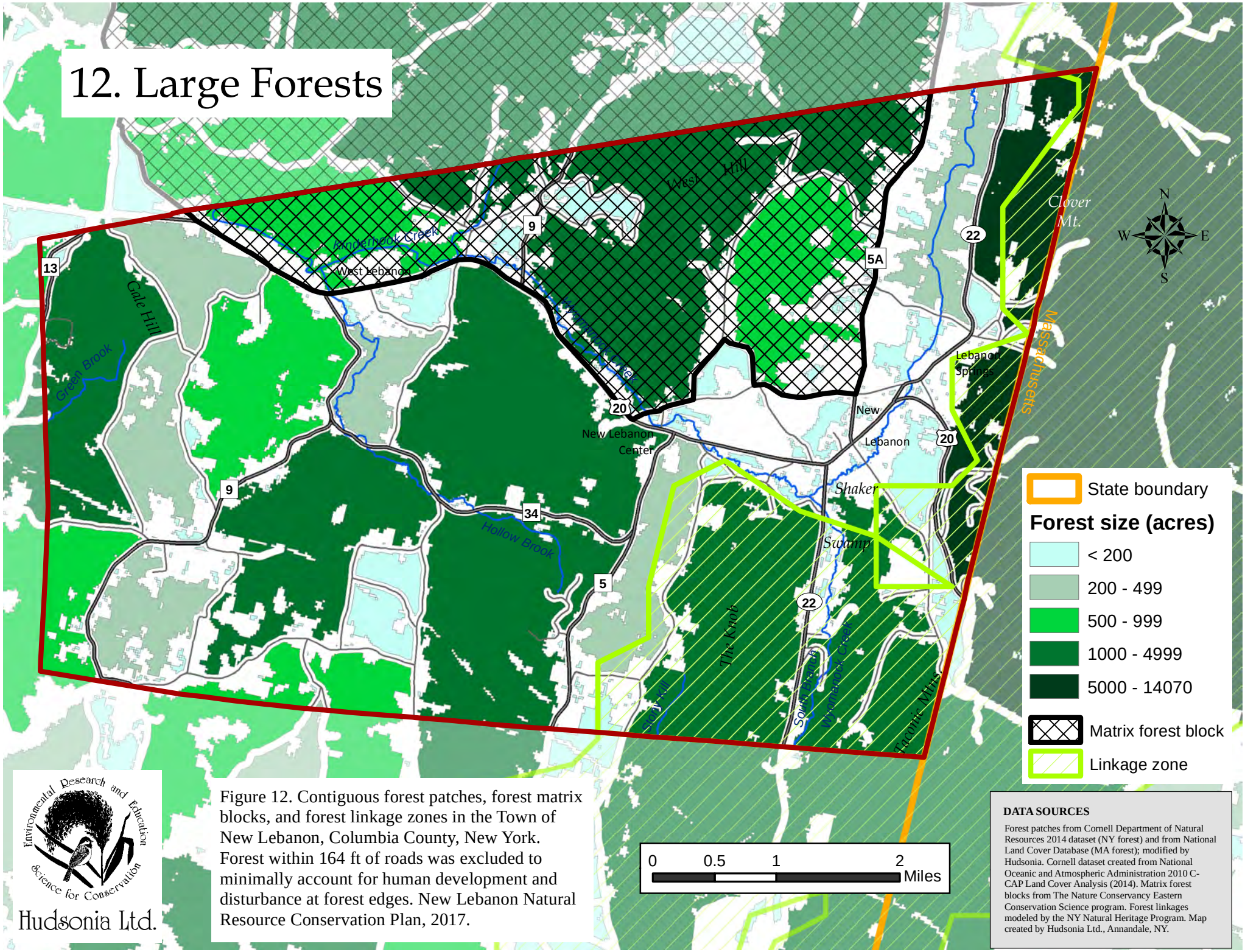


Figure 12. Contiguous forest patches, forest matrix blocks, and forest linkage zones in the Town of New Lebanon, Columbia County, New York. Forest within 164 ft of roads was excluded to minimally account for human development and disturbance at forest edges. New Lebanon Natural Resource Conservation Plan, 2017.

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DATA SOURCES

Forest patches from Cornell Department of Natural Resources 2014 dataset (NY forest) and from National Land Cover Database (MA forest); modified by Hudsonia. Cornell dataset created from National Oceanic and Atmospheric Administration 2010 C-CAP Land Cover Analysis (2014). Matrix forest blocks from The Nature Conservancy Eastern Conservation Science program. Forest linkages modeled by the NY Natural Heritage Program. Map created by Hudsonia Ltd., Annandale, NY.

Canada mayflower, starflower, white snakeroot, and white wood aster. Some forests or forest edges have non-native shrubs and forbs such as Bell's honeysuckle, common buckthorn, Oriental bittersweet, multiflora rose, winged euonymus (burning-bush), and garlic-mustard.

The calcium-rich soils in parts of New Lebanon support "**rich forest**" communities with many plants that are uncommon in the region, such as maidenhair fern, American ginseng, may-apple, blue cohosh, and leatherwood, and including abundant "**spring ephemeral**" wildflowers—those that bloom early before the leafy tree canopy has fully developed—such as bloodroot, hepatica, spring beauty, squirrel-corn, cut-leaved and two-leaved toothworts, and wild ginger. Spring ephemerals are becoming rarer in the region due to the convergence of multiple factors such as over-grazing by deer, disruption of forest soils by humans and by non-native earthworms, competition from non-native plants, and the warming climate (Barbour 2004, Gezon et al. 2016). Table B-1 (Appendix B) lists some of the plants and animals of conservation concern that are known to occur in New Lebanon forests, as well as those that occur in other forests of the region and may also occur here.

New Lebanon's "rich forests" have abundant spring ephemeral wildflowers.

The Farmscape Ecology Program uses the term "**ancient forest**" to refer to 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. Apparently because of their less-disturbed soils, ancient forests sometimes support an array of plants that are absent or rare in younger forests. For example, in Columbia County these forests tend to have significantly more eastern hemlock, yellow birch, chestnut oak, American chestnut, basswood, and witch-hazel, and forest herbs such as American ginseng, American spikenard, beechdrops, bush-honeysuckle, Canada violet, gaywings, and Dutchman's breeches. These old forest areas are scarce and declining due to land development (Vispo and Knab-Vispo 2012), but deserve conservation attention due to their unusual ecology and their support of many plant species that are themselves becoming rare in the region.

Loss of ancient forests may lead to the disappearance of rare species not found in younger forests.

Shrubland

Upland shrubland is a common habitat on abandoned farmland, in utility corridors, in cleared, burned, or blowdown forest areas, and in rocky areas with shallow soils. It is often a transitional habitat stage between upland meadow and young forest. Shrubland plant communities vary according to soils, age, past land uses, and recent management, but they often share many of the plant species of oldfields (see below), with plants such as Kentucky bluegrass, sweet vernal grass, timothy, bentgrass, pointed broom sedge, clovers, wild madder, common milkweed, spotted knapweed, goldenrods (early, wrinkle-leaved, grass-leaved), and yarrow, along with shrubs such as gray dogwood, meadowsweet, steeplebush, multiflora rose, and autumn-olive.

Shrublands are used by many kinds of wildlife, including butterflies, bees, dragonflies, small mammals and their larger mammal predators such as fox and coyote, songbirds, turtles, and snakes. The complex habitat and microhabitat structure and diverse herbaceous (non-woody) communities often support diverse and abundant spiders, ground beetles, ants, and other invertebrates.
Many species of conservation concern are known to use shrubland habitats in the region, including butterflies such as dusted skipper,† Leonard's skipper, and cobweb skipper (all regionally rare or scarce), nesting songbirds such as golden-winged warbler,† blue-winged warbler,† and American woodcock,† and mammals such as the New England cottontail.†

The latter species—very similar in appearance to the eastern cottontail (the common non-native species)—is our only native cottontail, but its populations have declined dramatically in the Northeast in recent decades. It seems to prefer large areas of shrubland with dense shrub thickets that provide protection from predators. New Lebanon is within the historic range of New England cottontail, and it is not known if the species occurs here today. The DEC is attempting to locate extant populations in the region and works with landowners in southeastern New York to develop and enhance shrubland habitats for this rabbit. For landowners interested in supporting the New England cottontail, the DEC website has information on managing shrublands especially for this rare and vulnerable species.

American robin (eggs and nestlings above) is well-adapted to human-settled landscapes. Moy Wong © 2017

Upland Meadow

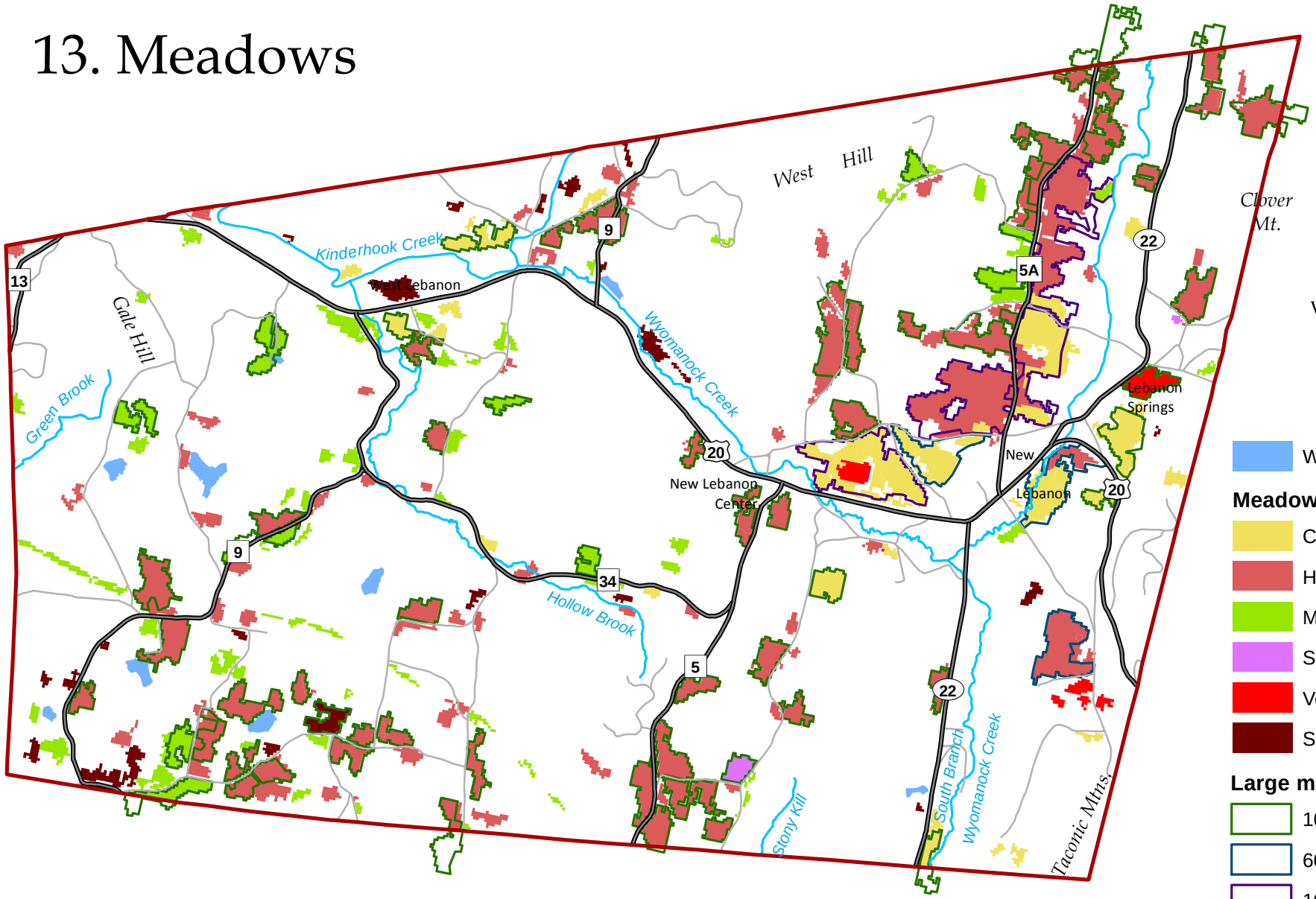
The term "upland meadow" can include row cropfields, hayfields, pasture, and oldfields. Of these, cropfields have perhaps the least habitat value for native plants and animals, although even cropfields are used by rodents, nesting turtles, foraging snakes and songbirds, nesting killdeer, pollinating insects, and a host of other kinds of wildlife. Cropfields can act as ecological traps however, attracting animals that are then harmed or killed by farm equipment, pesticides, and other hazards. Hayfields, pastures, and oldfields, because of less frequent and less intensive disturbance, are more likely to support plants and animals of conservation concern.

Hayfields and pastures typically have non-native grasses and forbs such as Kentucky bluegrass, timothy, orchard grass, smooth brome, bentgrasses, clovers, vetches, wild madder, yarrow, and Queen Ann's lace. Oldfields often have very diverse vegetation including species of pastures and hayfields along with many other such as broom sedge, common milkweed, knapweeds, asters, and goldenrods.

Oldfields become valuable habitats for butterflies, moths, bees, other insects, small mammals, and many other kinds of wildlife. Claudia Knab-Vispo © 2017

The ecological values of meadow habitats can differ widely according to the types of vegetation present and the disturbance histories (e.g. tilling, mowing, grazing, pesticide applications). Large (e.g., ≥ 10 acres) hayfields or pastures dominated by grasses, for example, may support grassland-breeding birds (depending on the mowing schedule or intensity of grazing) and many other kinds of wildlife, while intensively cultivated cropfields have comparatively little wildlife habitat value. Undisturbed meadows develop diverse plant communities of grasses, **forbs**, and shrubs and support an array of wildlife, including invertebrates, some frog species, reptiles, mammals, and birds. Meadows with shallow, nutrient-poor soils (especially common in mid-slope locations) often support a higher abundance and diversity of native, warm-season grasses and other native plants (Vispo & Knab-Vispo 2012). It is

13. Meadows



Water body

Meadow type

- Corn or soy
- Hay or pasture
- Meadow
- Specialty crop
- Vegetables
- Shrubland

Large meadows (acres)

- 10 - 59
- 60 - 99
- 100 - 163

0 0.5 1 2 Miles

Figure 13. Uses and sizes of meadow, crop, and shrubland areas in the Town of New Lebanon, Columbia County, New York.New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCE

Meadow, crop, and shrubland areas extracted from the 2011 National Land Cover Database (NLCD). (See Figure 11.) Land use data from field observations by New Lebanon Conservation Advisroy Council, 2017. See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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for both present and potential ecological values that we consider all types of meadow habitat to be ecologically significant.

There are many statewide and regionally rare plants of oldfield habitats, including spring avens, purple milkwort, and late purple aster which are known to occur in New Lebanon (see Table B-1). Several species of rare butterflies, such as Aphrodite fritillary, meadow fritillary, dusted skipper,† Leonard's skipper, swarthy skipper, and striped hairstreak use upland meadows that support their particular host plants (see Table B-2). Upland meadows can be used for nesting by wood turtle,† spotted turtle,† box turtle,† painted turtle, and snapping turtle.† Wild turkeys forage on invertebrates and seeds in upland and wet meadows. Upland meadows often have large populations of small mammals (e.g., meadow vole) and can be important hunting grounds for their predators—raptors, foxes, and eastern coyote.

Grassland-breeding birds such as northern harrier,† grasshopper sparrow,† vesper sparrow,† savannah sparrow, eastern meadowlark,† and bobolink† use large meadows for nesting and foraging. Although bobolink or eastern meadowlark can nest successfully in a ten-acre meadow, other grassland species require meadows of 25, 50, or 100+ acres to maintain longterm breeding populations. Each species has its own requirements and preferences for vegetation type and structure (e.g., grasses vs. forbs, short or tall, dense or sparse, tolerance for shrubs, etc.), and sensitivity to the surrounding landscape. The grassland bird species nest on or near the ground and are sensitive to nest predators and nest parasites. The deep interior areas of large meadows provide some protection from those disturbances. Mowing or heavy grazing in spring or early summer is also likely to destroy nests or nestlings.

Upland meadows occur in all parts of New Lebanon, and large meadows are especially concentrated along County Route 5A and Cemetery Road (Figure 13).

Cool Ravine

The term "cool ravine" refers to a rare kind of ravine with very high, very steep rocky walls narrowly flanking a rocky stream that runs through the ravine bottom. New Lebanon has many ravines along its intermittent and perennial streams, but only a few cool ravines—a rare habitat in the town and the region.

Cool ravines may offer refuge to plants and animals stressed by the warming climate.

The walls of a cool ravine are typically forested with a mixture of hardwoods and eastern hemlock. The physical and biological structure of this habitat creates an unusually shady, cool, moist microclimate that often supports plants of more northern affinities, such as striped maple, mountain maple, Canada yew, yellow birch, red-berried elder, American spikenard, and hobblebush. Bryophyte cover (mosses and liverworts) is often

extensive. Ferns such as ebony spleenwort, walking fern, and purple-stemmed cliffbrake may be present if the rocks are calcareous. Stream salamanders such as northern dusky and northern two-lined salamander are likely to use cool ravine habitats, and spring salamander is a possibility. Slimy salamander may use the rocky ravine wall areas, and other terrestrial-breeding salamanders may be abundant there and in the surrounding forest. Rare and uncommon birds such as winter wren, Acadian flycatcher, blackburnian warbler,† and black-throated green warbler† sometimes breed in these habitats. Mammals may include woodland jumping mouse and southern redback vole, and small-footed bat† may roost in **talus** on the ravine walls.

New Lebanon has at least three cool ravines, and perhaps more that are yet undiscovered. These habitats where air temperatures are markedly cooler than those of the surrounding landscape provide habitat for unusual plants and animals, and may offer critical refuge for organisms stressed by the warming climate in the coming decades.

Ledge and Talus

In this document we use the term "ledge" for bedrock exposed at the ground surface, and "talus" for the fields of loose rock that often accumulate below steep ledges and cliffs. Some ledge and talus habitats support well-developed forests, while others have only sparse, patchy, and stunted vegetation. Ledge and talus habitats sometimes appear to be harsh and inhospitable, but they can support an extraordinary diversity of uncommon and rare plants and animals. Some species, such as wall-rue, smooth cliffbrake, purple-stemmed cliffbrake, and northern slimy salamander are found only in and near such rocky places in the region. The communities and species that occur at any particular location are determined by many factors, including bedrock type, outcrop size, aspect, exposure, slope, elevation, biotic influences, and kinds and intensity of human disturbance.

Moss-covered calcareous ledge with walking fern, regionally uncommon. Claudia Knab-Vispo © 2017

The rock chemistry helps to determine the kinds of biological communities that develop in these habitats. For example, ledge and talus of calcareous (calcium-rich) bedrock may have trees such as American basswood and butternut; shrubs such as bladdernut, American prickly-ash, and Japanese barberry; and

herbs such as wild columbine, ebony spleenwort, maidenhair spleenwort, maidenhair fern, and fragile fern. They can support diverse and abundant land snails and numerous rare plant species, such as walking fern, pale corydalis, and American ginseng. More acidic ledges and talus may have trees such as red oak, chestnut oak, eastern hemlock; shrubs such as lowbush blueberries, chokeberries, and scrub oak; and herbs such as Pennsylvania sedge, little bluestem, common hairgrass, bristly sarsaparilla, and rock polypody. Rare plants of non-calcareous ledges in the region (not yet known from New Lebanon) include mountain spleenwort, clustered sedge, and slender knotweed.

Ledge and talus areas often support rare and uncommon plants and animals

Northern hairstreak† (butterfly) occurs with oak species which are host plants for its larvae, and olive hairstreak occurs on open ledges with its host eastern red cedar. Rocky habitats with larger fissures, cavities, and exposed ledges may provide shelter, den, and basking habitat for black rat snake, black racer, and other snakes of conservation concern. Northern slimy salamander occurs in wooded ledge and talus areas. Breeding birds of these habitats include Blackburnian warbler,† worm-eating warbler†, and cerulean warbler.† Turkey vulture sometimes nests in ledge and talus habitats. Porcupine and bobcat use ledge and talus for denning. Southern red-backed vole is found in some rocky areas, and eastern small-footed bat† roosts in talus habitat. Most of the ledgy areas in New Lebanon are on the steep forested slopes of the Taconic hills, The Knob, West Hill, Gale Hill, and other steep hillsides.

Gravel Mines

Numerous rare plant species—such as rattlebox, slender pinweed, field dodder, and slender knotweed—have been found in gravel mines in the region, and rare lichens and mosses may also occur in abandoned mines. Variegated horsetail and violet bush-clover (both regionally rare) occur in a New Lebanon gravel mine. Spotted turtle† and wood turtle† may use these habitats for foraging or nesting. Bank swallow and belted kingfisher sometimes nest in the stable walls of active or inactive portions of soil mines. Bare, gravelly, or otherwise open areas provide nesting grounds for spotted sandpiper, killdeer, and possibly whip-poor-will† or common nighthawk.

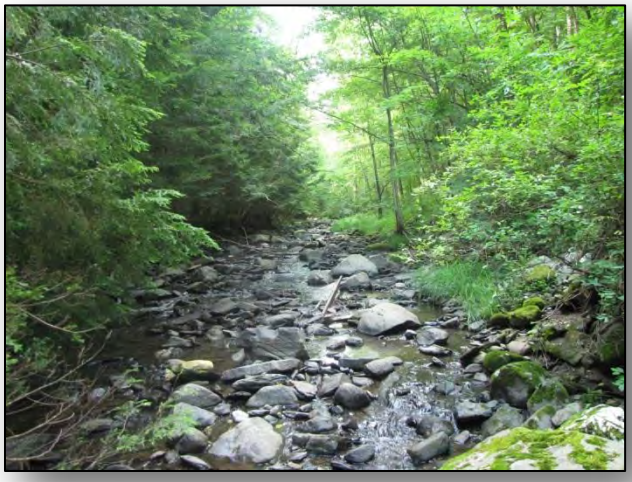
Bank swallows sometimes establish nesting colonies in the walls of a gravel mine. Conrad Vispo © 2017

The biodiversity values of an abandoned gravel pit typically increase for a period of a few years after mining has ceased when vegetation remains relatively sparse. Over time as the former gravel pit becomes more vegetated and eventually reforested, these areas lose some of the unusual habitat values distinctive to gravel pits and become more similar to surrounding forests. Areas known to support a rare species or serve as an important turtle nesting habitat may need to be actively managed to maintain the sparse vegetation and substantially bare soil often required by these species.

Streams, Ponds, and Wetlands

Streams, Floodplains, and Riparian Corridors

The Wyomanock Creek, so named by the Mahicans, rises in Stephentown and enters New Lebanon near NYS Route 22 at the northeastern corner of the town, flows south to the hamlets of Lebanon Springs and New Lebanon, and then northwest to join Kinderhook Creek in West Lebanon. A large tributary—the Wyomanock South Branch—begins in the Taconic hills in Canaan, NY, and Richmond, MA, flows north through the Shaker Swamp, and joins the Wyomanock mainstem in the New Lebanon hamlet. The Wyomanock drains most of the eastern half of the town (Figure 9), and its entire watershed is approximately 9.5 square miles. It is fed by many of the spring-fed streams running off the Taconic hills, as well as other tributaries west of the New Lebanon hamlet.



Wyomanock Creek. Conrad Vispo © 2017

Kinderhook Creek rises in a valley in the Taconic hills in Hancock, MA, winds southwest through Stephentown, and dips only briefly into New Lebanon in the vicinity of the West Lebanon hamlet. From there it re-enters Stephentown for a short distance, and then flows generally west and southwest through the Town of Nassau and then Columbia County towns until joining Stockport Creek in the Town of Stockport, whence it enters the Hudson River. The entire length is 49 miles, and the entire watershed is 329 square miles, including all of the Town of New Lebanon.

Wyomanock Creek, Kinderhook Creek, Black River, several of their tributaries and several of the Stony Kill tributaries are classified as trout streams in their New Lebanon reaches, and the mainstems are classified as trout spawning streams (Figure 16). These designations are given to streams that have the clear, clean, cool water required by brown trout, brook trout,[†] slimy sculpin, and other coldwater fishes that do not thrive in warmer, more turbid, or more polluted streams. A

"trout spawning" designation indicates that the streams also have the coarse-textured, unsilted substrates needed for trout spawning and nursery habitat. Figure 16 shows the streams segments where wild native trout have been found in DEC fish surveys and the corridors identified as "Important Areas" for maintaining the habitats for coldwater stream organisms.

Clean, coldwater streams are no longer common in the region, due to siltation, loss of streamside shade, and water pollution.

Trout streams are a disappearing 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. The degradation of streams coincides with the decline of wild-reproducing populations of brook trout† and other organisms of high-quality coldwater streams. Brown trout (non-native) are stocked annually by the DEC in the Kinderhook Creek mainstem. They compete with brook trout for habitat and food resources, and may interfere with the growth of slimy sculpin, another fish of coldwater streams (Zimmerman and Vondracek 2007).

Slimy sculpin, found in Kinderhook Creek, is a fish of clean, cool streams.
Conrad Vispo © 2017

Wood turtle† uses perennial streams with deep pools and recumbent logs, undercut banks, or muskrat or beaver burrows. It is known to use parts of Kinderhook Creek, and is also likely in parts of the Wyomanock and other perennial streams of New Lebanon. Perennial streams and their **riparian** zones, including gravel bars, provide nesting or foraging habitat for many species of birds, such as spotted sandpiper, belted kingfisher,† tree swallow, bank swallow, winter wren, Louisiana waterthrush,† great blue heron, American black duck,† and green heron. Red-shouldered hawk† and cerulean warbler† nest in areas with riparian forests, especially those with extensive stands of mature trees. Many bat species, including Indiana bat,† northern long-eared bat, and eastern small-footed bat, use perennial stream corridors for foraging. Muskrat, beaver, mink, and river otter are some of the mammals that regularly use riparian corridors.

Intermittent streams, which generally flow only during certain times of the year or after rains or snowmelt, are the headwaters of most perennial streams, and are significant water sources for lakes, ponds, and many kinds of wetlands. The condition of intermittent streams therefore directly influences the water quantity and quality of those waterbodies and wetlands. Intermittent streams provide **microhabitats** not present in perennial streams, supply aquatic organisms and organic drift to downstream reaches, and can be important local water sources for wildlife (Meyer et al. 2007). Their loss or degradation in a portion of the landscape can affect the presence and behavior of

wildlife populations over a large area (Lowe and Likens 2005). Although intermittent streams have been little studied by biologists, they have been found to support rich aquatic invertebrate communities. Both perennial and intermittent streams provide breeding, larval, and adult habitat for northern dusky salamander, Allegheny dusky salamander, northern spring salamander, and northern two-lined salamander.

Intermittent streams provide valuable habitat and resources to wildlife and to downstream waterbodies

Streams of all kinds and sizes are greatly influenced by the condition of their **watersheds** (the land area that drains to the stream)—the topography, the land cover, the character of the soils and bedrock, and the kinds of land uses. They are also influenced by the condition of the stream corridor itself—the floodplain and the larger riparian corridor.

The "**floodplain**" is the area bordering a stream that is subject to flooding. Some streamside areas flood annually or more frequently, and some flood only in the largest storms or snowmelt events. Floodplains at some locations are just a few feet wide, and elsewhere are a half-mile wide or wider, depending on the local topography. Figure 14 illustrates the extent of the 100-year flood zone in New Lebanon identified by the Federal Emergency Management Agency (FEMA); this is the zone that, according to estimates based on historical flood records, has a 1% chance of flooding in any given year.

In all cases the floodplain serves critical roles in the stream ecology and flow dynamics. A well-vegetated floodplain helps to stabilize the streambank and reduce stream channel erosion, moderate stream water temperatures, and trap and remove sediment and pollutants from runoff and floodwaters. Characteristics of the topography, soils, and vegetation at any particular location govern the effectiveness of the streamside and floodplain habitats for providing these services. Well-vegetated floodplains also provide important habitat for terrestrial plants and animals, and contribute woody debris and other organic detritus to the habitat structure and food base for stream organisms (Wenger 1999). Many rare plants occur on streambanks and floodplains in the region, such as cattail sedge, Davis' sedge, and goldenseal.

The environmental conditions of riparian corridors and floodplains strongly influence stream ecology and floodflows.

The "**riparian corridor**" can be loosely defined as the zone along a stream that includes the stream, stream banks, floodplain, and adjacent areas, but it can be delineated differently according to local conservation concerns. Intact riparian areas tend to have high species diversity and high biological productivity. Many species of animals depend on riparian areas in some way for their survival (Hubbard 1977, McCormick 1978).

Floodplains and riparian corridors support many different kinds of habitats, including wetland and non-wetland forests, shrubland, meadows, and ledges. Forested floodplains and corridors tend to be

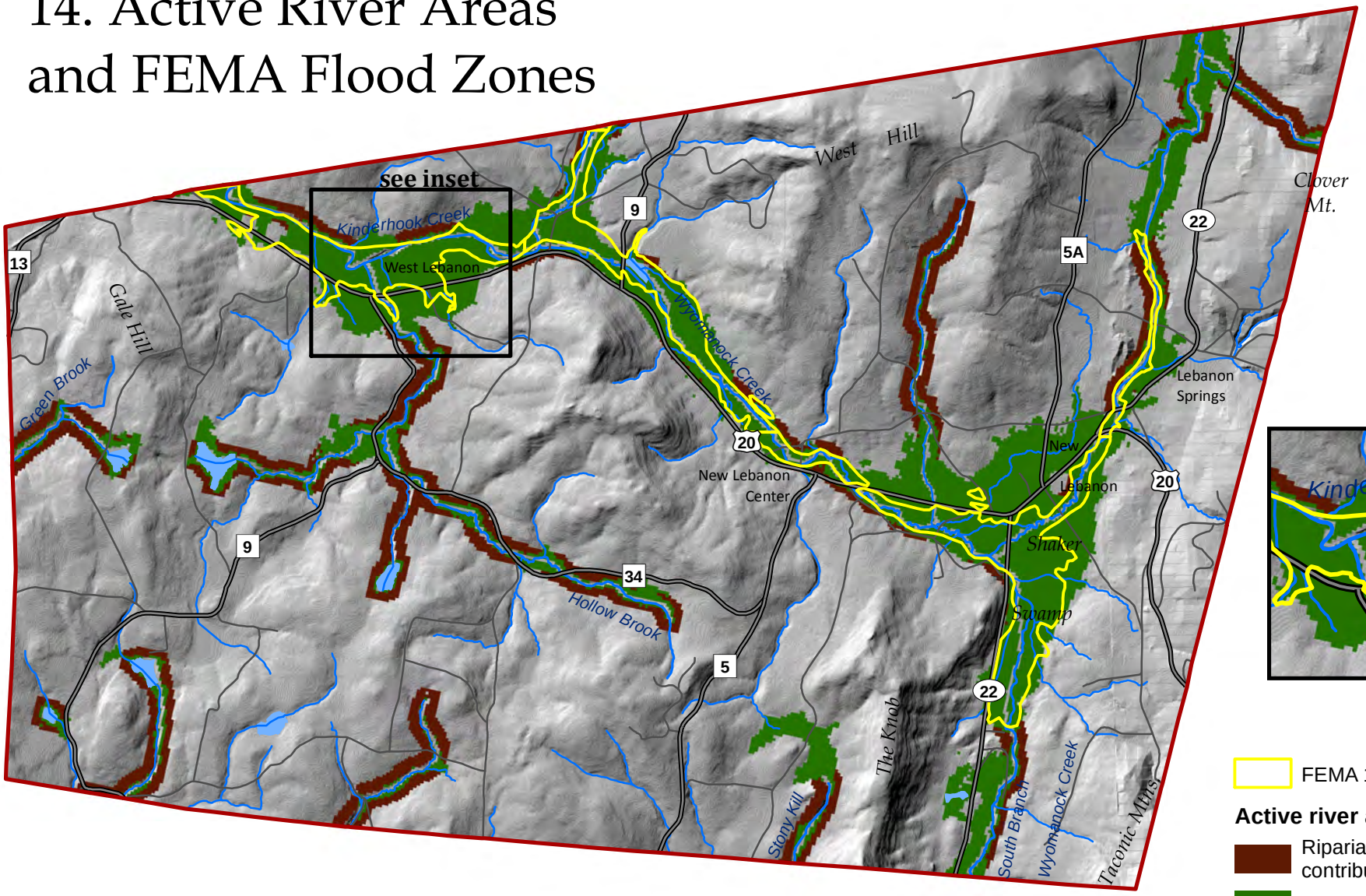
the most effective at providing the stream protection and habitat services outlined above. In a study of floodplain forests in Columbia and Dutchess counties in 2007-2009, the Farmscape Ecology Program found a great diversity of plant and animal species, including many rarities, and many that are closely tied to the forested floodplain habitats. They found that "ancient" floodplain forests—that is, those that may never have been cleared—are a rare occurrence in the two counties, had a significantly higher diversity of native herbaceous plants than recently reforested floodplains, and had significantly lower densities of invasive shrubs. They concluded that ancient floodplain forest remnants are ecologically unusual, potentially irreplaceable, and deserve high priority for conservation, especially the larger examples of such forests (Knab-Vispo and Vispo 2010). Kinderhook Creek and Wyomanock Creek have several sizable areas of floodplain forest in New Lebanon, including some areas of "ancient" floodplain forest (Figure 15).

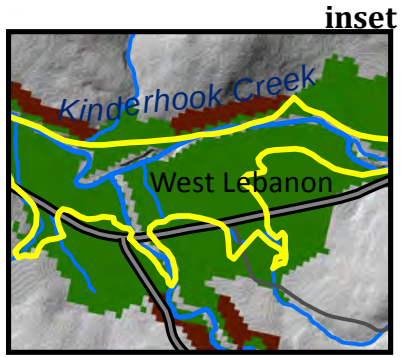
The Nature Conservancy developed the concept of the **Active River Area** to help describe the physical and ecological processes that drive and sustain a stream, and can inform stream protection strategies. The ARA includes five major components:

- material contribution zones, which regularly contribute organic and inorganic (e.g.,sediments, water) material to streams;
- meander belts—the lateral areas within which the channel migrates over time;
- floodplains—the streamside areas that flood regularly or episodically;
- riparian wetlands;
- terraces—former floodplains that may still flood in the largest flood events.

Floodplain forests help to maintain cool streamwater temperatures, provide organic materials to the stream food web and habitat structure, and attenuate floodflows. Conrad Vispo © 2017

14. Active River Areas and FEMA Flood Zones





FEMA 100-year flood zone

Active river areas (TNC)

Riparian material contribution zone

Riparian base zone

0 0.5 1 2 Miles

Figure 14. Active River Areas (ARA) and FEMA-designated flood zones in the Town of New Lebanon, Columbia County, New York. Inset shows close-up of ARA zones. FEMA 500-year flood zones were not available for New Lebanon. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Flood zones from the Federal Emergency Management Agency. Active River Areas developed by The Nature Conservancy. See Figure 2 for relief-shading, roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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15. Floodplain Forests

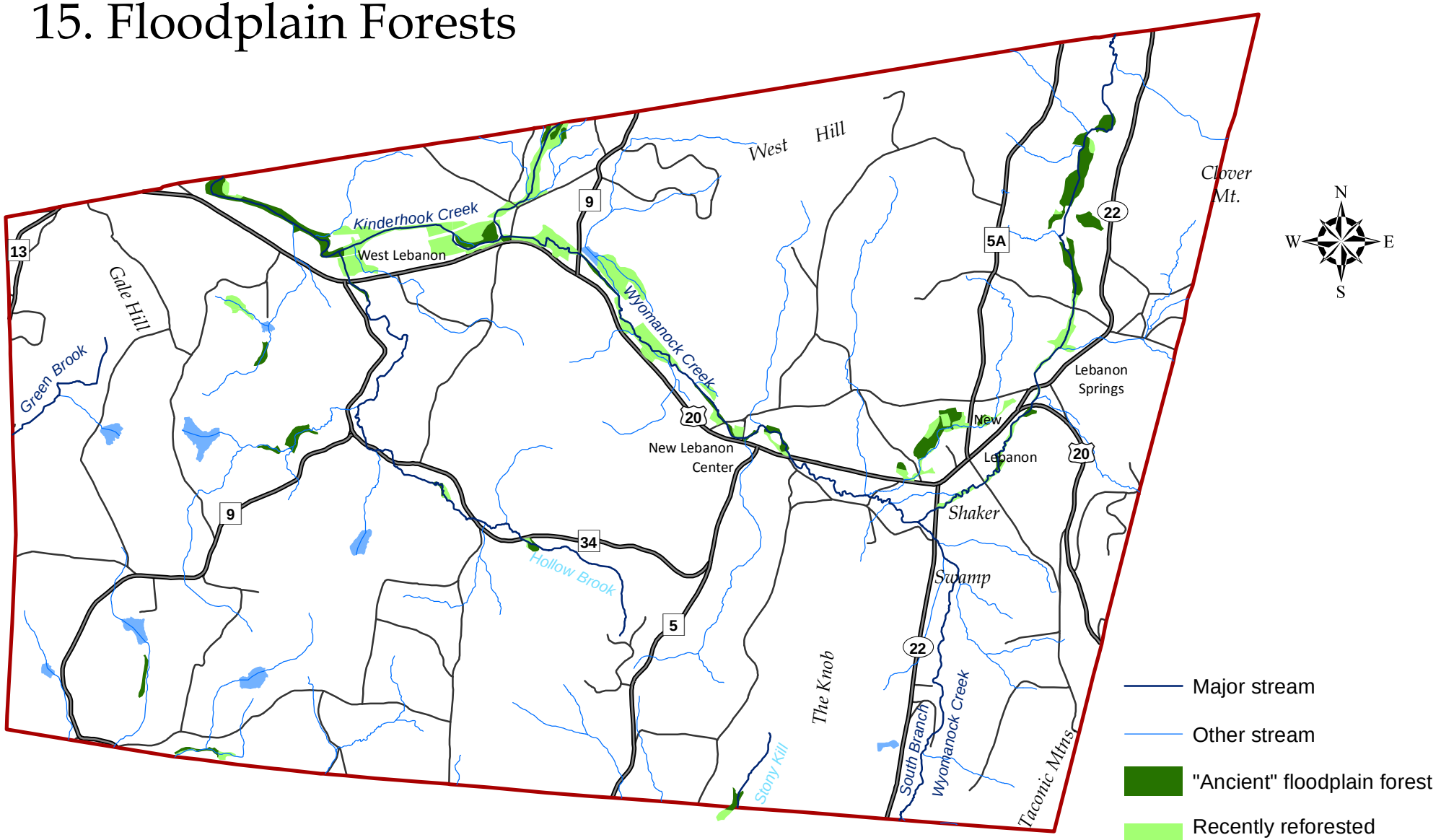

Figure 15. Floodplain forests in the Town of New Lebanon, Columbia County, New York. Wetland (swamp) forests on floodplains are not included. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Floodplain forests from the Hawthorne Valley Farmscape Ecology Program (Knab-Vispo and Vispo 2010). See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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The contributions of these five components encompass the major processes influencing the stream—system hydrology, sediment transport, processing and transport of organic materials, and key biotic interactions (Smith et al. 2008)—useful concepts when considering effective measures for stream conservation. Figure 14 shows the Active River Areas in the larger streams of New Lebanon and their relationship to the 100-year floodplain as mapped by FEMA. Sections below offer ideas for protecting the habitats of streams, floodplains, riparian corridors, and Active River Areas.

Ponds and Lakes

Here are profiled some of the biological aspects of constructed and natural open-water ponds and lakes. Open-water areas of natural wetlands are included in description of those wetlands, below.

The yards of many New Lebanon residences have constructed ponds built for the visual appeal, for recreation, or for fire control, and many farms have ponds built for watering livestock or for crop irrigation. Another reason often given for constructing an artificial pond is "for wildlife habitat." While most backyard and farm ponds in New Lebanon are small—e.g., $\leq$ 2 acres—there are several much larger ponds or lakes—e.g., 10, 14, and 20 acres—constructed by excavation and/or damming of small streams.

The wildlife habitat values of constructed ponds—and especially the intensively managed ornamental ponds—do not ordinarily justify altering streams or intact wetland or upland habitats to create them. In most cases, the loss of ecological and wildlife habitat functions of the pre-existing natural habitats far outweigh any habitat value gained in the artificially-created environments. The habitat values of these ponds—large and small—vary depending on factors such as the character of the surrounding landscape, the extent of human disturbance, and degree of infestation by non-native species.

Juvenile (red eft) stage (left) and adult stage (right) of the red-spotted newt. In the juvenile/sub-adult stages, the red efts are entirely terrestrial in upland forests. The adults are aquatic residents of permanent ponds. Moy Wong and Conrad Vispo © 2017

In general, the habitat values are higher when ponds have undeveloped, unmanicured shorelines, are relatively undisturbed by human activities, have more native vascular plant vegetation, and are embedded within an area of intact habitat. Many constructed ponds, however, are not adequately buffered by undisturbed vegetation and soils, so they are vulnerable to the adverse impacts of agricultural runoff, septic leachate, pesticide or fertilizer runoff from lawns and gardens, and lights, noise, and other disturbances from nearby human activity. We expect that many maintained as ornamental ponds are treated with herbicides and perhaps other toxins, or contain introduced fish such as non-native grass carp and various game and forage fishes. Constructed ponds may nonetheless serve as potential habitat for a variety of common and rare species, so care should be taken to minimize those impacts. Ponds that were originally constructed by humans but have since reverted to a more natural state (e.g., allowed to revegetate, and become surrounded by unmanaged vegetation) can develop habitat values similar to natural ponds and wetlands.

Emergent and submerged vegetation and unmanicured edges are likely to enhance the wildlife habitat values of a pond.

The habitat values of *natural* open water areas are often greater than those of constructed ponds, since the areas tend to be less intensively managed, less disturbed by other human activities, and surrounded by undeveloped land. Open water areas can be important habitat for many common species, including invertebrates, fishes, frogs, turtles, waterfowl, muskrat, beaver, and bats. Open water areas sometimes support submerged aquatic vegetation that can provide important habitat for aquatic invertebrates and fish. Spotted turtle† uses ponds and lakes during both drought and non-drought periods, and wood turtle may overwinter and mate in open water areas. Wood duck, American black duck,† pied-billed grebe,† osprey,† bald eagle,† American bittern,† and great blue heron may use open water areas as foraging habitat. Bats, mink, and river otter also forage at open water habitats.

Springs and Seeps

Springs and seeps—places where groundwater discharges to the ground surface—are common on forested hillsides throughout New Lebanon. They often occur at the origin of a stream and at many places along the stream's length. They occur at the edges of and in the interiors of wetlands and ponds, as well as in upland (non-wetland) areas. Springs and seeps originating from deep groundwater sources flow more or less continuously and emerge at a fairly constant temperature, creating an environment at the surface that is cooler in summer and warmer in winter than the surroundings. For this reason, seeps and springs sometimes support aquatic species that are ordinarily found at more northern or more southern latitudes. The habitats created at particular springs and seeps are determined in part by the **hydroperiod** and the chemistry of the soils and bedrock through which the groundwater flows before discharging.

Springs and seeps help maintain stream flows and maintain the cool water temperature of streams—an important habitat characteristic for certain rare and declining fishes, amphibians, and other

aquatic organisms. Springs and seeps also serve as water sources for animals during droughts and in winters when other water sources are frozen.

Herbaceous plant diversity may be higher in seeps than in surrounding upland forest (Morley & Calhoun 2009). Golden saxifrage is an uncommon plant more-or-less restricted to springs and groundwater-fed wetlands and streams. Northern dusky salamander and spring salamander use springs and cool streams. A few rare invertebrates are restricted to springs, and gray petaltail† and tiger spiketail† are two rare dragonflies found in seeps elsewhere in the region. Springs emanating from calcareous bedrock or calcium-rich surficial deposits sometimes support an abundant and diverse snail fauna.

Cynthia Creech (CAC) and Gretchen Stevens (Hudsonia) at a forested seep in central New Lebanon. David Farren © 2017

Intermittent Woodland Pool

An **intermittent woodland pool** is a small wetland partially or entirely surrounded by forest, typically with no surface water inlet or outlet (or an ephemeral one), and with standing water during fall, winter, and spring that dries up by mid- to late summer during a normal year. This habitat is a forest subset of the widely recognized "**vernal pool**" habitat which may occur in forested or open settings. Seasonal drying and the lack of stream connection ensure that these pools do not support fish, which are major predators on amphibian eggs and larvae. Intermittent woodland pools provide critical breeding and nursery habitat for a special group of amphibians—wood frog, Jefferson salamander, and spotted salamander—that require these fish-free habitats for successful reproduction. (Although marbled salamander, which also breeds in woodland pools, is not known to occur as far north as New Lebanon, climate warming could allow it to move into this region.) The surrounding forest supplies the pool with organic detritus—the base of the pool's food web—and is the essential habitat for adult pool-breeding amphibians during the non-breeding season. These pools are also used by other amphibians such as spring peeper, blue-spotted salamander† and four-toed salamander.† Despite the small size of intermittent woodland pools, those that hold water

Intermittent woodland pools and the surrounding forests comprise the critical habitat complex for pool-breeding amphibians.

through early summer can support amphibian diversity equal to or higher than that of much larger wetlands (Semlitsch and Bodie 1998, Semlitsch 2000).

Reptiles such as wood turtle,† spotted turtle,† and eastern ribbon snake† use intermittent woodland pools for foraging, rehydrating, and resting. Wood duck, mallard, and American black duck† use intermittent woodland pools for foraging, nesting, and brood-rearing, and a variety of other waterfowl and wading birds forage in these pools. The invertebrate communities of these pools can be rich, and include organisms such as fingernail clams and fairy shrimp whose life cycles depend on the seasonal drying. Springtime physa is a regionally rare snail associated with intermittent woodland pools. Clam shrimp occur in intermittent woodland pools and other temporary pools. The invertebrates provide abundant food for songbirds, such as yellow warbler, common yellowthroat, northern waterthrush, and other wildlife. Large and small mammals use these pools for foraging and as water sources. False hop sedge (NYS Threatened) and other rare plants occur in intermittent woodland pools elsewhere in Columbia County and could occur here in New Lebanon.

New Lebanon has few intermittent woodland pools compared to many other Columbia County towns. Most do not appear on federal or state wetland maps, and some occurrences may be unknown even to landowners, but the CAC is conducting field investigations to identify and map the woodland pools and small streams wherever possible.

Vernal pools support many animals that depend on both the temporary water in winter and spring, and drying-up in summer. Claudia Knab-Vispo © 2017

Swamp

"Swamp" is an ecologists' term for a wetland dominated by woody vegetation—i.e., trees or shrubs. There are many forested and shrub swamps around New Lebanon; the largest are concentrated in the Wyomanock and Kinderhook creek valleys (called "woody wetlands" in Figure 11). Swamps are very variable in their plant composition, vegetation structure, and hydrology.

Marsh-marigold and brome-like sedge, typical plants of New Lebanon's hardwood swamps. Claudia Knab-Vispo © 2017

Swamps are important to a wide variety of birds, mammals, amphibians, reptiles, and invertebrates, especially when they 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 box turtle† frequently use swamps in a variety of settings for summer foraging, drought refuge, overwintering, and travel corridors. Pools within swamps are used by several pool-breeding amphibian species, and are the primary breeding habitat of blue-spotted salamander.† Four-toed salamander,† somewhat uncommon in the region, 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,† and Canada warbler† nest in hardwood swamps.

In New Lebanon, large areas of forested and shrub swamps occur along the Wyomanock Creek mainstem and South Branch (including Shaker Swamp), along Kinderhook Creek and on a tributary to Hollow Brook in New Britain (Figure 11). Small swamps are here and there throughout the town.

In 2007-2012 the Farmscape Ecology Program conducted a biological survey of the Shaker Swamp, a 250-acre wetland complex on the Wyomanock South Branch and mainstem. The "swamp"

includes areas of marsh and wet meadow in addition to hardwood and mixed forest swamp and shrub swamp. Island and shoreline areas include upland hardwood, mixed, and conifer forest, and calcareous cliffs and boulders. The wetland is in a broad valley underlain by marble bedrock (figures 5 and 10), and the plant communities reflect the calcium-rich nature of the water and soils. FEP found several uncommon plant communities in the wetland, including an area of red maple/black ash swamp. In and near the wetland they observed (among many other organisms) mink, fisher, bobcat, and beaver, several rare and uncommon butterflies and dragonflies, and many uncommon plants of calcareous habitats. Details of their findings are in *Shaker Swamp: A Preliminary Ecological Description* (Knab-Vispo and Vispo 2012), a report to the Shaker Swamp Conservancy.

Marsh

A "**marsh**" is a wetland that has standing water for most or all of the growing season and is dominated by herbaceous (non-woody) vegetation. Marshes often occur at the fringes of deeper water bodies (e.g., lakes and ponds), or in close association with other wetland habitats such as wet meadows or swamps. The edges of marshes, where standing water is less permanent, often grade into wet meadows. Cattails, tussock sedge, common reed, arrow arum, broad-leaved arrowhead, water-plantain, and purple loosestrife are some typical emergent marsh plants in this region. Some marshes are dominated by floating-leaved plants such as pond-lilies, water-shield, and duckweeds.

Several rare plant species are known from marshes in the region, and the diverse plant communities of some marshes provide habitat for butterflies such as the Baltimore checkerspot, monarch, and northern pearly eye. Marshes are also important habitats for reptiles and amphibians, including northern water snake, eastern painted turtle, snapping turtle, spotted turtle,† green frog, pickerel frog, and spring peeper, among others. Numerous bird species, including marsh wren, American bittern,† least bittern,† great blue heron, American black duck,† and wood duck use marshes for nesting or as nursery habitat. Pied-billed grebe also nests in this habitat where it occurs adjacent to open water areas. Many raptors, wading birds, and mammals use marshes for foraging.

In New Lebanon, marshes occur within larger wetlands such as the Shaker Swamp, in beaver ponds, here and there at the edges of other wetlands and along streams.

Wet Meadow

A "**wet meadow**" is a wetland dominated by herbaceous (non-woody) vegetation and lacking standing water for most of the year. Its period of inundation is longer than that of an upland meadow, but shorter than that of a marsh. Some wet meadows are dominated by purple loosestrife, common reed, reed canary-grass, or tussock sedge, while others have a diverse mixture of wetland grasses, sedges, forbs, and scattered shrubs. Bluejoint, mannagrasses, woolgrass, soft rush, blue flag, sensitive fern, and marsh fern are some typical plants of wet meadows.

Wet meadows with diverse plant communities may have rich invertebrate faunas. Blue flag and certain sedges and grasses of wet meadows are larval food plants for a number of regionally-rare butterflies. Wet meadows provide foraging habitat for spotted turtle,† smooth green snake, American woodcock,† American bittern † and Virginia rail.† Wet meadows that are part of extensive meadow areas (both upland and wetland) may be especially important to species of grassland-breeding birds. Large and small mammals use wet meadows and a variety of other meadow habitats for foraging.

Wet meadows are widely distributed in New Lebanon, in hayfields, pastures, and oldfields, and at the edges of marshes, swamps, and other wetlands. Many are small, and most (whether small or large) do not appear on state or federal wetland maps.

Circumneutral Bog Lake

A "circumneutral bog lake" is a spring-fed, calcareous water body that commonly supports vegetation of both acidic bogs and calcareous marshes (Kiviat and Stevens 2001). These lakes typically have a deep organic substrate, mats of floating vegetation, drifting peat rafts (that sink in winter and rise to the surface in spring), and abundant submerged and floating-leaved plants such as bladderworts, pondweeds, fragrant pond-lily, and watershield.

Peat mats of circumneutral bog lakes often have bog plant communities with extensive carpets of *Sphagnum* mosses, leatherleaf, cranberries, pitcher-plant, and sundew. Shoreline areas may support cattails, purple loosestrife, water-willow, alder, buttonbush, and leatherleaf. The lakes may have shrubby or forested swamps, calcareous wet meadows, and/or fens at their margins.

Rose pogonia, Loesel's twayblade (orchids) and the insectivorous round-leaved sundew, uncommon plants in New Lebanon's circumneutral bog lake. Conrad Vispo and Claudia Knab-Vispo © 2017

In New Lebanon we know of just one circumneutral bog lake, in the vicinity of The Knob, but there may be others yet undiscovered. This is a rare habitat type in the region and is known to support many rare and uncommon species of plants and animals, including rare sedges, orchids, and submerged aquatic plants. In New Lebanon we know of Loesel's twayblade,† hiddenfruit bladderwort,† and large cranberry (all rare in Columbia County) in this habitat. Animals of conservation concern associated with circumneutral bog lakes include eastern ribbon snake,† spotted turtle,† blue-spotted salamander,† marsh wren,† and river otter. These habitats have also been found to support diverse communities of mollusks, dragonflies, and damselflies. In Dutchess, Ulster, and Orange counties, circumneutral bog lakes are the core habitat for the northern cricket frog (NYS Endangered). The species is not known to occur north of Dutchess County, but could move northward into suitable habitats in the coming decades in response to a warming climate.

Special Habitat Areas

Significant Biodiversity Areas

The DEC identified twenty-two "Significant Biodiversity Areas" (SBAs) throughout the ten counties of the Hudson River estuary corridor. One of these, the Taconic Ridge SBA (Figure 16), runs along the eastern border of Rensselaer, Columbia, and Dutchess counties, and is notable for its large areas of contiguous, high-quality forests. These forests, which extend into Connecticut, Massachusetts, and Vermont, support numerous species of regionally rare and state-listed rare and uncommon plants and animals, and are a primary recharge area for the wetlands and streams of the lowlands to the west (Penhollow et al. 2006). The large forests provide wintering and breeding habitat for diverse songbirds and raptors and the ridge serves as an important bird migration corridor.

This SBA is by no means the only significant area for biodiversity in New Lebanon, but it has been recognized for especially high concentrations of important, unusual, and vulnerable biological features.

Areas of Known Importance

The New York Natural Heritage Program (NYNHP) has identified "Areas of Known Importance" for biodiversity throughout the state. These are areas deemed to be important for the continued persistence of rare plants, rare animals, and significant ecosystems, identified through analysis of known occurrences of exemplary ecological communities or rare species, their life histories and habitats, and the physical and hydrological features of the landscape. The Town of New Lebanon has two of these areas—the beech-maple mesic forest on the The Knob, and the sensitive coldwater stream habitats supporting wild native brook trout (Figure 16).

Although beech-maple forests are not uncommon in the region, this is an especially high-quality example of the community type. The mapped areas for coldwater streams (Figure 16) include wild brook trout locations identified in DEC fish surveys since 1980, and corridors along associated

stream and waterbody segments and streamside areas most likely to affect the quality of the stream habitat. Most of the mapped areas have no public fishing rights, however, and many are unsuitable for recreational trout fishing due to small fish populations and small fish size.

The identification of Significant Biodiversity Areas and Areas of Known Importance is intended to guide conservation planning, environmental reviews of land development projects, and other land use decision-making, but neither of these designations has any regulatory power. The purpose of the designation is to alert landowners, developers, municipal agencies, and other land use decision-makers to the importance of these areas to unusual biological features, and the potential for impacts to rare species and rare communities, so that the most sensitive areas can be protected.

When new land uses are contemplated in or near an SBA or an Area of Known Importance, people are encouraged to contact the NYNHP to learn more about the particular elements of concern in the vicinity. These areas are not to be interpreted, however, as the only areas of conservation concern, or the only areas where rare species may occur. Many parts of the landscape have never been surveyed for exemplary habitats or rare species, so no one knows the other places where these elements might occur. For these reasons, the Important Areas or SBA maps should never be used as substitutes for onsite habitat assessments or rare species surveys where such studies are warranted. Nonetheless, the maps are a useful depiction of areas of known importance for rare plants and animals.

Wet meadow/marsh at an abandoned beaver pond, Gilson property.
Peg Munves © 2017

16. Special Biological Resources

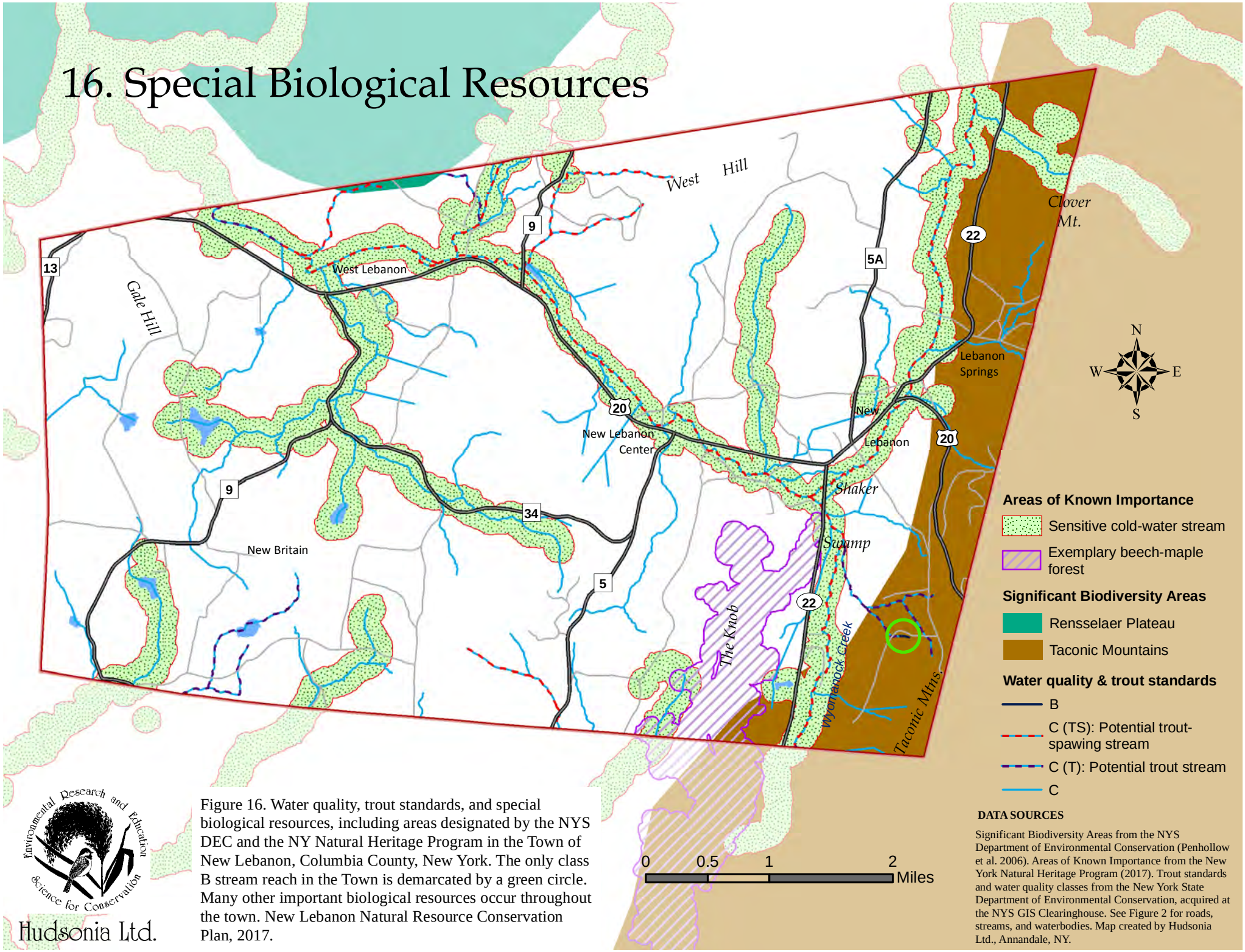

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Figure 16. Water quality, trout standards, and special biological resources, including areas designated by the NYS DEC and the NY Natural Heritage Program in the Town of New Lebanon, Columbia County, New York. The only class B stream reach in the Town is demarcated by a green circle. Many other important biological resources occur throughout the town. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Significant Biodiversity Areas from the NYS Department of Environmental Conservation (Penhollow et al. 2006). Areas of Known Importance from the New York Natural Heritage Program (2017). Trout standards and water quality classes from the New York State Department of Environmental Conservation, acquired at the NYS GIS Clearinghouse. See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

Conservation of Biological Resources

Protecting large contiguous areas of undeveloped land will protect the habitats of area-sensitive wildlife species that require large habitat patches to fulfill their life history needs, and will also protect the array of natural communities in each area, even those of which we are yet unaware.

We encourage the town to identify all ecologically significant habitats or communities (such as calcareous and acidic ledges, upland deciduous forests, upland shrublands, conifer swamps, intermittent woodland pools, circumneutral bog lakes, intermittent streams), as well as habitats and habitat complexes critical to particular plant and animal species of conservation concern. Once such areas have been identified, either townwide or on a particular site, landowners and town agencies will be better equipped to consider the sensitivities of those areas in the design of new land uses.

Protecting habitats and habitat complexes critical to particular plant and animal species of conservation concern will provide an umbrella for many other species using the same habitats and landscapes. For example, for the wood turtle, a broad (e.g., 3000-ft wide) zone centered on low-gradient perennial streams with undeveloped riparian zones would encompass most of the turtle's summer migrations for foraging and nesting (Fowle 2001), and would also cover the habitat areas used by a host of other wildlife of stream corridors. While the entire zone need not be set aside for conservation, proposed land development in that zone could be designed to maintain broad connectivity between the stream and the various other habitats used by the turtle.

For pool-breeding amphibians, such as wood frog, and Jefferson and spotted salamander, maintaining large areas of surrounding forest and intact forested connections between clusters of intermittent woodland pools (within 1,500-ft of each other) would help to protect local populations. These animals need to move safely between critical breeding, foraging, and overwintering habitats and need safe routes between pools to facilitate population dispersal and genetic exchange. Such habitat complexes also provide habitat for many other forest and pool wildlife species. Proposed land development in that zone could be designed to maintain broad connectivity between pools and the forest. For the black racer (snake) contiguous habitats within a 1.5-mile radius around forested and open ledges would encompass much of the snake's denning, breeding, and basking areas, as well as critical areas for foraging and dispersal migrations (Todd 2000). The design of proposed land development within that zone could accommodate broad connections between the ledges and the other habitats likely to be used by the snake.

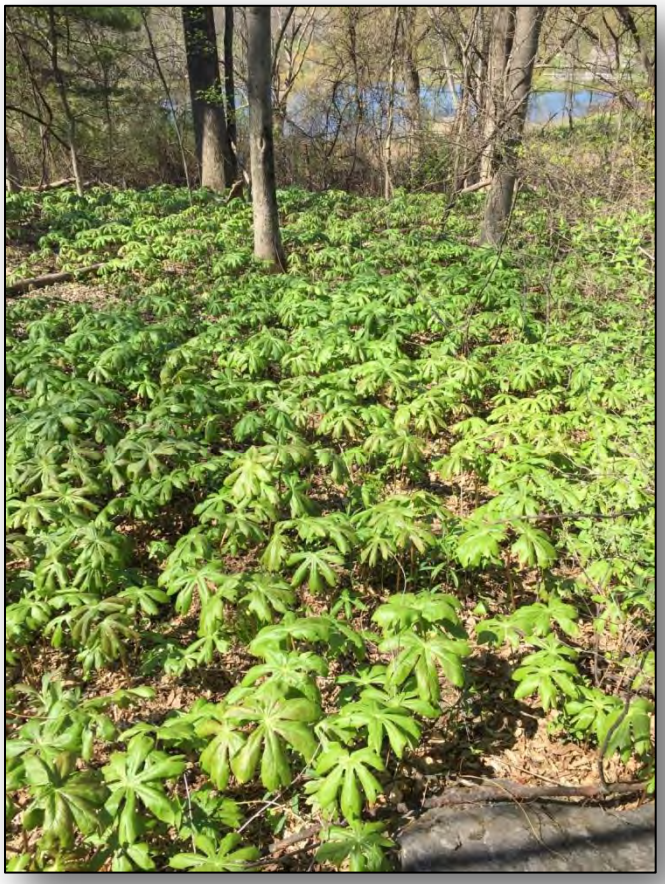
The conservation of large forests will help to protect habitat for plants and animals of conservation concern, maintain habitat connectivity, facilitate species' movement in a changing climate, protect groundwater and surface water resources, promote and maintain high levels of carbon sequestration, and preserve scenic viewsheds. The forests of the Taconic Hills have been recognized for their

3global significance, but are threatened with loss and fragmentation from residential sprawl development and other disruptive uses.

According to The Nature Conservancy's analysis (Figure 12), New Lebanon is part of a significant landscape corridor connecting large parts of the Northeast. These areas may be especially important, both as large contiguous habitat areas and also as movement corridors for wildlife. Other corridors are evident on figures 11 and 12 that may be equally significant for wildlife on a regional scale.

The general measures for biological resource conservation (next page) are based on some of the ideas explained above, and these basic principles:

- Many wildlife species of conservation concern require habitat complexes to fulfill their life needs.
- Large, intact, well-connected land areas representing all elevational gradients and significant land forms (such as hill summits, side slopes, ravines, high- and low-elevation valleys), bedrock types, and hydrological conditions will help to conserve landscapes, ecosystems, habitats, and species of conservation concern.
- Large, intact, well-connected land areas provide the greatest opportunities for adaptations and safe migration of wildlife and plants to new habitat areas as climate change renders their traditional habitats unsuitable.
- Working lands (e.g., forests for timber harvest, meadows for agriculture) are most viable in large blocks instead of small patches.
- Broad buffer zones of undisturbed soils and vegetation help to protect sensitive areas from the adverse effects of human activities.



May-apple is an uncommon plant of forests and forest edges on calcium-rich soils. This large patch was at the Darrow School. David Farren © 2017

GENERAL MEASURES FOR BIOLOGICAL RESOURCE CONSERVATION

- For townwide planning, consider ways to protect areas **representing all significant landforms** and the full array of elevations, bedrock geology, and surficial geology that occur in New Lebanon.
- **Direct human uses toward the least sensitive areas**, and minimize alteration of natural features, including vegetation, soils, bedrock, and waterways.
- Protect habitat areas in **large, broad configurations** wherever possible, with broad connections to other habitat areas.
- Maintain and restore **landscape connectivity** between large habitat areas wherever possible.
- **Avoid fragmentation of large forest patches** by roads, driveways, clearings, and other disturbances that open the forest canopy.
- **Avoid fragmentation of large meadow and contiguous farmland** by roads, driveways, or other non-farm uses.
- **Maintain broad buffer zones** of undisturbed vegetation and soils around ecologically sensitive areas.
- **Protect habitat complexes for species of conservation concern** wherever possible.
- **Minimize impervious surfaces** and design new land uses (and retrofit existing uses wherever possible) to ensure that surface runoff of precipitation and snowmelt does not exceed pre-development patterns and volumes of runoff.
- **Concentrate new development along existing roads**; discourage construction of new roads in undeveloped areas.
- In working forests, **employ sustainable forestry practices that promote tree species diversity and structural diversity**, protect soils from erosion, and protect streams from direct disturbance or siltation.
- **Employ sustainable agricultural practices that build living soils and conserve water**.
- **Where possible, promote wildlife-friendly agricultural practices**, such as late mowing to accommodate ground-nesting grassland birds, leaving unmowed strips and fallow rotations to support pollinators and other invertebrates, and minimizing applications of pesticides and fertilizers.
- **Consider environmental concerns early in the planning process** for new development projects, and incorporate conservation principles into the choice of development sites, site design, stormwater management, and construction practices.

Farmland Resources

Farming in New Lebanon

Much of the New Lebanon landscape had already been opened up for pasture, grain production, and other agriculture, but the sheep boom of the early 1800s spurred the opening of more land on the steep hillsides and high elevations that were unsuitable for other kinds of agriculture. By 1835 much of the formerly forested land in the region had been cleared—a pattern widespread throughout the Hudson Valley and New England (Vispo 2014). Although the Albany-to-Boston stage road and other roads facilitated commerce between New Lebanon and nearby towns, starting in 1852 the railroad with stations in the hamlets of West Lebanon, New Lebanon, and Lebanon Springs greatly improved the marketing and transport of agricultural and other products to distant places (Ellis 1878).

Dairy farming was prominent in the Hudson Valley region through much of the 20th century, but was declining by the 1980s (Vispo 2014). Nearly 1,000 head of Jerseys (more than 400 at Fairweather Farm, 150 at Shaker View Farm, 120 at Tom Benson's farm, 115 at a Chittenden farm in Stephentown, a huge herd at High Lawn Farm in Lee, MA) were milked in the region as late as the 1990s, in aggregate the largest Jersey concentration in the eastern US at a time when most dairy farms had switched to Holsteins (Barbara Benson, pers. comm. to David Farren).

Pasture and Taconic ridge viewed from Cemetery Road. Cynthia Creech © 2017

But no Jerseys are milked today in New Lebanon, and no commercial dairy farms remain in the town. Beef, sheep, pigs, hay, silage, and vegetables are now the primary forms of commercial agriculture in the town. Honey and maple syrup are also produced. Meat, eggs, and produce are sold at on-farm and remote farm stands, and to nearby and distant restaurants, including those in New York City.

Many of the farms operate, wholly or in part, on a Community Supported Agriculture (CSA) model, in which CSA members pay an annual fee—or in some cases contribute labor—for a share of the anticipated harvest. Each member then receives shares of produce at intervals during the growing season. The members thus provide the farmer with up-front capital and share some of the inherent risks, and the farmer has funds to purchase seed, feed, soil amendments, equipment, fuel, and other necessities long before realizing any income from farm products each year.

At least seven CSAs were operating in New Lebanon in 2017, selling vegetables, herbs, flowers, eggs, and meat. In addition, many New Lebanon households have a vegetable garden, fruit trees, goats, sheep, or chickens that provide produce, meat, and eggs largely for domestic use or small-scale retail.

Community Supported Agriculture is now a prominent part of New Lebanon's agriculture.

Figure 17 shows the extent of Prime Farmland Soils and Farmland Soils of Statewide Importance throughout the town, based on the soils map in Case (1989). Prime Farmland Soils are those that have the "best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is also available for these uses." Those soils have "the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management" (Soil Survey Division Staff 1993). Farmland Soils of Statewide Importance include soils "that are nearly prime farmland and that… produce high yields of crops when treated or managed according to acceptable farming methods" (NRCS, no date).

The *Town of New Lebanon Comprehensive Plan* (2005) recognizes that the town's "agricultural heritage and farmland vistas are central to [the town's] identity" and asserts that the town intends to "encourage preservation of prime agricultural lands and the promotion of environmentally sensitive management and use of agricultural resources," and "[e]ncourage the preservation of existing farms and open farmlands, and the creation of new economically viable farms."

Protecting areas of New Lebanon with the best farmland soils will help to preserve the town's ability to produce high-quality local food, and will support the local economy in numerous ways. Active farmland is an important part of New Lebanon's scenic landscapes that attract visitors and businesses, as well as New Lebanon residents. Farm produce sold at farm stands, farmers markets, and local stores and restaurants supports both farmers and local businesses.

Farmland and Biodiversity

The longterm viability of farm enterprises these days depends in part on regional, national, and international market forces, but also—importantly—on productive land, on efficient operations, on crops and livestock well-suited to the location, and on "sustainable" practices that build living soils, conserve and protect water resources, and support local ecosystems.

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, for example, relate to mowing and grazing schedules, patterns, and techniques to improve habitat for butterflies, bees, nesting birds, and nesting turtles; or land management for water and soil conservation; or management of field borders to improve pollination, reduce pest problems, and support wildlife; or least-toxic or non-toxic pest management techniques.

Integrating farm practices with local habitats and native plants and animals can provide benefits to farm productivity and to ecosystems.

Maintaining intact habitat areas and building living soils in cropland areas can reduce agricultural pests and foster populations of native insects that are beneficial to agricultural crops, including pollinators and insect predators. Reducing tillage can improve soil health, reduce the need for artificial soil amendments, and reduce soil loss due to erosion. With the growing interest in agroecology, there is now considerable literature on agricultural practices that support local ecosystems and native biological diversity, and use ecological processes and interactions to boost farmland productivity (e.g., Shepherd et al. 2003, NRCS 2010, Mader et al. 2011, Hatfield et al. 2012, Travis 2013, 2014, Xerces Society 2014).

Hayfield and forest edge viewed from McGrath Hill Road. Craig Westcott © 2017

17. Farmland Soils

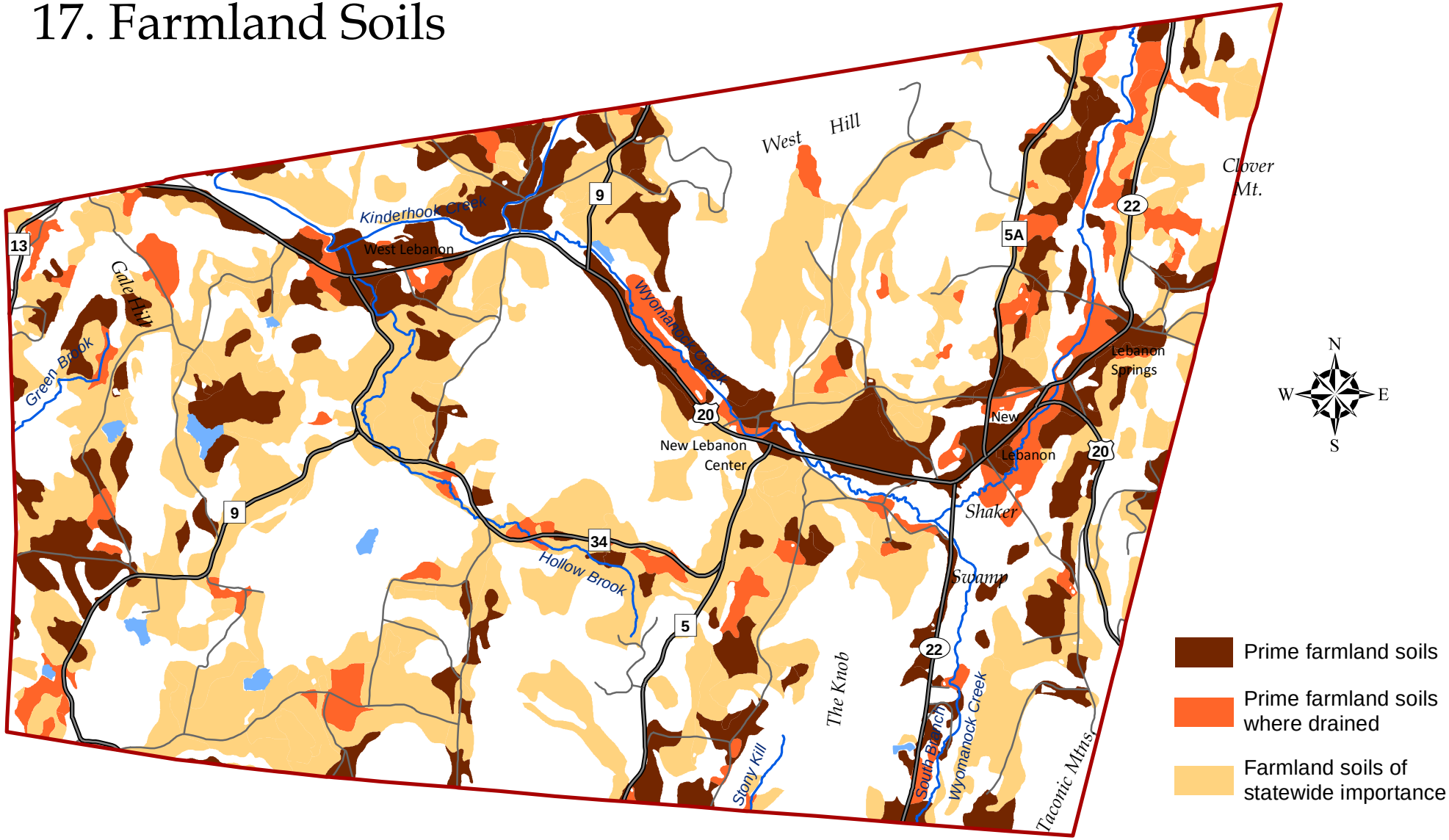


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Figure 17. Farmland soils in the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCES

Soils data and categories from USDA Natural Resources Conservation Service. See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

18. Priority Agricultural Lands

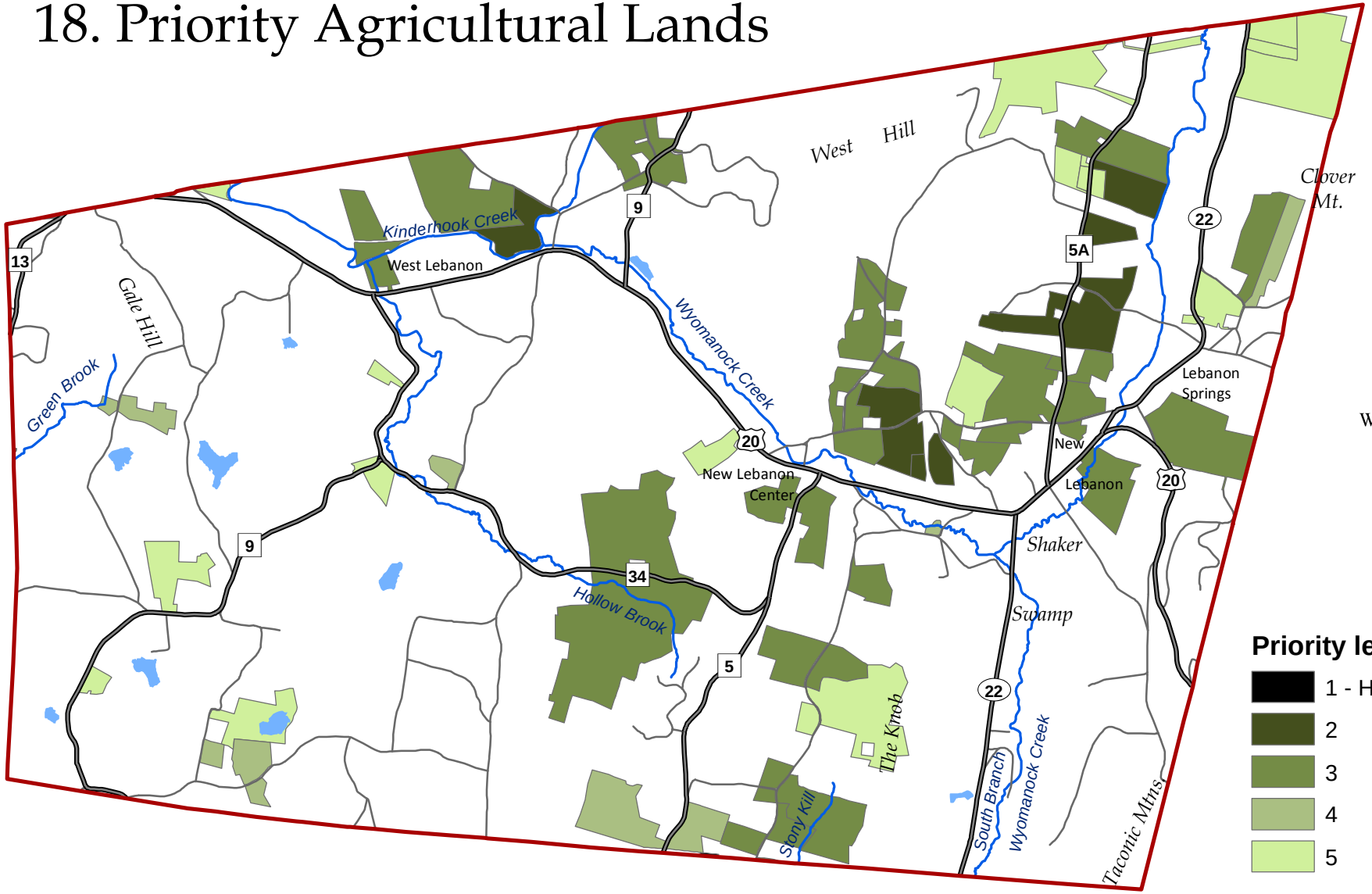

Figure 18. Priority agricultural lands in the Town of New Lebanon, Columbia County, New York. Lands identified through a Land Evaluation and Site Assessment System (LESA). No level-1 priority lands occur in New Lebanon. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Priority agricultural lands from a Land Evaluation and Site Assessment (LESA) adapted for Columbia County by the County Agricultural and Farmland Protection Board and mapped by Don Meltz Planning and GIS (AFPB 2013). Original LESA created by USDA Natural Resource Conservation Service. See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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Columbia County Farmland Protection Plan

In 2013 the Columbia County Agriculture and Farmland Protection Board (AFPB) published the *Columbia County Farmland Protection Plan* (AFPB 2013). The Plan was based in part on input from the public and a survey of agricultural producers on the current state of farming in Columbia County, an assessment of the future of farming, and an evaluation of a range of farmland protection tools. The Plan established that there is a strong commitment to agriculture in the county, and an understanding of the importance of farming to the county's economy, community and civic engagement, land stewardship, scenic values, and quality of life for county residents, and an intention to take advantage of the "extensive, high quality farmland, a vibrant farm community, substantial farm-support infrastructure, ready access to markets and a deep historical and cultural connection to a rural way of life."

The Plan concluded that the county's vision of a thriving agricultural economy can be accomplished by:

- providing technical assistance for existing and emerging agricultural production,
- engaging in agriculture-focused economic development including infrastructure support,
- developing a strategy and toolkit for protecting farmland, and
- educating and encouraging youth to enter into agricultural production and educating non-farm residents on agricultural needs and practices.

Whatever means are used to promote agriculture in the county, a fundamental need is the protection of high quality farmland and its continued availability for agricultural production. With limited financial resources for conservation, protection efforts should be directed toward farms and lands that have the greatest potential for successful agriculture over the long term. In order to identify those lands, the AFPB developed a Land Evaluation and Site Assessment tool (LESA) that can be used by the county and municipalities "to rate the agricultural importance of lands and to identify and prioritize lands that should be protected from conversion to non-agricultural uses."

The LESA evaluation looks at soil capabilities and other criteria related to the continued viability of farming (e.g., commitment of current farmers, status of surrounding lands, local conversion pressure), as well as open space, known biodiversity importance, and scenic or historic values, and uses a weighted point system to rate and prioritize parcels for protection (AFPB 2013).

The AFPB developed a working LESA model for Columbia County and municipalities to identify the agricultural lands most important and eligible for conservation action. The results of a county-wide LESA analysis are depicted in the Agricultural Land Protection Priority map of the county plan, and the New Lebanon portion of that map is presented here as Figure 18. (Note that the map shows whole parcels, including areas that are not farmed.) It shows several New Lebanon parcels as "high priority" on the countywide scale. At the townwide scale, however, New Lebanon farmers and other citizens might want to develop different criteria for ranking local priorities. As the town considers various ways to support farms and protect farmland, the LESA analysis can be used to

focus local efforts where they might be most effective. The section below on Achieving Conservation Goals discusses various tools and partners that can assist in these efforts.

Conservation of Farmland Resources

The town recognizes the many benefits of agriculture for local food security, for contributions to the local economy, for the scenic benefits that farmland imparts to the town, for the habitat values of active, fallow, and abandoned farmland, and for the cultural benefits that a working landscape offers to residents and visitors. The viability of local agriculture in New Lebanon and the region, however, is threatened by a difficult agricultural economy, rising property values, and competition for prime farmland from development interests.

Farmers are the active stewards of the hayfields, pastures, and cropland (Figure 13) that comprise much of the open (unforested) land in New Lebanon. With their daily lives and livelihoods so closely tied to the land, farmers tend to be highly attuned to and knowledgeable about the natural resources on which their farm enterprises depend, and continue to be the key players in determining the condition and conservation status of their land.

Some basic ideas and principles for farmland conservation are the following:

- Adopting municipal programs and policies to support and assist farmers can help them withstand the vagaries of weather and markets.
- While some kinds of agriculture can be carried out on small plots, others require large contiguous blocks to be economically worthwhile.
- Keeping the best farmland soils free of structures and pavement will help to preserve the potential for local agriculture.
- Intact habitats in the vicinity of farms can provide critical and irreplaceable services and resources (such as climate moderation, water, flood attenuation, and habitat for pollinators) to farm enterprises.
- Farm practices that conserve water, build living soils, and accommodate native pollinators, other insects, and other native organisms may be more resilient to environmental stresses (e.g., insect pests, drought, excessive heat) than conventional practices that rely on artificial inputs of water, petroleum-based fertilizers, and pesticides.

GENERAL MEASURES FOR FARMLAND CONSERVATION

MUNICIPAL ACTIONS

- Adopt **farm-friendly policies** and programs; for example, lowering tax assessments for active farmland; allowing density bonuses for cluster designs that permanently protect farmland; assisting farmers with grant acquisition, and promoting local markets for agricultural products, including uses by restaurants and institutions such as schools.
- Revise the Use Table (205 Sect 2 of the Zoning Law) to **allow wind turbines** for on-farm electricity use.
- Require that new subdivisions and development sites be designed in ways that **preserve the areas of best farmland soils intact and unfragmented** as much as possible.
- **Appoint farmers** to serve on the Planning Board, Zoning Board of Appeals, Zoning Rewrite Committee, and other town commissions dealing with land use policy and regulations.
- Establish a **Community Preservation Fund** to protect important agricultural lands, funded through grants, donations, budget appropriations, bond allocations, and a real estate transfer tax (through the Community Preservation Act).
- **Promote local markets for agricultural products**, including uses by restaurants and institutions such as schools.

FARMERS' ACTIONS

- **Join municipal agencies and commissions** (Planning Board, Zoning Board of Appeals, Zoning Rewrite Committee, etc.) dealing with land use policy and regulations.
- Where possible, **shift tilled land in floodplains to other uses** (such as pastures, hayfields, or perennial crops) more resilient to flooding.
- Adopt farm practices that **conserve water, prevent soil erosion and soil loss, and build living soils.**
- **Minimize applications of fertilizers and pesticides**, and especially in the more sensitive areas such as floodplain fields and near wetlands and streams.
- **Maintain cover crops and thatch** to reduce soil loss during heavy precipitation or flood events.
- **Maintain intact habitats** in and near hayfields, cropland, orchards, and pastures where possible, and adopt farm practices (such as mowing schedules and patterns) that accommodate the needs of native pollinators, birds, and other wildlife.

Scenic Resources

Scenic resources are landscape patterns and features that are visually appealing and help to define the character of a community or region. Beyond aesthetic value, scenic resources can help connect people to the land, foster an appreciation of the natural landscape, distinguish one community from its neighbors, display the natural resources of an area, and promote the economic benefits associated with tourism and recreation. The visual landscape is widely recognized as a primary driver of local economies, acting as a magnet not only for recreation and tourism and the businesses that support visitors to the town, but also for residents and unrelated businesses that have been drawn to and captivated by the area.

The scenic quality of the town and the region is intimately tied to the other resources addressed in this conservation plan—the physiography, water resources, biological communities, farmland, and recreational resources. Many scenic areas are associated with other resources of concern, such as large forests, farmland, streams, and ponds. Scenic areas that are visible to the public from roads, public lands, parks, and trails are of special importance to the town. This *Plan* identifies some of the areas of scenic significance, and considers those in establishing overall conservation priorities.

In a survey and public meetings held during the preparation of the *New Lebanon Comprehensive Plan* (2005), respondents identified the scenic views and the visual character of the town among their highest concerns. Consequently, among the goals detailed in the *Comprehensive Plan* is to "[p]rotect and enhance the natural scenic vistas and the publicly visible aspects of the man-made environment, in keeping with the Town's rural and "small town character" and the objectives include "[preserving] scenic vistas of the area's natural beauty including vistas of woodlands, fields, ridgelines, hillsides, hilltops and valleys."

The scenic landscape is closely tied to the quality of the forests, farmland, streams, and ponds.

The town's rural character consists not only of the visible landscape from public spaces, but also the ecological condition of the land, and the land uses such as farming, logging, and mining that directly depend on the land and have shaped the culture and character of the area and the town for over 200 years. These land-dependent uses tie the community to the land, and make the town more than a mere bedroom and retirement community with lovely views. This *NRCP* encourages the continuation of working landscapes and land-dependent uses that employ sustainable practices and protect sensitive biological, water, and scenic resources.

In 2006, following one of the directives in the 2005 *Comprehensive Plan*, Karen Ross identified and documented several places around New Lebanon that provide examples of particularly scenic views along County routes 5 and 5A, and US Route 20 and NYS Route 22, and in 2017 the CAC identified additional scenic views .

In 2015-2016 the Columbia Land Conservancy and the Hawthorne Valley Farmscape Ecology Program asked people to identify special outdoor places, including those of particular scenic value throughout the county. The places identified in that survey, also shown in Figure 20, include historic landscapes of the Mt Lebanon Shaker community, views of farmland and rolling hills along County Route 9, and a view of Meizinger Lake at the Hand Hollow Public Conservation Area. The locations of scenic places identified in these surveys are noted in Figure 19 and described in Table 2 and some of the views are illustrated in Figure 20.

Scenic areas occur in many other places in the town where there are pastures, cropfields, meadows, marshes, streams, ponds, and open and forested hills. We encourage the town to identify other areas of scenic importance that should be considered in land use planning and decisions, and added to future updates of this document.

Western view from The Abode of the Message. Claudia Knab-Vispo © 2017

New Lebanon's historic sites, such as the Shaker community on Mt Lebanon, the warm spring, and the Cemetery of the Evergreens, are central to the town's identity and culture. For reasons of historic fidelity, the landscape settings of historic sites can be an important component of the present-day experience. Thus, the visual appearance of the *viewshed* of an historic farm or dwelling, for example, may be a worthwhile consideration in addition to the historic fidelity of the farm property itself or the historic house and yard. The town could identify and map the places and landscapes that seem especially important for this purpose, so that future land use planning and decisions can take these landscapes into account.

Protection of scenic areas is often very compatible with and, indeed, dependent on protection of natural habitats, water resources, and farmland, but where they are incompatible, visual concerns should not necessarily take precedence over conservation of other resources. For example, it is often tempting to site a new house deep inside a forest so that the house is invisible from public roadways. The adverse ecological effects of forest fragmentation, however, and the harm to water resources often caused by long driveways, may outweigh the visual harm of a house visible from a road. From a biodiversity standpoint, building a new house close to an existing road and close to other existing development is often the much better choice because it minimizes habitat fragmentation and confines the ecological "edge effects" of human uses (caused by lights, noise, pets, polluted runoff, etc.) to a smaller area.

Autumn colors are a seasonal pleasure for New Lebanon residents, and also draw visitors to the region. David Farren © 2017

Table 2. Scenic locations along public roads in New Lebanon, identified by Karen Ross (2006) and Conservation Advisory Council (2017). Map codes refer to locations depicted in figures 19 and 20.

Map Code	Location	Description
A	County Rt 5, 1.6 mi south of jct with US Rt 20	North and northeast views of Lebanon Valley and Taconic hills, into Stephentown. Meadows and forest in foreground and distance. (Karen Ross)
B	West St (County Rt 5A), 0.3 mi north of jct with US Rt 20	Views (north and southeast) of nearby West Hill and distant Taconic ridgeline. (Karen Ross)
C	West St (County Rt 5A), 0.4 mi north of Cemetery Rd	Nearly panoramic views, with barns, cornfield, horse pasture, forested hills and ridgeline. (Karen Ross)
D	West St (County Rt 5A), 0.9 mi north of NYS Rt 22	Eastern and southeastern views of meadows and Taconic Ridge. (Karen Ross)
E	NYS Rt 22, north of jct with Old Post Rd for 1.1 mi	Views to the west, northwest, and north of meadows, hills, and ridgeline. (Karen Ross)
F	US Rt 20, 0.2 mi east of jct with NYS Rt 22	Nearly panoramic views of meadows, pasture, barns, stream, forested ridge, distant mountains. View to southeast marred by billboards. (Karen Ross)
G	US Rt 20, 0.5 mi east of jct with NYS Rt 22	Westward views of forests and meadows on Temple Hill. Barns in middle ground. Several houses on hillside. Cemetery of the Evergreens. (Karen Ross)
H	US Rt 20, 2.6 mi east of jct with NYS Rt 22	Vistas to west, northwest, and north of ca. 3-15 miles of New Lebanon forested hills and farmland, and distant views of Helderbergs and Rensselaer Plateau. Eastern gateway to Lebanon Valley. (Karen Ross)
I	NYS Rt 22 and Churchill Rd	View to east of Shaker Swamp. (Moy Wong)
J	Canaan Rd, 1.2 mi south of US Rt 20	View to southwest of meadow and forested hills. (Moy Wong)
K	Canaan Rd and Stone House Rd	View to west across meadow (fall-planted hemp) and wooded hills. (Cynthia Creech)

(continued)

Table 2. (cont.)

Map Code	Location	Description
L	Canaan Rd and Stone House Rd	View of meadow through hedgerow (Moy Wong)
M	Canaan Rd at town line	View to northwest across meadow to wooded hills.(Moy Wong)
N	Rockledge and Deer Ridge rds	View to south of planted hedgerow, meadow, and distant hills. (Moy Wong)
O	Kelly Rd ca. 0.25 mi east of McGrath Hill Rd	View south of meadow, barn, and wooded hills. (Moy Wong)
P	Schoolhouse Rd, 0.3 mi north of Hand Hollow Rd	View northwest across sloping meadow to wooded hills (Moy Wong)
Q	Hand Hollow Rd and County Rt 9	View north across mowed and unmowed meadows. (Moy Wong)

Looking north from County Route 5. Moy Wong © 2017

19. Scenic Resources

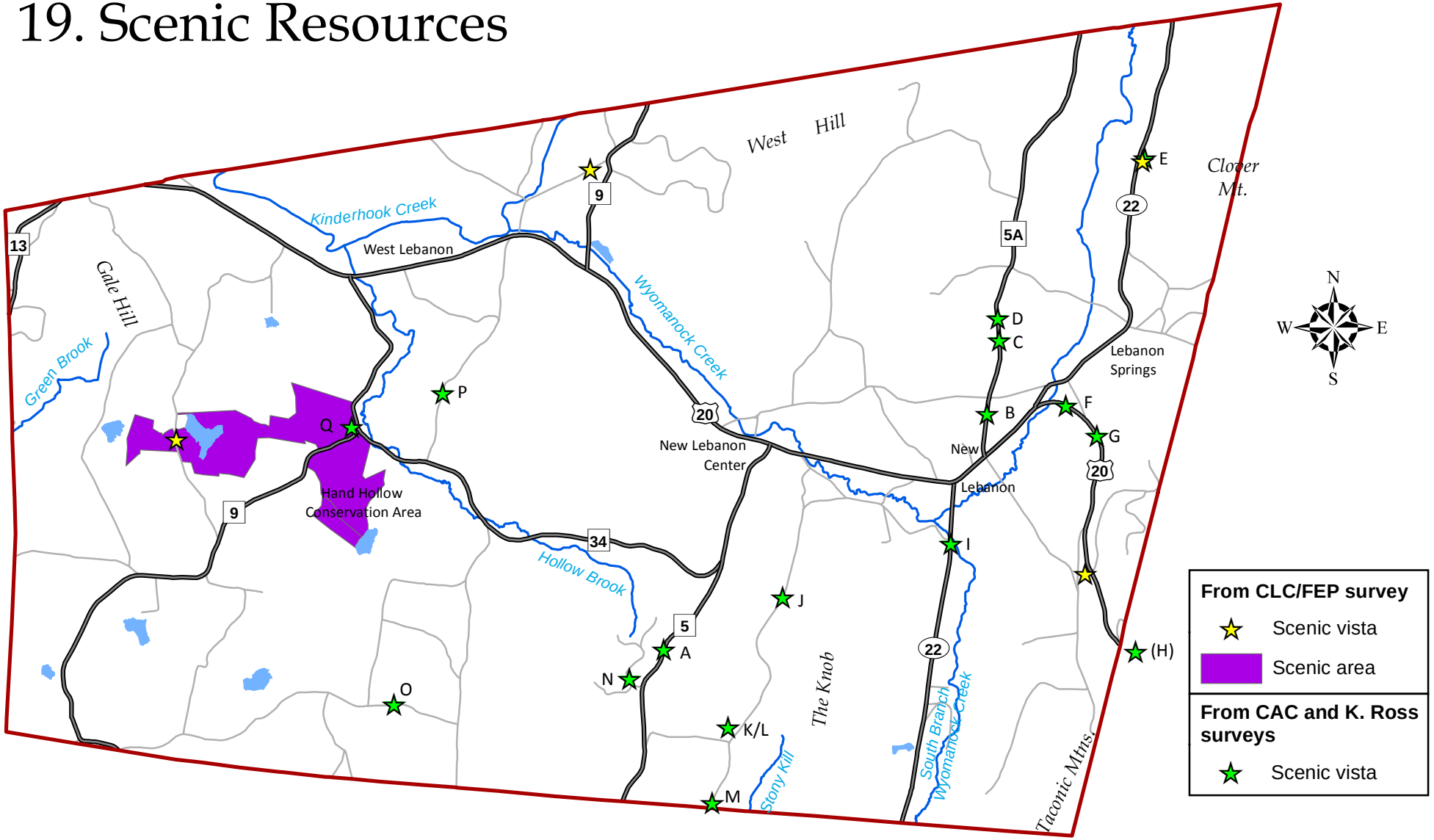

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Figure 19. A few scenic locations in the Town of New Lebanon, Columbia County, New York. Letter codes (A,B,C, etc.) correspond to locations described in Table 2. New Lebanon Natural Resource Conservation Plan, 2017.

0 0.5 1 2 Miles

DATA SOURCE

Scenic locations identified by participants in a Columbia Land Conservancy/Farmscape Ecology Program survey (2015-16), and preliminary scenic survey by Karen Ross (2006) and the New Lebanon Conservation Advisory Council (2017). See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

A. Views of Lebanon Valley and Taconic hills, from County Route 5, fall 2006. Karen Ross © 2017.

B. Views of West Hill and Taconic ridge-line, from County Route 5A, fall 2006. Karen Ross © 2017.

C. Barns, cornfield, forested hills, and ridgeline, from County Route 5A, fall 2006. Karen Ross © 2017.

D. View toward Taconic ridge, from County Route 5A, fall 2006. Karen Ross © 2017.

Figure 20. A few scenic locations along public roads. Locations are described in Table 2. New Lebanon Natural Resource Conservation Plan, 2017.

(continued)

Figure 20 (cont.)

E. Meadows, hills, and ridgeline from NYS Route 22, fall 2006. Karen Ross © 2017.

F. Meadow, barn, forested ridge from US Route 20, fall 2006. Karen Ross © 2017.

G. West view of forests and meadow on Temple Hill from US Route 20, fall 2006. Karen Ross © 2017.

H. New Lebanon forested hills, and distant views of Helderbergs and Rensselaer Plateau, fall 2006. Karen Ross © 2017.

(continued)

Figure 20 (cont.)

I. Shaker Swamp from NYS Rt 22, fall 2017. Moy Wong © 2017.

J. Southwest view from Canaan Rd of meadow and forested hills, fall 2017. Moy Wong © 2017.

K. Meadow of fall-planted hemp off Canaan Rd, fall 2017. Cynthia Creech © 2017.

L. Western view of meadow from Canaan Rd, fall 2017. Moy Wong © 2017.

(continued)

Figure 20 (cont.)

M. Northwestern view of meadow and wooded hills from Canaan Rd, fall 2017. Moy Wong © 2017.

N. Southern view of meadow and distant hills from Rockledge Rd, fall 2017. Moy Wong © 2017.

O. Meadow, barn, and wooded hills from Kelly Rd, fall 2017. Moy Wong © 2017.

P. Hillside meadow and wooded hills from Schoolhouse Rd, fall 2017. Moy Wong © 2017.

Conservation of Scenic Resources

The scenic character of the town is intimately tied to the other resources described in this *Plan*—the hills and valleys, streams and ponds, forests and farmland. The town recognizes that the beauty of the New Lebanon landscape is fundamental to the town's identity, and that maintaining scenic vistas will benefit New Lebanon residents, businesses, and visitors. The most scenic areas, however, still have no formal protection despite the documented public interest in the visual landscape. Completion of a scenic inventory, as called for in the *Comprehensive Plan*, will help to foster a proprietary interest among landowners, and could be the first step toward establishing policies to protect areas of exceptional importance. Figure 19 gives a very incomplete picture of areas of scenic importance in the town.

Pine Ridge Place. David Farren © 2017

GENERAL MEASURES FOR SCENIC RESOURCE CONSERVATION

- **Complete an inventory and map** of scenic resources throughout the town.
- When reviewing site plans and subdivision proposals, and the location and design of any new structure or new land use in the town, **consider the impacts on the entire viewshed** of those features.
- **Maintain intact natural areas and farmland visible from public roads and public-access lands** wherever possible.
- **Maintain intact (undeveloped) hilltops and sideslopes** wherever possible.
- **Minimize outdoor lighting,** and design any necessary outdoor lighting to minimize visibility of lights in nearby habitat areas and offsite areas throughout the viewshed.
- Develop town policies that **support working landscapes and land-dependent uses** (e.g., farming, logging, recreation) that employ sustainable practices.
- Adopt environmental review standards that consider impacts on scenic resources.

Recreation Resources

Outdoor recreation is an essential part of family and community life in New Lebanon. Local recreation opportunities improve the daily lives of residents, attract visitors, and benefit local businesses, and can strengthen people's connections to and appreciation for the land. Public recreational opportunities tied to the natural landscape can help to spur economic development and, if designed carefully, have relatively low environmental impacts. The kinds of public outdoor recreation best suited to New Lebanon are those that take advantage of natural landscapes and cultural features while protecting intact the resources of conservation concern.

Many of the large and small land parcels in New Lebanon are posted against trespassing, so most private lands are inaccessible for walking, hiking, biking, skiing, motor sports, hunting, or other recreational uses without landowner permission. The public-access recreation areas in the town are briefly described below, and their locations are shown in Figure 21.

Corkscrew Rail Trail.

The Corkscrew Rail Trail is an unpaved trail that generally follows the old rail bed of the Corkscrew Division of the Rutland Railroad. The rail line carried passengers, milk, freight, and mail until 1952, when it was abandoned and the right-of-way conveyed to adjacent landowners. The Corkscrew Rail Trail Association, formed in 2014, negotiated agreements with landowners and in 2015 opened the first segment of the trail to the public. It runs 2.5 miles through Stephentown and northeastern New Lebanon, following the Wyomanock Creek for part of its length. The trail is open for hiking, bicycling, horseback riding, skiing, and snowmobiling. The Association hopes to establish agreements with additional landowners and extend the trail north and south (http://www.corkscrewrailtrail.org/)

Hand Hollow Public Conservation Area

The Hand Hollow PCA is a 433-acre area owned and managed by the Columbia Land Conservancy. It is open to the public for hiking, skiing, and picnicking, and for fishing and hunting by permit from the CLC. It has 2.8 miles of hiking trails that run past active beaver ponds, through forests and meadows, and along streams and the lake.

Hand Hollow State Forest

Hand Hollow State Forest, established in 2014, is a mostly wooded property adjacent to the Hand Hollow Public Conservation Area and bordering the 10-acre Spiegelberg Lake. Through collaboration with the Open Space Institute, the State Forest will soon nearly double in size with the addition of large adjacent properties (not shown on Figure 21). The State Forest land is open to the public for hiking, biking, picnicking, horseback riding, primitive camping, skiing, hunting, fishing, trapping, non-motorized boating, and snowmobiling.

Shatford Memorial Park

Shatford Memorial Park is a ca. 20-acre parcel owned by the Town of New Lebanon and developed primarily for public recreation and public events. It has a playground, three baseball fields, two tennis courts, a basketball court, a pavilion, and other open lands for public uses.

Shaker Swamp

The Shaker Swamp Conservancy has recently purchased a 39-acre parcel (not shown on Figure 21) that will allow parking and public access to the wetland. The Conservancy plans to install an information kiosk and build a boardwalk and trail that may connect with trails on adjacent properties.

Fishing

Many of New Lebanon's streams support brown trout and brook trout. Those that have been classified by the DEC as trout streams are shown in Figure 16. Brown trout (non-native) are stocked annually in Kinderhook Creek by the DEC, and some also reproduce in the wild. Brook trout (native) have also been stocked in the past. Although the brook trout of our streams also reproduce in the wild, most have likely descended from hatchery stock (Bob Schmidt, pers. comm.). Figure 21 shows the areas along Kinderhook and Wyomanock creeks with Public Fishing Rights—places where permanent easements have been purchased by the DEC from willing landowners to provide anglers fishing access from the banks (usually within a 33-foot strip). Many other informal locations are used for fishing and other stream-associated recreation from bridges and roadsides of public roads, and from private lands with permission of landowners.

Landowners also stock fish in private ponds. This requires a state permit, and all hatcheries and vendors must certify that their fish have passed state inspection for pathogens. Many of the stocked fish are of non-native species.

Hunting

Hunting is allowed on the Hand Hollow Public Conservation Area by permit from the Columbia Land Conservancy, and at the Hand Hollow State Forest. Hunting elsewhere in New Lebanon is only by permission from individual landowners.

Motor Sports

Snowmobiling and other ATV use are permitted at the Hand Hollow State Forest. Use on other properties is by permission of the landowners. Motorized watercraft are prohibited on Meizinger Lake and Spiegelberg Lake. Because of the contributions to noise, water pollution, and air pollution, damage to soils, and disturbance to wildlife, motorized recreation is often discouraged in ecologically sensitive areas.

Walking and Biking

Paved and unpaved public roads throughout the town are available for biking and walking (and skiing before they are plowed), but the experience is comfortable only on those with little automobile traffic. Certain roads could be improved for foot and bike travel by expanding shoulders or delineating bike or walking zones. New York's Complete Streets program (see below) offers many ideas that could be implemented incrementally on roads where other construction or restoration work is underway.

Complete Streets

One way to expand recreation opportunities in New Lebanon, while simultaneously making the roads and hamlets safer for all users, is to adopt a "Complete Streets" program for transportation projects. The New York State Complete Streets program, authorized under Chapter 398 of the Laws of New York, requires that any transportation projects receiving state and federal funding must be designed with consideration of the convenience, mobility, and safety of users of all ages and abilities, including bicyclists, pedestrians, people with disabilities, riders on public transportation, as well as motorists. Although the law applies only to projects using federal and state funds, local governments are also encouraged to consider these principles for locally funded projects. Street design features may include, but are not limited to: sidewalks, paved shoulders suitable for use by bicyclists, lane striping, bicycle lanes, "share the road" signage, crosswalks, pedestrian control signals, bus pull-outs, curb cuts, raised crosswalks and ramps and traffic calming measures.

The purpose of the Complete Streets program is to promote a "cleaner, greener transportation system," promote the health benefits of non-motorized travel, create safer conditions for all users, relieve traffic congestion, and reduce auto-related air pollution. In New Lebanon's hamlets, well-marked pedestrian crossings, accessible curb cuts, and street trees can improve the safety and comfort of users. On the town's rural roads, wide shoulders can improve the safety and comfort of pedestrians and bicyclists, as well as motorists. More information on Complete Streets can be obtained at www.dot.ny.gov/programs/completestreets.

Expanding Recreational Resources

The town recognizes that expanding opportunities for outdoor recreation will benefit New Lebanon residents, businesses, and visitors. Projects that protect, enhance, or expand opportunities to engage the public, especially children, in outdoor activities, and expand local and regional hiking, multi-purpose trails, and the rail trail deserve special attention. All new trails and other recreational features should be located and designed to minimize impacts on intact habitats, wildlife, and water resources.

GENERAL MEASURES FOR EXPANDING RECREATIONAL RESOURCES

- Promote the **extension of the Corkscrew Rail Trail** through agreements with willing landowners.
- Adopt the **Complete Streets** approach to enhancing the quality and safety of New Lebanon's roads for biking, walking, and other uses.
- Develop additional **public access sites for fishing** on New Lebanon's streams.
- Collaborate with the Shaker Swamp Conservancy in efforts to develop **public access to Shaker Swamp**.

After being hunted to near-extinction in the 19th century, white-tailed deer populations have exploded in the 20th and 21st centuries due to removal of top predators, reduced hunting pressure, and human land uses. Moy Wong © 2017

21. Recreation Resources

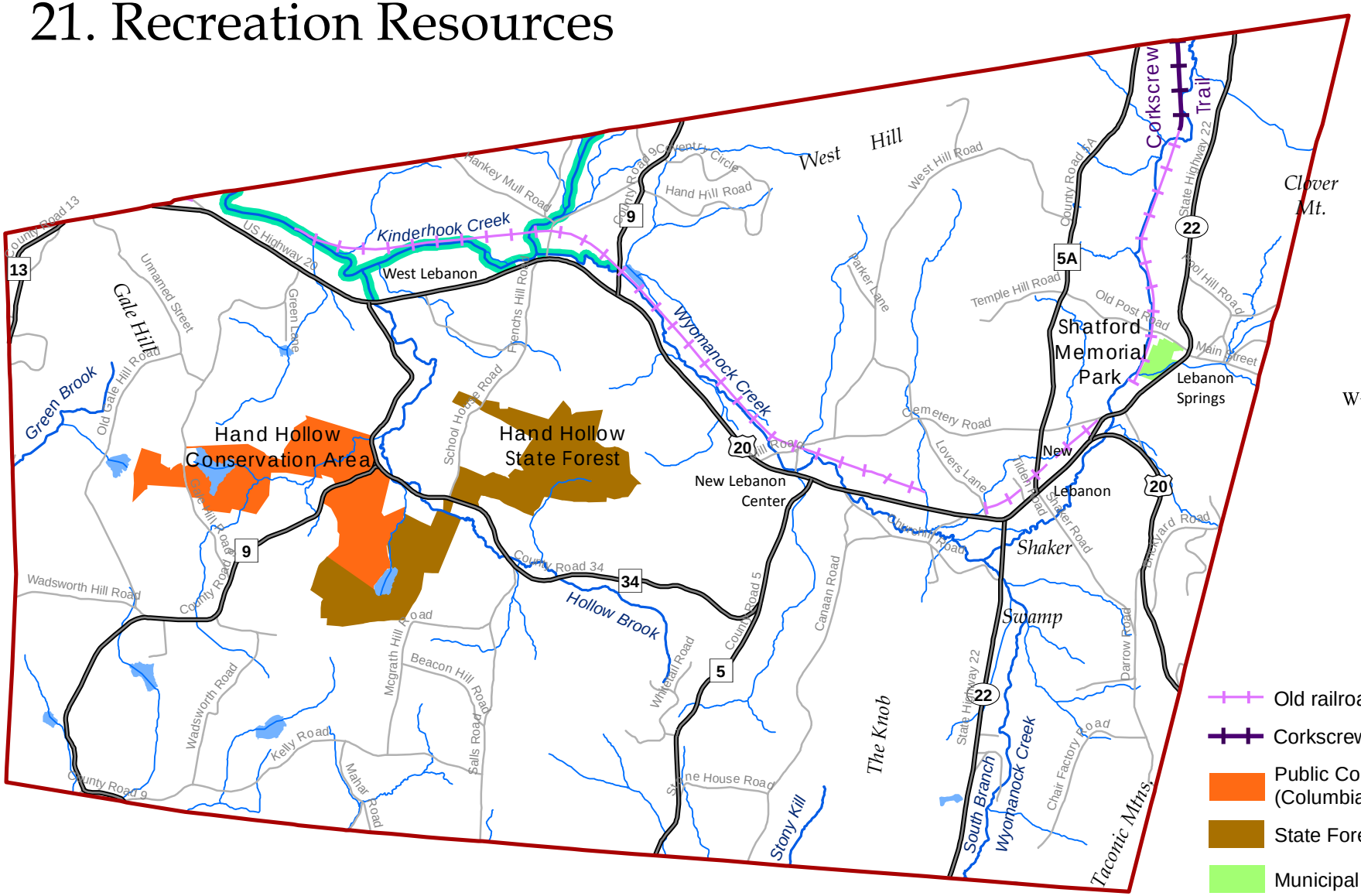

Figure 21. Public recreation resources in the Town of New Lebanon, Columbia County, New York. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Public fishing rights areas from the NYS Department of Environmental Conservation. Public conservation area from the Columbia Land Conservancy. Municipal park from the NYS GIS Clearinghouse. See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

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Threats to Resources of Conservation Concern

Climate Change

The climate has been changing measurably in the Northeast for decades, and the effects are likely to be felt more acutely in the coming years—larger and more frequent floods, higher temperatures, droughts, wildfires, and severe storms, as well as some less dramatic symptoms such as increases in invasive pests, in pathogens affecting humans, livestock, and wildlife, and depletion of native biological diversity (Rosenzweig et al. 2011). The future effects on local biological and water resources could be large, but the specific nature and magnitude of those effects are still difficult to predict.

Over the past 50 years the Northeast has experienced a 74 percent increase in precipitation falling in very heavy events (Small-Lorenz et al. 2016). New York's average annual air temperatures have risen 2° F since 1970, and winter temperatures have risen by 5° F in that period. The average annual temperature in Columbia County is expected to increase 4-6° F by mid-century and 11° F by the end of the century (Horton et al. 2014).

Precipitation during heavy storms has increased by 74% in the Northeast in the last 50 years.

More frequent and intense heat waves pose threats to human health, wildlife, and native plants, and will alter many aspects of the natural landscape. Warmer, shorter winters are predicted to increase the occurrence of rainfall while the ground is frozen, hastening snowmelt, reducing **groundwater recharge**, and increasing the likelihood of flooding. Changes in snowmelt may reduce groundwater infiltration and increase the frequency and consequences of droughts. Warmer winters with less snow will alter the habitat suitability for native plants and animals. The frequency of extreme precipitation will continue to increase and may dramatically affect the quality and quantity of water supplies as well as the plants and animals of upland, wetland, and aquatic habitats. Alterations to air temperatures, snow cover, and freeze/thaw patterns are likely to disrupt the seasonal synchrony between pollinators and plants, and predators and prey. Warming temperatures are likely to significantly affect the composition and distribution of habitats and wildlife, and force many species to migrate as former habitats become unsuitable.

Below are brief discussions of some of the expected effects of climate change to agriculture, water resources, ecosystems, and human health.

Climate Change and Agriculture

Climate change is likely to affect agriculture in a variety of ways—some even beneficial; for example, warmer summers, warmer winters, longer growing seasons, and higher atmospheric carbon dioxide (CO_2) levels will favor some crops. But the mechanisms will be complex, with differential effects on crop growth, weeds, invertebrates, and pathogens. For example, higher CO_2 levels may benefit aggressive weeds even more than the crops, and may increase their resistance to herbicides (Ziska and Runion 2006). Higher CO_2 concentrations may also reduce the nutritional content—especially of protein and essential minerals—in crops such as wheat, rice, and potatoes (USGCRP 2011).

Warmer temperatures will be harmful to many existing crops and livestock adapted to cool climates, and will require adjustments to longstanding farm practices. For dairy cows heat stress can lead to lower milk production, reduced calving, and increased risk for health disorders. Heat stress similarly affects the well-being and productivity of other livestock, including beef cattle, pigs, and chickens (Klinedinst et al. 1993).

Increased frequency of summer droughts will stress many crops, and increased frequency of large rainstorms and flood events will lead to direct losses of crops, soils, and nutrients, and to costly delays in field access for farm equipment due to wet soils. Some insect pests, pathogens, and weeds will be favored by less severe winters. Rising winter temperatures are already allowing the northward expansion of agricultural pests that reduce crop production. Disruption of heat/thaw patterns may be especially harmful to woody plants (e.g., fruit trees) and perennial herbs. (Wolfe et al. 2011). Warming temperatures may have the effect of uncoupling the activity periods of insect pollinators from the flowering periods of both crop plants and native plants that rely on those pollinators.

Frequency and intensity of droughts and floods are predicted to increase due to climate change.

Disruption of the late winter/early spring freeze-thaw cycles will reduce the quality and quantity of maple syrup production. Indeed, sugar maples may be entirely displaced from the region by 2100, with suitable cool moist habitat remaining only on the highest peaks in the Adirondacks (Wolfe et al. 2011).

Perennial fruit crops are affected by the climate year-round, and the stresses experienced in one growing season may affect growth and productivity for two or more years afterward (Quarles 2017). While apple trees may benefit from longer growing seasons and increased atmospheric CO_2, warm winters may reduce fruit production the following summer, especially for the cold-adapted varieties, and summer heat stress and drought may harm the fruit quality. The fruit yield and wine quality of many of our grapes may benefit from warmer winters and longer growing seasons, but could be

harmed by late-summer droughts, and by damage to vines when winter warm spells are followed by very cold spells (Quarles 2017).Transitioning to warm-climate fruit varieties is an appropriate response, but will nonetheless be costly to farmers. These kinds of effects will put additional financial strain on farm operations whose profitability is already marginal.

Climate Change and Water

A warming climate is expected to affect both the quantity and quality of New Lebanon's groundwater and surface water resources, as well as the habitat quality of streams and ponds. Flooding hazards may increase due to the increased intensity of large rainstorms, although the timing of those storms and the condition of the land will determine the magnitude of flooding at any location. Parts of County Route 9 and US Route 20 in West Lebanon are within the 100-year flood zone identified by FEMA (Figure 14).

Both total annual rainfall and rainstorm intensity are predicted to increase in New York in the coming years, with multiple consequences to the land, to water resources, and to agriculture. The flooding hazards at any particular location depend on the rainfall intensity, the ability of the land 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 floodflows.

FEMA flood maps for this region are based on old data, and do not take into account recent large storms such as Irene, Lee, and Sandy.

The "100-year flood zone" shown on maps created by the Federal Emergency Management Agency (FEMA) is the extent of area that, based on historical flood data, has a 1% chance of flooding in any given year. The FEMA flood maps for this region (Figure 14), however, are extremely outdated (from a 1986 baseline), and do not take into account the large storms of the last 30 years, including hurricanes Irene and Sandy and tropical storm Lee in 2011-2012. Large floods can damage roads, bridges, and other infrastructure, destroy agricultural crops, wash away farmland soil, carry pollutants and large volumes of sediments into streams, and damage or destroy buildings and other structures in the flood zone.

Climate Change and Ecosystems

While floods and droughts are normal and expected events in this region, extreme floods and droughts can add to the multiple stresses on ecosystems from human activities. 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 and unsilted stream substrates. Warming in the region is predicted to significantly affect the composition and

distribution of habitats and wildlife, and will force many species to migrate to cooler microclimates, higher elevations, or higher latitudes as former habitats become unsuitable. Cold-adapted species such as sugar maple, brook trout, spring salamander, and fisher are especially at risk. Together with non-climate stressors such as habitat fragmentation, water pollution, invasive species, and overharvesting, climate change may have synergistic effects that magnify the stresses and hazards to wildlife (Hannah et al. 2005).

Already, many plant species now bloom 4-8 days earlier on average than in the early 1970s Wolfe et al. 2011)—an effect that may have far-reaching ecological consequences. For example, insect pollinators whose activity periods are closely tied to the particular flowering periods of their food plants may find that their pollen and nectar food is unavailable at critical times in the pollinators' life cycles. This would add to the existing stresses from more frequent and more severe weather events, and could severely harm regional populations of these insects. Shorter, warmer winters and longer, hotter summers have been aiding the spread of pathogens and invasive non-native species. Pathogens that are encouraged by less-severe winters will also take advantage of the weakened condition of trees and other plants stressed by rising temperatures and droughts. Forest pests such as the hemlock woolly adelgid and the emerald ash borer are likely to transform our forest communities with wide-ranging ecosystem consequences. Invasive plants such as mile-a-minute-weed are expected to thrive under elevated atmospheric levels of carbon dioxide (Wolfe et al. 2011).

Warmer summer and winter temperatures, longer growing seasons, and elevated levels of atmospheric carbon dioxide will favor certain plants and disfavor others, and are thus likely to alter the composition of plant communities. The changing climate conditions may also allow some insect pests and insect disease vectors to complete more generations per season and to allow greater winter survival (Rodenhouse et al., 2009).

Surface water temperatures will rise along with air temperatures. Higher water temperatures reduce the concentrations of dissolved oxygen—a key habitat component for fish and other aquatic organisms—in streams, lakes, and ponds. The life cycles of many stream invertebrates are closely tied to water temperatures and the seasonal patterns of water temperature fluctuations. Alterations to water temperatures will have large effects on the fish, salamanders, turtles, and other biota of streams and ponds—organisms that are already stressed by water pollution, siltation, and competition from non-native fish.

Heat stress effects on native plants and animals will be similar to those on livestock and crop plants (see above), and may eliminate some of the cold-adapted species and communities from our landscapes (Wolfe et al. 2011). Warmer, shorter winters and prolonged winter thaws may make some perennial plants more vulnerable to mid-winter freeze damage by disrupting their accustomed dormancy period, and may subject the early leaves and flower buds to frost damage (Wolfe et al. 2011). Reduced snow cover will harm small mammals and other animals that depend on snow for insulation and protection from predators, but may favor white-tailed deer—already over-abundant—whose intense grazing pressure has been transforming our forests for several decades.

Many of our native plants and animals have adapted over thousands of years to the seasonal temperature ranges of the Northeast, and are ill-equipped to adapt quickly to the present-day pace of warming—several orders of magnitude faster than the temperature changes experienced during the most recent ice age (Wolfe et al. 2011). The widespread fragmentation of today's landscape by roads and land development poses additional obstacles to adaption and migration.

Plants and animals with specialized habitat needs may be most affected by climate change.

In general, most at risk will be the plants, animals, and communities with more specialized habitat or food requirements, or specialized interactions with other species (e.g., butterflies and their host plants) that are likely to be disrupted by climate change, those with poor dispersal ability, and those with already-low population levels, including endangered, threatened, and special concern species. Plants and animals likely to benefit from climate change are those that are habitat- and food-generalists, such as white-tailed deer, warmwater fishes (e.g., bass, pickerel, sunfish, white perch), adaptable songbirds (e.g., northern cardinal, American robin, house sparrow, and European starling); and non-native invasive plant species (Wolfe et al. 2011).

Climate Change and Human Health

Climate-related health risks stem from heat events, extreme storms, disruptions of water supply and water quality, degraded air quality, changes in timing and intensity of pollen and mold seasons, and increased prevalence of infectious disease vectors and organisms. Expected 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 (Kinney et al. 2011). The actual extent of these health effects is difficult to predict, as are the magnitudes of the various changing climate factors.

People with pre-existing disease or otherwise compromised health may be among the most vulnerable to the impacts of climate change. Those with diseases such as asthma, cardiovascular diseases, or infectious diseases may be especially sensitive (Kinney et al. 2011).

Heat

Heat-related health effects may disproportionately affect the elderly, the poor, the sick, those with limited mobility and social contact, those belonging to nonwhite racial/ethnic groups, and those lacking access to public facilities and public transportation or otherwise lacking air conditioning. The combined effects of extreme temperature and air pollution are likely to increase the incidence of illness and death during heat waves (Cheng 2005).

Cardiovascular disease—already the single greatest killer of New York State residents (Kinney et al. 2011)—can reduce a person's ability to regulate temperature in response to heat stress, so the predicted increases in summer temperatures and heat waves may pose particular risks to those with compromised cardiovascular systems.

Air pollution

Increasing temperatures and increasing frequency of stagnant air events are likely to produce more days with high ozone levels—a risk factor for respiratory irritation and damage. The risks are greater for people who work or exercise outdoors, for children, and for those with respiratory disease (Kinney et al. 2011). Breathing ozone can cause lung inflammation and decrease lung function, and has been found to increase asthma episodes and cause respiratory failure leading to death.

Airborne particulate matter originates from a variety of sources, but some of the most important sources are combustion of fuels by motor vehicles, furnaces, and power plants, wildfires, and windblown dust. Particulates have been associated with premature deaths related to heart and lung diseases, and increased hospital visits for respiratory problems. The risk of wildfires increases with higher temperatures, reduced soil moisture, and extended periods of drought. Wildfires produce fine airborne particulates that can be carried long distances from the fire where they originate.

Changing patterns and timing of temperature and precipitation can alter the timing and intensity of allergy triggers such as pollens and molds. Warming temperatures and higher CO_2 levels may create extended pollen seasons, and spur greater pollen production and allergen potency in plants such as common ragweed (Ziska et al., 2003). Warm temperatures and rising air moisture, especially after extreme storms, may also spur the growth of indoor and outdoor molds.

Pathogens

Mosquitoes, ticks, and fleas are among the animals that can transmit pathogens—such as viruses, bacteria, and protozoa—from other animals to humans. A warming climate and large rainstorms are likely to increase mosquito and tick populations in the region along with the risk of diseases carried by those organisms. Many pathogens for human disease that are carried by ticks and mosquitoes—such as Lyme disease, erlichiosis, and malaria—have increased their geographic range in recent decades in part due to warming winter temperatures (Quarles 2017). Other infectious pathogens may also be climate-sensitive, including those spread by contaminated food and water (Kinney et al. 2011).

Droughts may also provide breeding sites for mosquito larvae, and warmer temperatures will spur mosquito reproduction and speed the growth of mosquito-borne pathogens (Quarles 2017). These conditions may help to explain instances of malaria and expansion of the West Nile virus in New York. West Nile is carried by certain species of *Culex* mosquitoes and spread by birds and humans.

Droughts act to bring birds and mosquitoes together at reduced water sources, and also to reduce populations of dragonflies and other predators of mosquitoes (Epstein 2000, 2001). These phenomena together may hasten the spread of the virus. Warmer temperatures may also make this region hospitable to the *Aedes* mosquitoes that spread the Zika virus.

Even small increases in average temperatures can increase rates of population growth and average population densities of mosquitoes (Kinney et al. 2011). In addition, the biting rates of mosquitoes and the replication rates of the parasites and pathogens they transmit has been found to increase with increasing temperatures (Harvell et al., 2002).

Ticks do not survive prolonged periods of very cold temperatures. Warming temperatures are a significant factor in the northward spread of Lyme disease (Leighton et al. 2012) and the increased numbers of Lyme-infected ticks in the Northeast (Levi et al. 2015). Climate models predict that their populations will continue to expand northward into areas now considered to be too cold to support them (Brownstein et al. 2005, Ogden et al. 2005).

Increased precipitation and accompanying flood events and large volumes of runoff may increase the risk of water-borne illnesses from bacteria, viruses, and parasites, from toxins produced by blooms of algae and cyanobacteria, and from chemical contaminants from human activities. Warmer temperatures may also increase the incidence of *Salmonella* and other bacteria-related food poisoning.

A common green darner (dragonfly) on iris. . Moy Wong © 2017

Habitat Loss and Degradation

The concept of habitat loss is simple to understand: construction of a new house, driveway, lawn, parking lot, or road in an undeveloped area will destroy the habitats in the footprints of those built features. In some cases the ecological consequences of those losses may be minor, especially if the new features do not encroach on sensitive habitats.

Habitat degradation, however, is often less obvious but is responsible for much greater harms to biological resources in this region. That same new house, lawn, and driveway whose footprint may seem small—perhaps an acre or less—can negatively affect habitats in a large area of the landscape by means of light and noise pollution, chemical pollution, the spread of non-native species, and habitat fragmentation.

Lakes and ponds for example, are degraded by shoreline development, aquatic weed control, use of motorized watercraft, and polluted runoff from roads, lawns, and agricultural areas. Springs are easily disrupted by disturbance to up-gradient land or groundwater, altered patterns of surface water infiltration, or pollution of infiltrating waters. Pumping of groundwater for human or livestock water supply can deplete water available to nearby springs and seeps.

Disruption of Stream Flows, Water Quality, and Stream Habitat

Removal of trees or other shading vegetation along a stream can lead to elevated water temperatures that adversely affect aquatic invertebrate, amphibian, and fish communities. Clearing of floodplain vegetation can reduce the important exchange of nutrients and organic materials between the stream and the floodplain. It can also diminish the floodplain's capacity for **flood attenuation**, leading to increased flooding downstream, scouring and bank erosion, and siltation of downstream reaches. Any alteration of flooding regimes, stream water volumes, timing of runoff, or water quality can profoundly affect the habitat characteristics and species of streams and riparian zones.

Hardening of stream banks with concrete, **riprap**, **gabions**, or other materials reduces the biological and physical interactions between the stream and floodplain, and tends to be harmful to both stream and floodplain habitats. Channelized streams have higher velocities which can be destructive during large snowmelt and rain events. Removal of snags from the streambed degrades habitat for fishes, turtles, snakes, birds, muskrats, and their food organisms.

The habitat quality of a stream is affected not only by direct disturbance to the stream or its floodplain, but also by land uses throughout the watershed—that is, the entire land area that drains

into the stream. Activities in the watershed that cause soil erosion, changes in surface water runoff, reduced groundwater infiltration, or contamination of surface water or groundwater are likely to affect stream habitats adversely. For example, an increase in impervious surfaces (roads, driveways, parking lots, and roofs) may increase runoff, leading to erosion of stream banks and siltation of stream bottoms, and a consequent degradation of the habitat for invertebrates, fish, and other animals. Road runoff often carries contaminants such as petroleum hydrocarbons, heavy metals, de-icing salt, sand, and silt into streams. Applications of fertilizers and pesticides to agricultural fields, golf courses, lawns, and gardens in or near the riparian zone can degrade the water quality and alter the biological communities of streams. Construction, logging, soil mining, clearing for vistas, creating lawns, and other disruptive activities in and near riparian zones can hamper riparian functions and adversely affect the species that depend on streams, riparian zones, and nearby habitats.

Fragmentation of streams from dams and poorly-sized or poorly-installed culverts is a widespread cause of degraded stream habitats, and has led to the loss of whole populations of fish unable to navigate those barriers (see sidebar). Figure 9 shows the locations of barriers identified on New Lebanon streams. Over the last several years the Hudson River Estuary Program has been conducting surveys to identify culverts 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.

Stormwater management on land development sites is usually inadequate to maintain the patterns, volumes, and quality of surface runoff and groundwater recharge that occurred prior to development. Groundwater aquifers are vulnerable to **point source** and **non-point source pollution**, and to the expansion of impervious surfaces preventing groundwater infiltration and recharge.

Disturbances to soils in the course of forest clearing, mining, and construction of new houses and roadways often result in the spread of non-native invasive species. Seeds and vegetative propagules carried by vehicles and machinery readily spread invasive plants from one site to another.

Culverts, Bridges, and Stream Continuity

From headwaters to mouth, a stream is a continuous ecosystem dependent on upstream and downstream movement of nutrients, organic materials, sediments, and animals.

For example, many of our fishes need different parts of a stream for feeding, spawning, nursery areas, drought refuge, and overwintering, and sometimes need to make larger 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 certain predators, and invertebrate drift from upstream reaches can be essential to maintaining fish populations. Invertebrates, amphibians, reptiles, and other animals similarly need to move freely to take advantage of various stream habitats and materials in different seasons, life history stages, and stream conditions.

Dams are an obvious impediment to these movements, but bridges and 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 increased downstream velocities, often leading to streambed scouring and bank erosion, and damage to bridges, roads, and other infrastructure.

A culvert should be large enough so that stream flows are unimpeded, even during flood events, and the lower invert should be buried in the stream bottom so that water depth is similar within and outside the culvert. The DEC's recommended standards are that 1) bridges or open-bottomed arches are preferred; but, where culverts are used 2) the culvert is 1.25 times wider than the stream channel itself, and 3) the lower invert is buried in the stream bottom to 20 percent of the culvert height.

These measures will help ensure that stream continuity is maintained and the culvert can accommodate the large water volumes of future flood events.

Additional information can be obtained at http://www.dec.ny.gov/permits/49066.html.

Habitat Fragmentation and Rural Sprawl

Habitat fragmentation is a widespread form of habitat degradation, and among the primary threats to biodiversity worldwide (Davies et al. 2001) and in the Hudson Valley. While some species and habitats may be adequately protected in small patches, many wide-ranging species, such as black bear, barred owl, and red-shouldered hawk, require large, unbroken blocks of habitat. Many species such as wood turtle and Jefferson salamander need to travel among different habitats to satisfy their basic needs for food, water, cover, nesting and nursery areas, and population dispersal. Landscapes that are fragmented by roads, utility corridors, and development limit animal movements and interactions, disrupting patterns of dispersal, reproduction, competition, and predation.

Many species of wildlife require more than one kind of habitat to fulfill their life history needs; others are far-ranging and have territories spanning hundreds or thousands of acres. The fragmentation of habitats by roads, development, and other human disturbances inhibits the ability of wildlife to move across the landscape. Species that are able to cross human-created barriers (such as roads) face elevated mortality risk from vehicles and predators. Populations that become restricted to fragmented habitat patches may face local extinction. Over longer time scales, habitat connectivity is critical for maintaining genetic exchange among distant populations and facilitating the migration of species under deteriorating environmental conditions or climate change. Linking small or otherwise isolated habitat patches can help to ensure that the habitat, movement, migration, and behavior requirements of most native plant and animal species are conserved across a broad landscape.

Deciduous forest viewed from Old Gale Hill Road. Craig Westcott © 2017

Even a single house on a single long driveway through a forest or large meadow can have a severe impact on the forest or meadow ecology. Many "area-sensitive" wildlife species that require large habitat areas, and other "human sensitive" species are affected when a feature such as a driveway or a utility corridor cuts deeply into a large forest. Some animals do not tolerate, for example, the noise and lights around human activity areas; highly fragmented habitats; mortality and disruption of movement patterns posed by roads, driveways, mowed lawns and fields, and other such features; human-subsidized predators such as raccoons, skunks, and house cats; invasive plant species (often abundant near human-settled areas); and those that are otherwise affected adversely (directly or indirectly) by the proximity of humans. Area-sensitive and human-sensitive plants and animals include many of the rare and declining species in the region, and many that have already disappeared from our settled landscapes.

Fragmentation of forests increases the area of forest "edge" habitat with higher light and noise levels and often facilitates invasion by non-native plant species and by predators such as raccoons and domestic cats. Fragmentation makes the (formerly) deep interior forest areas newly accessible to nest predators and to brood parasites (such as the brown-headed cowbird) whose activities are ordinarily confined to forest edges. The cowbird is a non-native blackbird that makes no nest of its own, but lays its eggs in the nests of other species. The eggs are early to hatch and the nestlings develop quickly, outcompeting the young of the host species for food. The cowbird has been implicated in the decline of many forest songbird species in the Northeast.

Land development in the form of "rural sprawl" (low density, large lot size) is a growing threat to large contiguous habitat areas in the region, and could become a problem in New Lebanon. The town's *Comprehensive Plan* encourages the use of cluster designs for land development (Sect. III.A.3.b). New residential development often fragments or eliminates former meadow or forest habitat, for example, and often leads to the degradation of nearby streams, and the draining, filling, or pollution of unprotected wetlands, or conversion to ornamental ponds. Well-designed clustering of developed uses can be used to minimize the fragmentation of habitats and the influence of edge effects on nearby areas.

Roads, utility corridors, and other features dividing forests can also act as significant barriers to wildlife movement. Many animals avoid breeding near human activities, and the "edge effects" of human disturbance from roads, residential areas, and other development may reach hundreds of feet into forest patches (Findlay and Bourdages 2000, Forman and Deblinger 2000, Lampila et al. 1995, Murcia 1995, Trombulak and Frissell 2000). Fragmentation similarly reduces the habitat values of large meadows and many other habitat types for certain sensitive species.

In addition to the ecological problems described above, forest fragmentation also diminishes the economic viability of working forests, e.g., for timber production and harvest.

Other forms of habitat fragmentation occur along streams, where dams, poorly designed culverts, or improperly installed culverts create barriers to upstream or downstream movement of stream

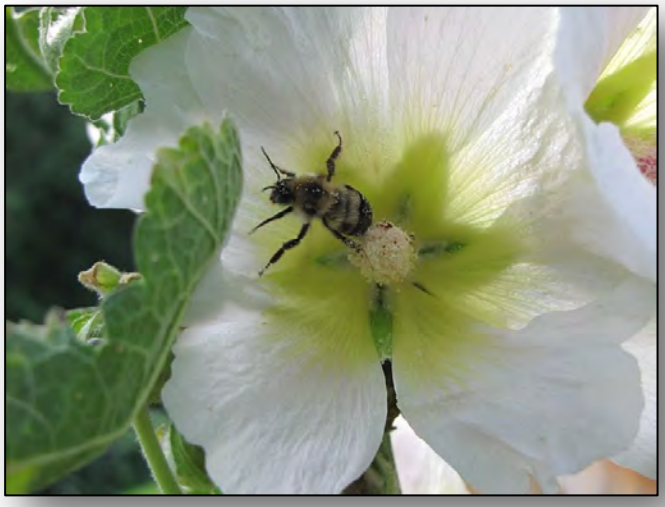
organisms. Many organisms—such as dragonfly nymphs, mussels, fish, salamanders, and turtles—use streams and streamside areas as pathways between habitats. Barriers such as dams or suspended culverts can partially or completely obstruct their movements. Even a small dam on a small stream, or a culvert suspended just a few inches above the stream bottom, can create an insurmountable barrier for some organisms.

Damage to Habitats

Insects of all kinds are essential to the sound functioning of the ecosystems that support the human community, agriculture, and the natural world around us, but human activities inflict multiple stresses on insects. Directly or indirectly, urbanization, rural land development, and agriculture have led to the loss, degradation, and fragmentation of habitats. Also harmful to insects are introductions of non-native plants and animals, the spread of pathogens, applications of pesticides, light pollution, genetically modified organisms, and a host of other factors.

Bees, wasps, flies, butterflies, moths and beetles are the major pollinators of native plants and agricultural crops in North America. Of these groups, bees are the most important because they collect both nectar and pollen as food, and they have physical structures especially evolved for transporting pollen (Mader et al. 2011). Certain wasps, in addition to their pollinating services, are also the natural enemies of many agricultural pest insects.

Pesticide applications may have had large impacts on the populations of bees, butterflies, and other pollinating insects. Even some of the widely-used insecticides that are approved for organic farming certification have broad-spectrum effects and are very toxic to bees and hazardous to a large array of other insects. Effects of pesticides and other toxic substances can be acute, chronic, or sublethal, and can be caused by not only the "active" ingredients but also the "inert" ingredients in the formulations as well as interactions between different pesticides (Kiviat 2009). Contaminated pollen can remain toxic for long periods.



Native bee gathering pollen from hollyhock. Moy Wong © 2017

Different groups and species of pollinating insects have different habitat needs for feeding, nesting, and dormancy periods, but all can be much affected by land management. While intensive mowing and cultivation may be essential to some kinds of farm production, they are lethal to insects at many stages of their life cycles. But certain measures can help to support the insect community without interfering with farm productivity. For example, maintaining significant areas of unmowed vegetation will provide larval food sources (for butterflies) and nectar sources (for all pollinators) throughout the growing season. Maintaining hedgerows and forest edges with structural diversity (e.g., trees, shrubs, forbs, and **graminoids**, and woody and herbaceous debris) and plant species diversity will provide habitat for an array of important insects, for nesting, larval and pupa stages, overwintering, and foraging. Avoiding use of broad-spectrum or systemic pesticides will prevent contamination of the vegetation, pollen, and nectar foods of pollinators. Avoiding soil fumigants will help to protect the habitats of ground-nesting bees and the many other soil-dwelling insects and other invertebrates.

Specific habitat needs of grassland breeding birds vary by bird species, but there are some characteristics that seem universally important: 1) Large meadows tend to be more valuable than small meadows. 2) Meadows dominated by grasses or sedges tend to support higher densities of nesting birds than those dominated by other forage crops or row crops. 3) Grasslands embedded in generally agricultural landscapes tend to support higher densities of grassland birds than those surrounded by forests or developed land (NRCS 2010). Fragmentation of meadows by roads, driveways, and other developed uses eliminates the interior meadow areas that shield the nests of grassland birds from nest predators and nest parasites that frequent meadow edges.

Because many birds nest in the spring and the young do not fledge until late spring or summer, mowing or intensive grazing of meadows in the spring or early summer is likely to be fatal to eggs and nestlings. If nests are destroyed or depredated, some birds will nest again, and the young may not fledge until August, or even later. Delaying mowing until mid- or late summer can significantly improve bird survival rates (Zalik and Perlut 2008), as many of the young will have fledged by mid-July. Similarly, rotational grazing that reduces the grazing intensity and allows for regeneration of vegetation between grazing periods also improves the survival rates of bird eggs and nestlings.
For hayfields, multiple cuttings are essential to the economies of some farm operations, and late-cut hay tends to have lower protein content, so delayed cutting is not always a practical option. For farm operations that cannot afford to reduce the intensity of mowing or grazing, another alternative is to simply set aside certain areas—perhaps those with poorer soils or wetter soils—to accommodate bird nesting, while maintaining more intensive operations elsewhere. Delayed cutting in wet areas will also reduce damage to soils, which can be severely harmed by compaction and other disturbance when wet.

Forest wildlife can be harmed by selective or clearcut logging or other forest disturbance at any time of year. Winter is often favored as the less-disruptive season for logging, because some organisms—such as migratory songbirds and summer-roosting bats—are present only in spring through fall. But many other animals—such as overwintering songbirds, small mammals, amphibians, reptiles, and

soil invertebrates—are here year-round, occupying live and dead trees, downed logs, leaf litter, and forest soils. Some of these forest animals are in winter torpor and cannot easily move out of harm's way, and those that can move may be unable to find adequate winter shelter in nearby areas. Logging equipment and techniques that reduce disturbance to forest soils and to non-target trees and shrubs will also help to minimize the disturbance to forest animals.

Pollution

According to the DEC, in this region the most significant threats to groundwater resources include "inactive hazardous waste sites and industrial discharges, pesticide application, chemical spills, animal feeding operations, and inadequate on-site wastewater treatment systems" (Bureau of Watershed Assessment and Management 2008).

While many sources of pollution (such as direct industrial discharges to waterways) have been curtailed over the last several decades, pollution of water and soils still occurs widely but often in less obvious ways. For example, some air-borne pollutants are transported long distances through the air, before settling here in the forms of sulfur dioxide, mercury, and nitrogen from fossil-fuel-burning power plants in the Midwest, and nitrogen compounds from distant agriculture (Driscoll et al. 2001). But many of our pollutants originate here from sources such as agricultural and lawn chemicals, leachate from failing septic systems, salts and hydrocarbons in roadway runoff, industrial waste, fuel spills and leaking gasoline storage tanks, and smokestack discharges from commercial and residential oil burners and wood stoves. Pollutants such as these in water and soils often go undetected for long periods during which time they can cause widespread harm to organisms, communities, and habitats.

All of the above disturbances represent common types of habitat degradation that are often invisible to us, but the impacts to habitats and species can be severe. The depletion of sensitive species of plants and animals that we observe in urban, suburban, and suburbanizing landscapes is usually due to the cumulative effects of these kinds of impacts.

Invasive Species and Pathogens

Non-native invasive species often lack significant predators or diseases in their new environments and can outcompete native species for limited resources or space, resulting in the decline of native biological diversity. Land development has the potential to promote the spread of these species into many high quality habitats and reduce the overall value of those habitats to native plants and animals.

Non-native plants such as common reed, Japanese stiltgrass, Japanese knotweed, purple loosestrife, water-chestnut, Eurasian watermilfoil, multiflora rose, Bell's honeysuckle, Japanese barberry, common buckthorn, tree-of-heaven, and many others are now widespread in the region, usually spreading out from areas in and near human development and land disturbance.

Non-native animals such as the rusty crayfish and the brown-headed cowbird have similar effects on native communities. The rusty crayfish (*Orconectes rusticus*) —native to the central and midwestern US—is large and aggressive, allowing it to displace native crayfish and escape predation. It may have arrived in our streams in fishermen's bait buckets, which can also carry other non-native animals, pathogens, and parasites.

The advance of the hemlock woolly adelgid and emerald ash borer, apparently hastened by the warming climate, promises to decimate our eastern hemlock and white, green, and black ash trees, greatly altering the forest communities of southeastern New York. The pear thrips, an insect native to Europe, attacks domestic (pear, apple, plum, cherry) and native (serviceberry, black cherry) fruit trees, and also native forest trees such as sugar maple, red maple, and American beech. A large outbreak can defoliate thousands of acres of forest, and can be triggered by warm, dry springs associated with climate change (Natural Resources Canada 2015). These are just a few of the climate-related stresses that may transform New Lebanon's forests in the coming decades.

Black swallow-wort, a non-native invasive vine related to native milkweeds. Claudia Knab-Vispo © 2017

Recreation

Outdoor recreation is essential to our physical and spiritual well-being, and is one of the amenities that attracts residents, businesses, and visitors to the region and contributes much to local economies. Expansion of opportunities for outdoor recreation is one of the goals set forth in the *New Lebanon Comprehensive Plan* and of this *Natural Resources Conservation Plan*.

Recreational activities can have various negative effects, however, on natural resources, depending on the kind of activity, how and when it is engaged in, and how the resources, uses, and impacts are managed. For example, lead sinkers used by anglers are often lost and later ingested as grit by waterfowl who may be sickened and die from lead poisoning. Discarded monofilament fishing line can entangle wildlife, and discarded lures and other litter be mistaken for prey or forage and cause injury or death when ingested. Motorized watercraft can harm aquatic animals, pollute waterways with leaking oil and gas, cause noise disturbance of wildlife, and introduce invasive aquatic plants to uninfested waters. All-terrain vehicles (ATVs) are also hard on trails and disruptive to wildlife due to direct damage to habitats, and to air pollution and noise. Mountain biking can quickly damage foot trails, and is particularly disruptive when soils are wet. Even a seemingly benign activity like hiking or birdwatching can disturb courting or nesting birds in forests or meadows, and reduce their nesting success. Walking trails in the deep interiors of large forests or large meadows can invite nest predators and nest parasites that would otherwise confine their activities to the habitat edges. Overuse or inadequate maintenance of trails can lead to concentrated runoff of rainwater and snowmelt, and consequent soil erosion and loss and damage to down-gradient streams and wetlands. Because many kinds of wildlife depend on darkness for hunting and cover, nighttime lighting of ballfields and other public spaces can disrupt the activities of both predators and prey.

These are just a few of the impacts of recreation on wildlife, habitats, water, and soils. At the same time, however, outdoor recreation is wholesome and restorative for children and adults of all ages, and especially important for children's physical development and their connections to the natural world. Outdoor recreation could even be considered a "birthright" for children growing up in a rural area like New Lebanon.

With some attention to the needs and potential sensitivities of nearby habitats and species, recreational facilities can be located, designed, and managed in ways that minimize harm to natural resources, and users can be educated in outdoor etiquette that respects the natural surroundings. Prior to siting new trails or other amenities, we encourage habitat assessments and biological surveys so that facilities and public education can be designed to be least disruptive and most compatible with the local environment.

Stormwater

In a well-vegetated landscape with undisturbed soils, a large proportion of the precipitation volume is captured in the organic duff and the soil. From there, some may run off along the ground surface, some evaporates, some is taken up by plants and animals at and near the soil surface, and some moves downward through the soil to replenish the groundwater. One of the consequences of land development with roads, driveways, parking lots, buildings, other structures, and lawns is that, unless carefully designed to promote onsite water infiltration to the soils, the movement of water overland and through the soils is often dramatically altered, to the detriment of groundwater and nearby streams and wetlands.

In conventional development designs, through grading, swales, ditching, and other means, precipitation and snowmelt are directed to run rapidly off the ground surface into the nearest ditch or stream. Stormwater from agricultural fields, lawns, and gardens carries fertilizers, pesticides, and sometimes sediments, and stormwater from paved areas and roofs carries petroleum hydrocarbons, heavy metals, salts, and other toxins. All of these substances can be damaging to the habitats and species of wetlands and streams.

The typical consequences of rapid runoff are that infiltration of rainwater and snowmelt to the soils is reduced or eliminated, groundwater recharge is reduced, soils are eroded and lost, stream flooding is increased, base flows of streams are reduced, and water quality of streams, lakes, ponds, and wetlands is degraded. These impacts are most pronounced where there are large areas of **impervious** surfaces (e.g., pavement, roofs), but the cumulative impacts of many smaller impervious areas can also be significant.

Roadside ditches are large contributors to the degradation of streams and wetlands. Ditches intercept rainwater and snowmelt from road surfaces and often from much larger watersheds, and convey it rapidly into nearby streams and waterbodies. Road runoff carries contaminants as well as sand from winter road treatments. Unvegetated ditches are especially susceptible to erosion, and carry additional sediments from the eroded banks.

Loss of Agricultural Land

Inactive farmland, if left undeveloped and unmanaged, usually reverts to oldfield, shrubland, and eventually forest. All of those stages offer valuable habitat for native plants and animals, and the land can be returned to agricultural uses at any time, although clearing shrubland or forests can be costly. Farmland is lost permanently only if it is developed with structures, pavement, roads, and driveways. Protecting active farms and areas with good farmland soils are fundamental requirements for maintaining the potential for viable local agriculture, which has obvious large benefits for New Lebanon's economy, local and regional food security, the scenic character of the landscape, and the culture of the human community.

Agricultural land is often considered prime real estate for development because it is often flat or gently sloped, well-drained, and cleared of woody vegetation. Many areas of the best agricultural soils in the Hudson Valley have been developed for non-agricultural uses. The growth in demand for high quality local and organic food in the Hudson Valley and the greater New York metropolitan region during the last decade comes at a time when escalating property values have made maintaining large farm properties unaffordable to many multi-generational farming families. Young farmers new to agriculture also face a critical shortage of accessible and affordable farmland in the region as old farms have been sold at high prices and converted into residential subdivisions and private estates. Moreover, even where conservation organizations have succeeded in acquiring **conservation easements** or development rights on important farmland parcels, keeping farms in active agriculture can be difficult. In many cases, land trusts are able to protect open space but unable to maintain working farms on protected land. Arrangements to lease land in private conservation easements to new farmers are limited by farmers' needs for permanence, housing, and equity. Farmland protection must go beyond open space protection to address access and affordability of farmland, and maintenance of opportunities for farming on protected agricultural lands.

The Columbia Land Conservancy (CLC) has partnered with the Dutchess Land Conservancy, in collaboration with the American Farmland Trust's Hudson Valley Farmlink Network, to operate the Farmer-Landowner Match Program which facilitates farm leases and helps farmers and private landowners find solutions to overcome some of the many challenges to leasing farmland, including building equity in a farm business, having security of land tenure, and farmer housing. Conservation organizations and partners in this region, including CLC, Scenic Hudson, and Equity Trust, are also trying out tools to keep conserved land in farming, such as the Preemptive Purchase Right, which aims to ensure that whenever a parcel of conserved farmland is sold in the future it will be sold to a qualified farmer at its agricultural value (Christine Vanderlan, pers.comm.). There may be ways for the Town of New Lebanon to collaborate in these programs with the Columbia Land Conservancy and other organizations to keep good farmland accessible and affordable for farming.

Some local policies and actions can have entirely unintended consequences relative to farmland and habitat conservation. For example, large-lot zoning can actually accelerate the loss of farmland, residential sprawl, and the fragmentation of habitats. When a 5+ acre farmland parcel is developed for a residential or other non-farm use, then the entire area is typically lost to potential farming. Also, extending the water and sewer systems of a hamlet farther into the countryside encourages the conversion of farmland to other uses. Still, keeping residential and commercial uses clustered in and near a hamlet may be the best way to minimize rural sprawl, maintain large areas of farmland, and minimize impacts to intact habitats.

Hayfield viewed from Kelly Road. David Farren © 2017

Protected Lands

The lands in New Lebanon with formal conservation status are fee-owned lands and conservation easements held by the Columbia Land Conservancy, and a state forest (Figure 22).

The Hand Hollow Public Conservation Area is owned and managed by the Columbia Land Conservancy for public recreation and education, and for natural resource conservation. It is open to the public for passive recreation and for fishing (by permit).

Hand Hollow State Forest is owned by New York State and is open to the public for hiking, biking, picnicking, horseback riding, primitive camping, skiing, hunting, fishing, trapping, non-motorized boating, and snowmobiling.

The Columbia Land Conservancy holds conservation easements on 1495 acres of privately-owned land in New Lebanon. A conservation easement is a voluntary legal agreement drawn up by the landowner and the land trust that ensures permanent protection of the land from unsuitable development. The landowner retains ownership with all its rights and responsibilities (including property taxes), and can 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 land trust, and describes permissible and impermissible land uses and sometimes other restrictions on land management.

Together these protected lands contain many of the conservation targets of this *NRCP*. For example, the conservation easement properties represent elevation gradients from low to high, have three of the six major bedrock types in the town, and include large forests, large meadows and active farmland, and some are broadly connected to other protected lands. The eased properties also represent parts of the Taconic Mountains Significant Biodiversity Area and the beech-maple forest that has been designated a Significant Natural Community.

Large areas of forest in the northern and eastern parts of New Lebanon are eligible for the federal Forest Legacy Program (FLP) (Figure 22)), and funds are available to conserve land within that area with the assent of willing landowners. The FLP is a federal grant program, initiated in the 1990 federal Farm Bill (16 U.S.C. Sec. 2103c) to protect important forest land from conversion to non-forest uses. Participation in the program is entirely voluntary, and is intended to relieve some of the financial pressure on landowners who might otherwise feel the need to sell their land for development purposes. More information is at http://www.dec.ny.gov/lands/63117.html.

There are many other parts of New Lebanon with important resources that deserve conservation attention, such as woodland pools, floodplain forests, small streams, and many of the large forests, large meadows, other unusual habitat areas, and good farmland soils. Recruiting landowners as long-term stewards of the special natural features of their land is the most important means of conserving the ecologically significant features of New Lebanon's landscape, but an array of other tools—regulatory and non-regulatory—are also available to municipal agencies, conservation organizations, and New Lebanon citizens (see the Achieving Conservation Goals section, below).

Looking east from McGrath Hill Road, Darrow School students Rianna, Matt, Marco, and Riley use the CAC tablet to geolocate scenic views into the scenic viewshed database. Craig Westcott © 2017

22. Protected Lands

(and Forest Legacy-eligible Area)

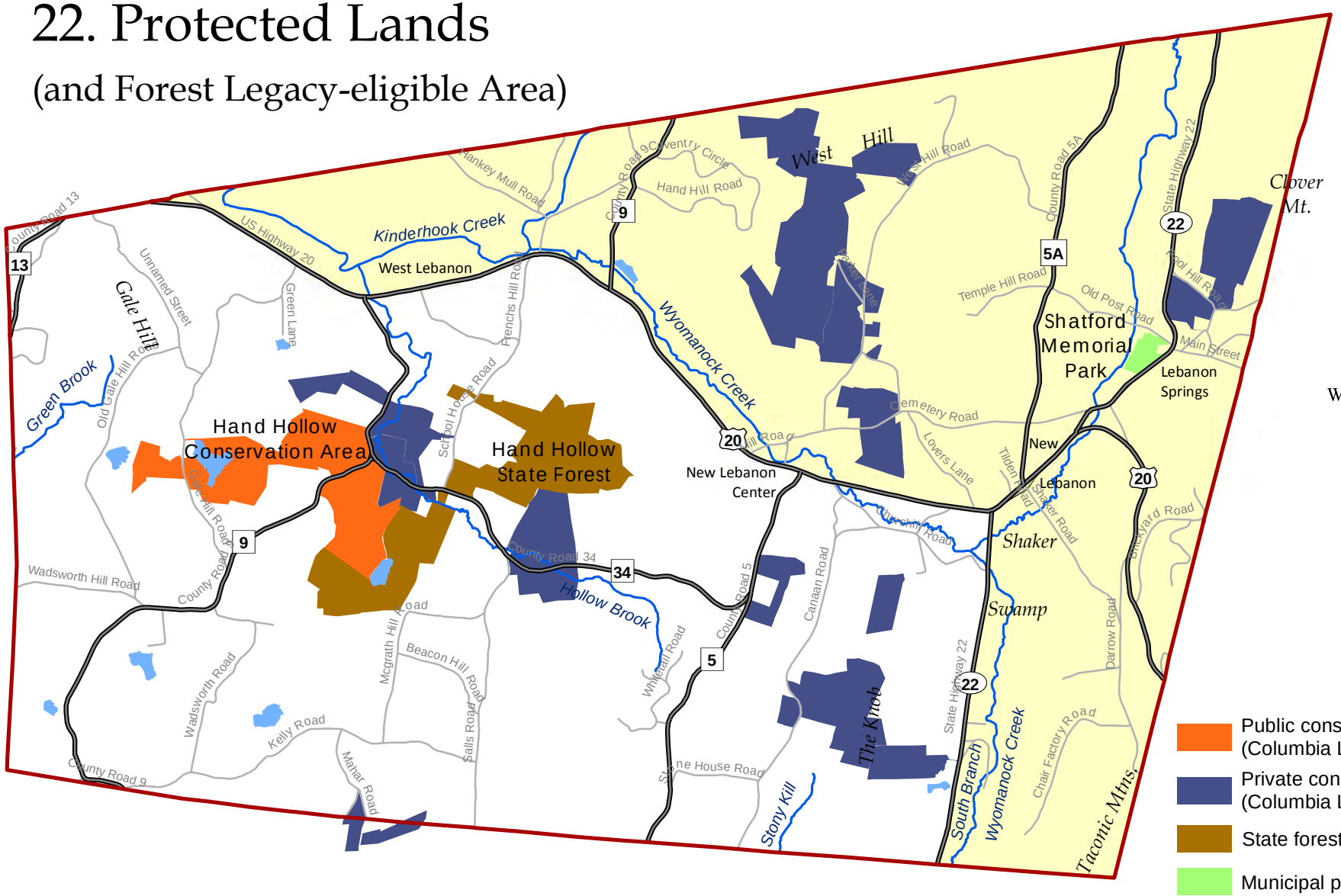


Figure 22. Protected lands and area eligible for the USFS Forest Legacy Program in the Town of New Lebanon, Columbia County, New York. Public access is not permitted to private conservation easements. New Lebanon Natural Resource Conservation Plan, 2017.

DATA SOURCES

Areas eligible for Forest Legacy Program, public conservation area, and private conservation easements from the Columbia Land Conservancy. State forest and municipal park from the NYS GIS Clearinghouse. See Figure 2 for roads, streams, and waterbodies. Map created by Hudsonia Ltd., Annandale, NY.

Environmental Research and Education
Science for Conservation
Hudsonia Ltd.

Conservation Areas

Significant habitats, farmland, water resources, and scenic areas are widely distributed throughout New Lebanon, and the general Conservation Measures listed in sections above are designed to be applied everywhere. But to help draw attention to the places where certain features of concern are concentrated, we have divided the town into four so-called "Conservation Areas" (Figure 1). Each is described below.

High Taconics

The eastern edge of New Lebanon is on the lower western slopes of the Taconic Mountains. The Taconics run through New York and three New England states, and encompass 40,000 acres of substantially **unfragmented forest** (Strong 2010). Large forests have particular value for biodiversity, for local and regional climate moderation, for carbon sequestration, and for conservation of water resources. Because large forests are disappearing in this region due to fragmentation by roads, driveways, residences, and other developed uses, the populations of many of the plant and animal species of large forests are also declining. These include area-sensitive birds such as red-shouldered hawk (SC), Acadian flycatcher (PB), and black-throated blue warbler (SGCN). Mammals that we associate with wilderness—such as black bear, bobcat, and fisher—also require deep interior forest habitats or other areas distant from human disturbance for certain of their life history stages.

Cool ravine on a Taconic Mountain slope, St. Germain property. David Farren © 2017

The Taconics have been recognized by the DEC as a **Significant Biodiversity Area** (Figure 16), due to their large forests, species of conservation concern, and importance as a water source feeding the wetlands, streams, and groundwater of the adjacent valleys. The forests on the western slopes of the Taconics in New Lebanon are interrupted by many roads, residences, farm fields, and other land uses but still retain some **large forest areas**,

including some that are part of immense forests of 5000+ acres extending into neighboring Massachusetts. These forests have been identified by the New York Natural Heritage Program as important "**linkage zones**" due to their apparent capability for providing ecological connectivity between larger forest blocks ("matrix forests"). Parts of New Lebanon's Taconic forests **border on the Pittsfield State Forest** and **Bates Memorial State Park** (both in Massachusetts), magnifying the conservation value of lands on both sides of the state boundary.

The Taconic slopes have forested **ledge and talus** habitats, several **cool ravines**, many **seeps** and **intermittent streams**, and several **perennial streams**. A northern stream has been designated as a Known Important Area for sensitive **coldwater stream habitat**. New Lebanon's famed **warm spring**, the only such feature known to occur in New York, emerges at the summit of Spring Hill Road. There are "**rich forest**" communities on the lower slopes, with many spring ephemeral wildflowers and at least one location of a state-listed **rare butterfly**. Some of the meadows, even at high elevations, have **prime** or **statewide important farmland soils**, and several land parcels were preliminarily designated as **priority agricultural lands** in the Columbia County *Farmland Protection Plan*.

The Taconics are a prominent **scenic feature** along and westward of US Route 20 and NYS Route 22, and represent one of the "**enduring features**" of fundamental conservation importance to the region. The lands and buildings of the former Shaker community on Mount Lebanon are a renowned and treasured **historic landmark**, now maintained by the Mount Lebanon Shaker Society, the Darrow School, the Abode of the Message community, and other private landowners.

Wyomanock and Kinderhook Valleys

The Wyomanock and Kinderhook creeks are the two **largest streams** in New Lebanon., and their valleys have surficial geology and past and present land uses distinct from the rest of the town. The primary glacial **outwash** and **kame** deposits are in these corridors, and thus the town's three commercial **gravel mines** are located here. The **floodplains** are narrow in some places, but nearly one mile wide at the confluence of the Wyomanock South Branch and mainstem in the New Lebanon hamlet. The Farmscape Ecology Program found large areas of **floodplain forest** in these corridors, including significant examples of "**ancient" floodplain forests**. These valleys hold the town's major unconsolidated **aquifers**, where groundwater yields and accessibility are likely to be much greater than elsewhere in the town, and where the groundwater may be most vulnerable to contamination from human land uses and activities.

The valleys contain numerous **wetlands**, including the iconic **Shaker Swamp** wetland complex, which supports **rare and uncommon species** of plants and animals, and has a long history and pre-history of uses by Native Americans, the Shakers, perhaps the Tilden Pharmaceutical Company, and

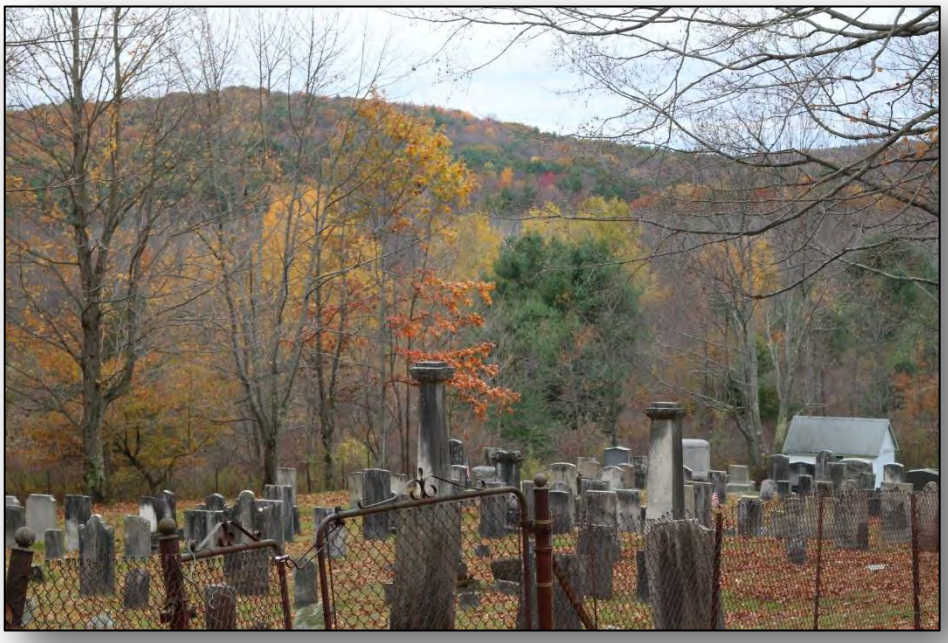
others that helped to shape the development of New Lebanon from its beginnings. **Prime Farmland Soils**, much of the **active farmland**, and many of the **large meadows** are concentrated in these valleys, and several of the parcels designated as **priority agricultural lands** are in these corridors. The mainstems and major tributaries of the Wyomanock and Kinderhook are designated as Known Important Areas for sensitive **coldwater stream habitat**, a declining resource in the Hudson Valley. The Wyomanock valley contributes to especially **scenic vistas** along County Route 5A and US Route 20. The banks of the Kinderhook and the lower reach of the Wyomanock are designated for **public fishing access**.

Rocky Foothills

This is the hilly area in the central part of the town that encompasses many of the **high-elevation** (1200+ft asl) areas, and those with shallow soils and exposed bedrock. The summits of **West Hill** and **The Knob** have some of the highest elevations in New Lebanon. The Knob, a ledgy, steep-sided ridge that extends south into Canaan, has been identified by the New York Natural Heritage Program as a Known Important Area for biodiversity because of the **exemplary beech-maple mesic forest** that covers much of the summit and slopes. The "**Little Knob**," a lower adjacent knoll, has a limestone ledge with a community of calcicolous (calcium-loving) plants, many of which are rare or uncommon in the county. Just west of the Little Knob is a wetland locally called "The Bog" that may be the town's only occurrence of a **circumneutral bog lake**, an uncommon habitat type in the region that is known to support rare plants and animals. The northern forests of the Rocky Foothills area are part of a large **matrix forest** and The Knob is in one of the **linkage zones** connecting large forest blocks; these areas were identified by The Nature Conservancy and the New York Natural Heritage Program for their particular value for supporting area-sensitive and interior-forest species, and providing landscape connectivity between habitat areas. The Rocky Foothills also have some of the largest contiguous forests (1000+ acres) internal to New Lebanon. The Rocky Foothills contain the **headwaters of Hollow Brook**, one of the major tributaries to Kinderhook Creek. Hollow Brook and one other small perennial stream have been designated as Known Important Areas for sensitive coldwater stream organisms. In addition, these hills have many other small, **intermittent streams**, most of which do not appear on publicly-available hydrography maps. The corridor along County Route 5a and West Hill Road has large areas of **Statewide Important** and **Prime Farmland Soils**, and contains several parcels identified as **priority agricultural lands** in the Columbia County *Farmland Protection Plan*. A location along County Route 5A has been recognized for exceptional s**cenic views** of Lebanon Valley and the Taconic hills. The Rocky Foothills has large areas of private land protected by **conservation easements**.

Western Hills

Covering much of the western half of New Lebanon, this area contains the **lower-elevation hills**, much of the **Hollow Brook mainstem and tributaries**, and most of the large **open waterbodies** in the town. The northwest corner of the Western Hills has small areas of bedrock types that occur nowhere else in the town—**shale, slate, argillite, quartzite,** and **greywacke**; these are not rare in the region as a whole, but are examples of "**enduring features**" that deserve some conservation attention due to their local rarity and the likelihood that they support biological communities distinctive from those elsewhere in New Lebanon. Hollow Brook, two tributaries, and two other streams have been identified as "Important Areas" for **wild native brook trout**. Several of these streams have small areas of **floodplain forest**, including some that have been identified as "**ancient**" **floodplain forest**. The Western Hills have large areas of **Prime Farmland Soils** and **Farmland Soils of Statewide Importance**, and a few parcels identified as **priority agricultural lands**. The **Hand Hollow Public Conservation Area** (PCA) and the **Hand Hollow State Forest** are the two largest areas for **public recreation** in the town, and the PCA has been recognized as a place of **special scenic importance** in partial surveys. The PCA and State Forest together with adjacent large private properties with **conservation easements** create a very large block of protected land, magnifying the conservation value of any one piece.



New Britain Cemetery viewed from New Britain Road. Craig Westcott © 2017

Achieving Conservation Goals

The New Lebanon *Comprehensive Plan* (2005) expresses the town's strong interest in protecting, conserving, and responsibly managing its natural resources, and lays out an ambitious set of goals and an action plan to achieve those ends. Some of the action items—such as creating a Conservation Advisory Council, encouraging adoption of a countywide farmland protection plan, and establishing a local farmers' market—have already been implemented. The town now has an active Conservation Advisory Council; the county has published a farmland protection plan; and the New Lebanon farmers' market has been operating successfully since 2009. This *Natural Resource Conservation Plan* supports the action items listed in the *Comprehensive Plan*, adds a few more, and provides natural resource information to underpin those actions.

Private landowners are the town's most important partners in natural resource conservation.

Conservation and sound stewardship of natural resources is most effectively achieved through a variety of means, and perhaps the most important of these is the voluntary actions of individual landowners. Most of the land in New Lebanon is and will continue to be in private ownership, and the overall condition of the forests, meadows, streams, and ponds reflects the cumulative history and present-day land management on each parcel. For this reason, landowners are the town's most important partners in natural resource conservation.

An important tenet of this *Plan* is that protection of valuable resources should occur on every land parcel in the town, including every half-acre or three-acre residential lot, every 10-acre subdivision, every 15-acre or 50-acre woodlot, and every 200-acre farm. This protection does not need to interfere with ordinary uses for living, farming, or conducting a business, but can nonetheless contribute to the care and stewardship of land and water.

Protection of valuable natural resources should occur on every land parcel in the town.

Other ways to promote the protection and stewardship of important resources include, for example, guidance to applicants during the town's review of land development projects, establishment of conservation easements with willing landowners, acquisition of land from willing landowners, or land use restrictions imposed by local policy or legislation

The ambitious goals of this *Plan* can only be achieved by pursuing multiple courses of action that exploit many different regulatory and non-regulatory "tools" available to the town, such as 1) outreach to landowners and the general public on matters related to conservation and stewardship

of important resources, 2) development of effective town policies, procedures, and legislation for natural resource conservation, and 3) collaboration with other agency and organization partners to accomplish goals that are beyond the capacity of the town to achieve by itself.

Assessment of habitats, water resources, and habitat connectivity should precede any new land development project.

One of the reasons for the degradation of water resources and the regional losses of biodiversity is that land development often occurs with little knowledge of the resources that might be affected. An assessment of habitats, water resources, and landscape connectivity should be among the first steps in planning a new project so that, right from the start, the project can be designed to accommodate the most sensitive areas. Providing assessment guidelines to applicants and their consultants will help to insure that sufficient information is supplied to the Planning Board.

A pre-application meeting between the applicant and the Planning Board can help the board and the applicant better understand the site and the proposal, and provide an opportunity for the applicant to learn about local land use regulations, and hear the Planning Board's concerns and recommendations before the applicant spends unnecessary time and money on a project or design unsuitable for the site.

For all development projects, a "conservation design"—that is, where developed uses are spatially clustered to allow contiguous open space to remain unfragmented—should be the default requirement, whether the proposed project is a for single house and driveway on a single lot, or a 20-lot residential subdivision. A waiver could be sought in cases where the conservation design seems unfeasible.

The town should encourage members of the Planning Board and the Zoning Board of Appeals to undergo annual training in landscape analysis, habitat assessment, and the SEQR process so that they are well-equipped to analyze materials submitted by applicants, and bring independent knowledge and natural resource information to the project review. When appropriate, the Planning Board should hire an outside expert to help review a proposed development site or the application materials, and to help answer some of the difficult questions about impacts to natural resources. The costs of the consultation can be passed on to the applicant.

Conservation Tools

Landowner Education

Educating landowners about their important roles as stewards of biological, water, farmland, and scenic resources can help raise awareness and support for conservation activities, and inspire voluntary action on their own land. Education can occur through outreach at community events, through lectures and workshops, through educational mailings, through materials posted on the town's website, through articles in local publications, and by involving landowners in townwide projects related to resource conservation. Educating landowners about appropriate preparations for, adaptations to, and responses to the effects of climate change will improve the town's overall preparedness and resiliency.

The Master Forest Owner program of the Cornell Cooperative Extension (https://www.ccecolumbiagreene.org/natural-resources/woodland-stewardship.html) provides advice to landowners on techniques and resources for sound forest management. The DEC Forest Stewardship program (http://www.dec.ny.gov/lands/45941.html) provides technical assistance to forest landowners to develop Forest Stewardship Management Plans to help achieve their goals for the land. The Environmental Quality Incentives Program (EQIP) (https://www.nrcs.usda.gov/wps/portal/nrcs/main/ny/programs/financial/eqip/) of the Natural Resources Conservation Service provides financial and technical assistance to help farmers install structural features or adopt management practices to improve environmental quality while maintaining agricultural production. The Forest Connect blog of the Cornell Cooperative Extension (http://blogs.cornell.edu/cceforestconnect/) provides information and resources related to forest ecology and sustainable forestry practices to forest owners and managers. Links to other sources of information and conservation ideas are on the webpage of the New Lebanon Conservation Advisory Council (http://www.townofnewlebanon.com/conservation-advisory-council-cac/).

Municipal Land Use Policy, Environmental Reviews, and Legislation

The Town of New Lebanon regulates certain aspects of land use through zoning and other local laws that set forth legal standards for reviewing development proposals and balancing private property rights with community environmental, health, and safety concerns. Carefully designed legislation, project review procedures, and standards for decision-making can ensure that any land use restrictions are applied consistently and fairly, and that resources important to the public welfare are protected.

New Lebanon's *Comprehensive Plan* and *Open Space Inventory* both lay out goals and specific actions for town policy and practice that bear on land and resource conservation. The *Comprehensive Plan*, now 12 years old, calls for the establishment of **Critical Environmental Areas** to protect aquifers and

scenic areas, **zoning overlay districts** to protect steep slopes and farmland, other legislation to establish streamside buffer zones, and restrictions on noise, light, and air pollution, and establishment of a **Community Preservation Fund** program to aid with resource protection. This *Natural Resource Conservation Plan* can serve as a catalyst to move some of those efforts forward.

Critical Environmental Areas

A Critical Environmental Area (CEA) is a geographical area with exceptional character with respect to one or more of the following:

- a benefit or threat to human health;
- a natural setting (e.g., fish and wildlife habitat, forest and vegetation, open space and areas of important aesthetic or scenic quality);
- 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. (http://www.dec.ny.gov/permits/45500.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 procedure for establishing a CEA is as follows:

1. Identify the CEA, delineate the boundaries, and prepare a written justification for a CEA designation.
2. Publish a public notice that describes the boundaries and special environmental characteristics of the proposed CEA.
3. Conduct a State Environmental Quality Review (SEQR) (as an Unlisted action).
4. Hold a public hearing.
5. Adopt the CEA (Town Board).
6. File the map, the written justification, and proof of a public hearing with the DEC and with town and county agencies.

Once a CEA has been formally designated and registered with the state, the special characteristics of the CEA must be specifically addressed in the SEQR process associated with a development project. The town can also adopt procedural or regulatory requirements to ensure that the important attributes of the CEA are considered in the siting and design of land development projects in that area. Thus, for example, a CEA could be delineated around the warm spring and the land area contributing to its water source; or around the Wyomanock and Kinderhook creek corridors that contain the major unconsolidated aquifer areas, some of the town's best farmland, and the floodplains and Active River Areas of those streams.

Create Local Funding

A variety of mechanisms are available to raise local funds for land acquisition, purchase of conservation easements, and assist with other conservation projects; for example:

- A dedicated fund can be established from a small increase in the local property tax.

- A local general revenue bond can be issued to obtain funds to acquire lands or easements for conservation.
- With authorization from the State of New York, the town could establish a Community Preservation Fund (CPF) to help with the establishment of parks or preserves, purchase of recreation lands, aquifer recharge areas, important habitat areas, scenic areas, or historic sites, purchase of conservation easements, and other purposes related to conservation of natural or cultural resources. The CPF program works by imposing a Real Estate Transfer Tax on properties whose sale price exceeds a certain minimum (e.g., the median sale price in town). New Lebanon could learn from the experience of other municipalities in the Hudson Valley (e.g., the towns of Red Hook and Warwick) that have established such funds.
- Grants can be obtained by the town from agencies such as the Hudson River Estuary Program, the Hudson River Valley Greenway, the Office of Parks, Recreations, and Historic Preservation, and the NYS Department of State, and organizations such as the Berkshire Taconic Community Foundation, the Hudson River Bank and Trust Fund, and others for projects related to conservation.
- The Clean Water State Revolving Fund (CWSRF) provides municipalities and not-for-profit organizations a mechanism to fund land acquisition projects that protect and enhance water quality and preserve open space.

These and other ways to raise local funds for conservation purposes are outlined in the *Local Open Space Planning Guide* (2004) (https://www.dos.ny.gov/lg/publications/Local_Open_Space_Planning_Guide.pdf).

Local Legislation

Although state and federal laws provide limited protection to certain wetlands and streams, many smaller wetlands and streams and most upland habitats lack any legal protection and are susceptible to loss or harm. Local legislation is one of the best ways to ensure that resources of importance to the community are not harmed by our uses of the land. Local laws can be crafted to protect small streams and wetlands, aquifer areas, farmland soils, special habitat areas, and other features deemed to be important to the public welfare. For example, an Aquifer Overlay Zone could be established to protect the unconsolidated aquifer from land uses with potential to contaminate the groundwater or reduce groundwater recharge.

Environmental Reviews

For proposed land development projects, the town could help ensure better outcomes by establishing environmental review procedures that foster a collaborative process between town agencies and applicants to design new projects in ways that minimize harm to sensitive resources. Requiring a natural resource assessment or a habitat assessment in the early stages of planning land development projects helps the landowner, developer, and town agencies understand the biological, water, and mineral resources and the particular sensitivities of a site, and enables them to design the

new project in ways that accommodate those features. Construction of even a single house and driveway on a single lot can have large impacts on habitat fragmentation; on loss and fragmentation of farmland; on quality, volume, and patterns of surface water runoff and groundwater recharge; and on the scenic viewshed. A natural resource assessment would inform the applicant and town agencies about which parts of a site may be best suited to the proposed new uses, and which areas are best avoided. The model *Habitat Assessment Guidelines* developed by Hudsonia Ltd. could be adapted to New Lebanon's needs and provide a starting place for these assessments.

Conservation Advisory Council

The role of the New Lebanon Conservation Advisory Council (CAC), whose members are appointed by the Town Board, is to assist and advise town agencies on matters related to environmental conservation. The CAC is available to help the Planning Board review land development projects, and to conduct research on local policy. It provides educational materials to agencies and the public and carries out special projects such as the New Lebanon *Open Space Inventory* (Conservation Advisory Council 2014) and this *Natural Resources Conservation Plan*. The CAC webpage provides information for landowners and residents, and links to other resources (http://www.townofnewlebanon.com/conservation-advisory-council-cac/.

Other Non-Regulatory Measures

- Provide incentives to land use applicants for setting aside certain important areas of development sites for conservation purposes;
- Establish Best Management Practices to protect sensitive areas from specific activities such as logging, mining, and farming;
- Establish a funding program to help landowners relocate buildings and other structures and materials to places outside of floodplains;
- Adopt a requirement that "**green infrastructure**" be incorporated wherever possible and practical when town roads, bridges, driveways, and other kinds of infrastructure are being upgraded.

Both the Wyomanock Creek and the Kinderhook Creek have been named "designated inland waterways" under the NYS Waterfront Revitalization of Coastal Areas and Inland Waterways Act. This designation makes the Town of New Lebanon, the Corkscrew Rail Trail Association, the Shaker Swamp Conservancy, and other organizations eligible to apply for grants dedicated to waterway revitalization along those streams. Such grants (funded by the NYS Environmental Protection Fund) could help support a variety of efforts related to protection of the stream corridors.

Land Acquisition

Although the Town of New Lebanon may rarely have funds available for acquiring lands for conservation purposes, the town can nonetheless collaborate with other public and private entities to help with acquisition efforts for lands with special environmental, historic, agricultural, recreational, or scenic importance, or lands that are threatened by inappropriate development. A decision to purchase a property for conservation purposes requires assessing the conservation values of the property in relation to conservation goals and priorities, and determining the long-term capacity for stewardship of the property. Financial and other forms of collaboration with other agencies, organizations, businesses, and landowners can expand the opportunities for and success of land acquisition projects. The CAC will share this *NRCP* with the Columbia Land Conservancy and other land conservation agencies to help them evaluate and prioritize potential conservation lands, and design conservation easements with willing landowners.

Land donation is simply a form of land acquisition whereby the town or another entity such as a land trust receives a gift of land and becomes the immediate owner. As with land purchases, the decision to accept a land donation should be based on an assessment of the property's conservation values and the capacity of the receiving agency to assume the long-term stewardship costs.

Conservation Easements

A conservation easement is a legal agreement between a landowner and an entity such as a municipality or a land trust. The easement is developed by the landowner and the receiving agency (such as a land trust) for purposes of protecting certain aspects of the property in perpetuity. Typically the easement permanently restricts the type, location, and amount of development and types of land uses that can occur on the property so that conservation values recognized by both entities—such as wildlife habitat, scenic views, agricultural value, and water resources—are protected forever. An easement may be donated by the landowner to the receiving agency, or may be purchased from the landowner by the receiving agency.

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 easement "runs with the land;" that is, the responsibilities and restrictions in the easement are conveyed to all future owners of the property. In this way a conservation easement allows the current landowner to maintain ownership and use of the property, and secure a conservation legacy for future generations. Conservation easements with, e.g., the Columbia Land Conservancy are completely voluntary, are developed on the landowner's initiative, and are designed to meet the wishes and long-term needs of the landowner while adhering to the conservation principles of the land trust. Easements require regular (annual) monitoring to ensure that the terms of the land use agreement continue to be met. Several properties in New Lebanon have conservation easements held by the Columbia Land Conservancy (Figure 22).

Legislative Protections

Protection of Wetlands

Federal Wetland Regulatory Program

Section 404 of the federal Clean Water Act is the basis for the federal wetland regulatory program, which is administered by the US Army Corps of Engineers (ACOE), sometimes in consultation with the US Environmental Protection Agency and other federal agencies. The federal government regulates activities in wetlands of any size as long as the wetland is functionally connected to "navigable waters." The law prohibits certain kinds of activities (especially filling) in jurisdictional wetlands without a permit. It imposes no regulated buffer zone around a wetland, but federal agencies may specify such a zone in permit conditions if they so choose.

Decisions about jurisdiction (that is, which wetlands come under the federal jurisdictional purview) are made by the ACOE on a case-by-case basis. The criteria for federal jurisdiction are somewhat vague after US Supreme Court decisions in 2000 and 2006. In most situations, however, a wetland adjacent to a perennial stream, or adjacent to a stream that ordinarily runs continuously for the duration of a season (e.g., all winter or all spring) and is tributary to a perennial stream, is considered jurisdictional under the federal program. An isolated wetland or a wetland adjacent to an intermittent stream that runs only a few days or a few weeks of the year is often non-jurisdictional. According to Kusler (2001) 30-60 percent of the nation's wetlands are excluded from federal jurisdiction; the percentages vary greatly by location and can be much higher in landscapes where small wetlands are concentrated.

New York State Wetland Regulatory Program

The New York State Freshwater Wetlands Act (Article 24 of the New York Conservation Law) regulates the kinds of activities that can occur in and near large wetlands (12.4 acres and larger), and in a few smaller wetlands "of unusual local importance." The most typical instances of the latter are wetlands connected to a public drinking water supply, or wetlands known to support a state-listed Threatened or Endangered animal. The law also regulates activities in a 100-foot-wide "adjacent zone" around the perimeter of any jurisdictional wetland. Most wetlands in New York do not fall under state jurisdiction, however, because they do not meet the size criteria or the criteria for "unusual local importance."

Thus, due to their small size or hydrologic isolation, most of our intermittent woodland pools, isolated swamps, wet meadows, and other small, isolated wetlands receive no protection from the federal or state governments. Small, isolated wetlands can have great value for biodiversity and for water management, however. Indeed it is often those very characteristics—small size and hydrologic isolation—that impart their special value to certain plants or animals. In the case of intermittent woodland pools, for example, their isolation from streams and other wetlands helps to maintain the

fish-free environment that is a critical characteristic for the pool-breeding amphibians of conservation concern (Jefferson salamander, spotted salamander, marbled salamander, wood frog). For the time being, local legislation is the only means of legal protection of the many wetlands that do not fall under state or federal jurisdiction.

The New Lebanon zoning ordinance refers to New York State and federal wetland jurisdiction, but extends no additional local protection to small or isolated wetlands that are excluded from federal or state jurisdiction. .

Protection of Rare Species

The federal and New York State governments maintain lists of rare species, and have laws intended to prevent harm to individuals and populations of those species. Most places in the state have never been surveyed for rare species, however, so no one knows all the locations where rare species occur. Consequently, most land development takes place without anyone knowing whether or not rare species occur in the vicinity and will be harmed by the project.

Most species, however, are associated with particular kinds of habitats, so information on habitats can help to determine where particular species are likely to occur. For example, Loesel's twayblade is a rare plant of wetland habitats, so we can safely assume that they will not occur in an upland forest. Similarly, an eastern meadowlark is likely to nest in a large meadow, but not in a marsh; and a blue-spotted salamander is likely to spend most of the year in an upland forest but not in a meadow. Thus, a habitat assessment is one of the best tools for determining the likely occurrence of a rare species.

Below are brief descriptions of some of the federal, state, and local laws, policies, and procedures that can help to protect rare species and their habitats.

Federal Endangered Species Act

The Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884) prohibits unauthorized taking, possession, sale, and transport of federally-listed endangered or threatened species of plants and animals. The US Fish and Wildlife Service establishes and revises the list of plant and animal species deemed to be rare nationwide, and assigns a rank of "Endangered" or "Threatened" to each. Only a few species in New York are on the federal list.

New York State Environmental Conservation Law

Animals ranked as Endangered, Threatened, and Special Concern are listed and regulated under 6 NYCRR Part 182 of the New York Environmental Conservation Law (ECL) 11-0535. The regulations prohibit the taking of (or engaging in any activity likely to result in the taking of) any species listed as Endangered or Threatened in New York. The regulations also prohibit importing,

transporting, possessing, or selling "any endangered or threatened species of fish or wildlife, or any hide or part thereof..."

Plants ranked as Endangered, Threatened, Rare, or Exploitably Vulnerable are listed and regulated under Environmental Conservation Law section 9-1503 Part (f): "It is a violation for any person, anywhere in the state to pick, pluck, sever, remove, damage by the application of herbicides or defoliants, or carry away, without the consent of the owner, any protected plant." ("Exploitably Vulnerable" plants are not rare but are likely to be picked for commercial or personal purposes.) Thus, plants are considered the property of the landowner, and are protected only to the degree that the landowner wishes. Under NYS law, any landowner can lawfully remove, damage, or destroy (or grant permission to others to destroy) state-listed plants on their own property, but others are not permitted to harm those plants without the landowner's permission.

Protection of Other Resources – New Lebanon Local Code

Many provisions in New Lebanon's local code are intended to protect natural resources of conservation concern. Among the stated purposes of the zoning law (2010) that are related to natural resources are:

- To protect and enhance scenic vistas and the town's natural beauty and rural and small-town character;
- To preserve and protect the environment;
- To preserve farms and farmland;
- To promote health and the general welfare;
- To provide adequate light and air;
- To prevent the overcrowding of land;
- To encourage the most appropriate use of land throughout the town.

The list of purposes is intended to guide general land use planning and reviews of proposed development projects, and provide the underpinning for regulatory decisions around land use.

The New Lebanon code has an "incentive zoning" provision to encourage the preservation of open space and agricultural lands. It authorizes the Planning Board to allow greater lot density in exchange for one or more benefits related to active farmland or good farmland soils. In the Residential-Agricultural/Conservation District (RA-5), a conservation subdivision plan is specifically required when the parcel contains, in whole or in part, state and/or federal wetlands occupying 25% or more of the site, slopes of greater than 20% occupying 25% or more of the site; a floodplain or flood hazard area as mapped by the Federal Emergency Management Agency's Flood Insurance Maps; a critical environmental area; an identified scenic view or scenic vistas; or if the parcel is under a DEC Forestry Management Plan.

The ordinance also states that all development within the Residential-Agricultural/Conservation District should incorporate smart or "low-impact development" measures to reduce the impacts of new growth, such as limiting total impervious surface, retaining and incorporating natural site features that promote infiltration of stormwater, and use of bioretention, pervious surfaces, open space, surface water dispersion, soil restoration, and other dispersed facilities to control stormwater as close to the origin as possible.

Furthermore, the ordinance provides that "the appropriate board may specify the location of the building envelope, to preserve trees or other resources, take advantage of soil conditions, or make the development more rural in character. New buildings adjacent to significant historic structures should be designed to harmonize with the general architectural features of the historic structures. Major modifications to the existing landscape such as extensive grading, clear-cutting of trees, or other similar activities shall be avoided."

The zoning provisions for the Flood Zone Overlay are intended to protect the public health and safety by regulating development in areas subject to flooding, and are designed to control the alteration of natural floodplains, stream channels and natural protective barriers that help to accommodate floodwaters, and control filling, grading, dredging and other development which may increase erosion or flood damages.

The ordinance authorizes the Planning Board to allow or require a "conservation subdivision" design, incorporating clustering and open space preservation, in subdivision applications where the Planning Board believes that the purposes of the ordinance cannot be met under conventional subdivision methods.

All these provisions in the local code affirm the town's interest in protecting biological and water resources, farmland, and scenic resources. Adherence to the code and enforcement of these provisions will help to sustain the natural features that define the town and support its economy and culture. This *Natural Resources Conservation Plan* provides supporting information and recommendations to help achieve the purposes and goals of the town's comprehensive plan and zoning ordinance.

Conservation Partners

The effectiveness and breadth of the town's conservation efforts can be greatly extended by collaboration with other public and private entities with shared conservation goals. The success of this Plan depends on marshalling the efforts of active volunteers, willing landowners, and partner organizations and agencies in the town, county, region, and state. Potential partners include:

- State and county agencies
- Statewide and regional conservation organizations
- Regional land trusts
- Regional recreation organizations
- Large and small landowners
- Local businesses

State and County Agencies

New York State Department of Environmental Conservation (DEC)

The regional DEC office conducts ongoing reviews of potential land protection projects based on priorities identified in the New York 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 state-identified open space priorities in New Lebanon include areas along the Taconic ridge and NYS Route 22.

> **Taconic Ridge/Harlem Valley**
> An area comprising the Taconic Mountain Ridge and its viewsheds, where it straddles the New York, Connecticut, Massachusetts, and Vermont borders in Putnam, Dutchess, Columbia and Rensselaer counties, and the Harlem Valley. …Protection of this area continues to be a high priority due to the region's high biodiversity, presence of threatened and endangered species, scenic views, substantial recreational value, thousands of acres of intact/unfragmented forestland, steeply sloping hillsides, unique geologic segments, historic architecture, working farm landscapes, and multiple connection opportunities to land currently protected by the State, federal government, counties, towns and private land conservation organizations. The Taconic Ridge is a Forest Legacy Area and qualified to apply for land acquisition grants through the federal Forest Legacy Program. In 2013, DEC received a federal Forest Legacy Program grant for the purchase of a 1,300-acre conservation easement on Mount Lebanon, which contains some of the most spectacularly scenic, ecologically important and culturally significant resources found in the area. The easement will provide opportunities for public recreation, environmental education and archeological research.
>
> ….[A]cquisition of properties in the Taconic Ridge/Harlem Valley and Route 22 corridor will protect important open space, scenic viewsheds, working farm landscapes, and watersheds and water quality, and preserve critical wildlife habitat for several threatened and endangered species.
>
> Specific projects include the Shaker Swamp, an almost 500-acre wetland complex supporting high biodiversity and serving as an important aquifer recharge area; surrounding active farmland, formerly owned by the Shakers and regarded as historically significant….

> [B]ecause key portions of the area demonstrating high biodiversity, scenic views, recreational value, working forests and farmland, and potential connections to other protected lands remain unprotected, the Taconic Ridge/Harlem Valley and associated viewsheds continue to be high priorities for protection. In addition,… protection of the Route 22 corridor, which includes scenic vistas, highly productive farmland, and wetland habitat supporting endangered and threatened species, continue to be important considerations within the overall area. [p. 115]
>
> **Hand Hollow Conservation Area**
> This Columbia County property, which is the Town of New Lebanon's only public conservation area, now encompasses 434 acres, including a 21-acre lake, smaller ponds, perennial and seasonal streams, a great blue heron rookery, and more than 5 miles of public trails. There exists the potential to enhance this conservation area if a number of key parcels are acquired. These parcels would secure a portion of the lakefront and Hand Hollow watershed, as well as contribute to the overall habitat diversity by adding extensive areas of woodland and meadows, in addition to streams, upland ponds, and wetlands. [p. 119]

The DEC'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.

The **Hudson River Estuary Program** of the DEC has a strong interest in developing the capabilities of municipalities for conserving important resources. They offer education opportunities for municipal officials and grants to municipalities and nonprofit organizations for projects that advance local biodiversity conservation efforts. The Estuary Program prepared a "*Habitat Summary*" for the town (Strong 2010), and an Estuary Program grant has funded the preparation of this *Natural Resource Conservation Plan*. Other offices of the DEC can provide information and technical assistance with stream and lake monitoring, groundwater protection, and floodplain mapping.

New York State Department of State (DOS)

The 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.

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. A grant from the Greenway helped to fund the preparation of the New Lebanon *Comprehensive Plan* (2005).

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 US 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 and provide consultations and other services, and assist with obtaining funding for projects that enhance environmental quality or economic viability of farm-related enterprises.

Columbia County Environmental Management Council

The Columbia County Environmental Management Council (EMC) advises local and state government on matters related to use, protection, and conservation of natural resources. Members are representatives of the 18 towns and the City of Hudson appointed to two-year terms by the county Board of Supervisors.

Columbia County Agriculture and Farmland Protection Board

The Agriculture and Farmland Protection Board, a committee of 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* (2013).

Municipal Agencies

Neighboring towns can be valuable partners in land conservation, 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.

Statewide, Regional, and Local Conservation Organizations

Columbia Land Conservancy

The Columbia Land Conservancy's mission is to conserve the farmland, forests, wildlife habitat, and the rural character of the county, and to strengthen connections between people and the land. They own and manage the Hand Hollow Public Conservation Area in New Lebanon, and they hold conservation easements on several private parcels in the town. (Both the easement lands and the properties owned outright by the CLC remain on the local tax rolls.) The CLC also sponsors education programs for the public 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 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.

The Conservation Fund

The Conservation Fund is an environmental non-profit that works with local governments, businesses, landowners, and conservation NGOs on projects that integrate economic and environmental objectives. They are active in all 50 US states, providing funding, loans, training, and other assistance to help with land acquisition, strategic planning, and other initiatives for longterm conservation and the sustainable use of natural resources. They recently purchased a 23,000 acre forest in New York, Vermont, and Massachusetts to be managed as a working forest and eventually turned over to other entities for long-term conservation.

The Nature Conservancy

The Nature Conservancy (TNC) is an international land conservation organization that has worked extensively throughout the state to further land protection through partnerships with other organizations and agencies (e.g., DEC, Open Space Institute) and private landowners to protect and prevent further fragmentation of important ecosystems. TNC's conservation targets include protecting matrix forest blocks, wetlands and vernal pools, drinking water sources, rare and endangered plants and animals, and they have a particular interest in helping communities adapt to

climate change (www.nature.org/media/newyork/rw_070509_exec.pdf). TNC has designated the Berkshire-Taconic region as one of the world's "Last Great Places" in the world.

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 forests and 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 New Lebanon 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.

Shaker Swamp Conservancy

The Shaker Swamp Conservancy is an all-volunteer not-for-profit organization that works to discover the history of New Lebanon's Shaker Swamp and provide opportunities for public education and recreation. The Conservancy has recently purchased a parcel adjacent to the Shaker Swamp (not shown on Figure 21), and has plans to develop trails and other features for public access and education.

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 local, county, state and federal government agencies as well as other conservation organizations to achieve shared goals. The local chapter of TU is the Columbia-Greene Chapter #569 (Hudson). TU has an extensive network of volunteers that 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. Due to the presence of many small and large trout streams, the local TU chapter (Columbia-Greene, Hudson) might be well-positioned to obtain funding for projects to restore, enhance, or protect the habitat quality of New Lebanon's streams.

Trust for Public Land

The Trust for Public Land (TPL) is a nationwide conservation organization working 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.

Recreation Organizations

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 New Lebanon in building and maintaining biking trails should properties become available for these uses.

Corkscrew Rail Trail Association

The Corkscrew Rail Trail Association established and now manages the Corkscrew Rail Trail which now runs approximately 2.5 miles through private property in parts of Stephentown and New Lebanon. The organization partners with willing landowners and the community to support and enhance the trail.

Environmental Research and Education Organizations

Farmscape Ecology Program

The 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 many properties in New Lebanon—looking especially at farmland, floodplain forests, and the CLC public access lands—and, in an ongoing study of the plants and animals of important ecological communities throughout Columbia County, FEP and Hudsonia (see below) have explored several other sites in the town. The FEP has contributed much information on the plants, animals, and habitats of New Lebanon to this *Natural Resources Conservation Plan*. 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 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 people better understand how to recognize, assess, and protect important biological resources. Hudsonia also collaborated with the New Lebanon Conservation Advisory Council to prepare this *Natural Resources Conservation Plan*.

Local Businesses

Some local business owners have a deep personal appreciation for and commitment to the town and the region, and also recognize that their business success is closely tied to the town's natural and cultural environment. 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 are 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 New Lebanon 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 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, amateur naturalists, teachers, environmental engineers, landscape architects, and LEED-certified architects, often have a wealth of knowledge and expertise related to natural resources. Some have a strong personal interest in resource conservation and 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.

Native bee at domestic bee-balm.
Moy Wong © 2017

Conservation Action Plan

This *Natural Resources Conservation Plan* has identified features of special importance (e.g., floodplains, aquifers, good farmland soils, habitat areas, scenic areas) that should be protected wherever possible, as well as some basic conservation principles that can help to guide other decisions about land uses and town policies. Because most of the land in New Lebanon is now and will continue to be in private ownership, the most important component of this *Plan* is the voluntary actions of landowners.

The CAC has identified the following general conservation targets for the purposes of this *Natural Resources Conservation Plan*:

- Streams, floodplains, Active River Areas
- Unconsolidated aquifers
- Active farmland and good farmland soils
- High-elevation areas
- Large forests
- Large meadows
- Unusual and exemplary habitats and ecological communities
- Known locations of plants or animals listed as NYS Species of Greatest Conservation Concern
- Wetlands, lakes, and ponds
- Intact corridors linking large habitat areas
- Scenic areas
- Public recreational resources (existing and potential)

In general we recommend that the town aim to protect large areas representing all elevational gradients and significant land forms, with broad connectivity of intact habitat areas. This approach will help to maintain and protect important physical and biological elements in the present, and provide the greatest opportunities for adaptations and safe migration of wildlife and plants to suitable habitats in a changing environment.

The highest priority areas for conservation may be where multiple conservation targets overlap and are well-connected with formally protected lands, and other high-priority areas may be places with

one or more of those targets. But important natural resources occur throughout New Lebanon, so in addition to those "priority" areas, conservation actions can and should take place on every land parcel by the actions of landowners, developers, and municipal agencies, so that streams, groundwater, farmland, intact habitats, habitat corridors, and scenic vistas are well cared for throughout the town.

Below are some concrete actions that will help to accomplish the goals of this *Plan,* and can be carried out by landowners, other citizens, conservation organizations, and town government to help ensure that the most important natural resources and recreational features are maintained intact for present and future generations. The CAC encourages citizens, agencies, and commissions to review the action items in the *Town of New Lebanon Comprehensive Plan* for additional measures that will contribute to sound stewardship of the town's resources.

Landowner, Farmer, and Citizen Actions

1. Apply the *NRCP*'s general conservation measures (Appendix D) to lands throughout the town, where applicable.
2. Remove structures and hazardous substances from floodplains, and shift to flood-resilient land uses to minimize economic losses from flood damage, flood hazards to downstream areas, soil loss, and stream contamination. Some appropriate land uses are forests, hayfields, and pastures (without structures).
3. Maintain floodplain forests intact wherever possible, and especially the "ancient" floodplain forests that may never have been cleared.
4. Where possible, adopt wildlife-friendly agricultural practices that protect water supplies, build living soils, support native pollinators, and accommodate ground-nesting birds while maintaining efficiency and profitability for farm operations.
5. Minimize applications of polluting substances to the land, such as de-icing salts to driveways and walkways, and pesticides and fertilizers to lawns, gardens, and cropfields.
6. Complete a townwide survey of scenic locations throughout the town, so that they can be considered in land use planning and environmental reviews of land development projects.

Town Policy and Procedures

7. Apply the *NRCP*'s general conservation measures on lands throughout the town, where applicable.
8. Adopt habitat assessment guidelines for applicants, to help ensure that adequate natural resource information is provided to the Planning Board and Zoning Board of Appeals with land use proposals.

9. Consider impacts to water resources, sensitive habitats, good farmland soils, and important scenic and recreational resources at the sketch plan stage of reviewing land development projects.
10. Hold erosion control and stormwater management plans to a high standard, to ensure that soils are not lost and stormwater is conserved.
11. Discourage disturbance of floodplain forests, and especially the "ancient" floodplain forests (Figure 15) identified by the Farmscape Ecology Program.
12. Develop educational programs and materials for town agencies, landowners, business owners, famers, and residents on topics related to natural resource conservation. (See the CAC webpage for links to materials and information from other agencies and organizations in the region.)
13. Join the Complete Streets program to make roads convenient, safe, and efficient for all users, including pedestrians, bicyclists, and motorists.
14. Reduce applications of de-icing salts on town roads, and town-owned parking areas and driveways, and manage stormwater runoff from such areas to promote infiltration of water to the soils.
15. Apply lower assessment values to lands with active farms and with conservation easements.
16. Develop a program to collaborate with farmers in their efforts to reduce pollution of surface water and groundwater, and to assist with obtaining grants and other support to defray the costs of those efforts.
17. Manage town-owned lands in ways that exemplify sound conservation principles (e.g., buffer zones along streams, or bioretention installations to manage stormwater)

Town Legislation

18. Adopt design standards for all land development projects to ensure that harm to sensitive areas is minimized. Standards should address, at a minimum, landscape connectivity; design, sizing, and installation of culverts; exterior lighting; soil erosion; and stormwater management.
19. Adopt local legislation to extend protection to the small streams, and small, isolated wetlands (and buffer zones) that are of critical importance to ecosystems and water supplies but are not protected by state or federal laws.
20. Strengthen steep slope regulations in the local code to better address soil erosion, stormwater management, and protection of streams.
21. Establish an Aquifer Overlay District with regulations to help protect the areas most important for aquifer recharge and most vulnerable to groundwater contamination.

22. Establish a Mining Overlay District in areas of glacial outwash deposits, with requirements that the continued accessibility of sand and gravel resources be considered during reviews of land development projects.
23. Establish Critical Environmental Areas to draw attention to areas of special concern for water resources, farmland, biodiversity, recreation, and scenic values. (Zoning overlay districts may be appropriate for some of these features.)
24. Prohibit construction of new buildings, roads, driveways, and other structures in the 100-year floodplains of New Lebanon streams, and encourage the removal of structures, equipment, and materials that could interfere with natural flood dynamics, or create local or downstream hazards if flooded. (Expand this to the 500-year floodplain when FEMA data is available.)
25. Create local funding for land acquisition, purchase of conservation easements, and other measures that the town deems important for natural resource conservation.

Great blue heron nests in standing snags of beaver ponds, and forages in a variety of other wetlands, ponds, and streams. Moy Wong © 2017

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Appendices

Appendix A

Glossary

Glossary

Active River Area The area along a stream that is dynamically involved with the physical and ecological processes that drive and sustain the stream (Smith et al. 2008).

asl Above sea level.

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.

argillite A fine-grained compact rock derived from mudstone or shale.

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 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.

base flow (of a stream) The sustained flow of a stream in the absence of direct precipitation or surface runoff. Natural base flow is sustained largely by groundwater discharges (https://water.usgs.gov/edu/dictionary.html).

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.

borrow pit A place where surficial material (e.g., sand or gravel) is excavated for use as fill elsewhere. The term is often used for small excavations of material for onsite or nearby use.

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), and thus calcareous environments are generally circumneutral or alkaline.

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 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.

circumneutral Having a pH at or near 7.0 (approximately 6.6–7.3).

conifer forest A forest dominated by conifer trees; i.e., where conifer tree species constitute ≥75% of the forest canopy. Conifers are cone-bearing trees such as white pine, eastern hemlock, tamarack, and eastern red cedar. The native conifers in this region have needle-like or scale-like leaves and are evergreen—that is, they maintain their leaves year-round. An exception is tamarack, which sheds its leaves in the fall. See "deciduous forest" for comparison.

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.

dolomite The mineral calcium magnesium carbonate ($CaMg(CO_3)_2$).

dolostone A durable sedimentary rock composed primarily of dolomite (calcium magnesium carbonate); similar to limestone in appearance, hardness, solubility, and human uses.

NYSDEC New York State Department of Environmental Conservation

deciduous forest (Also called a "hardwood forest.") A forest dominated by deciduous trees; i.e., where deciduous tree species constitute ≥75% of the forest canopy. Deciduous trees are those that shed their leaves annually. In this region, deciduous trees include oaks, maples, ashes, cherries, beech, and many others. See "conifer forest" for comparison. (Tamarack is the unusual case of a deciduous conifer.)

drumlin A low, elongated hill of compact glacial till, with the long axis parallel to the path of the glacier (Case 1989)

ecological community A group of plants and animals occupying a habitat and interacting with each other and with the non-biological components (such as sunlight, air, water, and bedrock) of the habitat.

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.

enduring features The hills, valleys, bedrock, glacial deposits, and other parts of the landscape that resist change; these are the foundational features that are substantially unaffected by human land uses, wildfires, droughts, floods, hurricanes, climate change, and other significant events that alter the land surface.

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 the NRCP, the term "fen" refers to 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 (*Dasiphora fruticosa*), grass-of-parnassus (*Parnassia glauca*), bog goldenrod (*Solidago uliginosa*), and woolly-fruit sedge (*Carex lasiocarpa*).

flood attenuation The effects of storing and retaining floodwater and slowly releasing it to the groundwater, a stream, or other water body, thereby reducing the peak downstream flows.

floodplain The area bordering a stream that is subject to flooding.

forb A broad-leaved herbaceous (non-woody) plant. (Compare to "graminoid.")

gabion (As used here) a rock-filled wire container used as a building block for stabilizing slopes and stream banks.

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.

graminoid A grass-like plant. Graminoids includes grasses (Poaceae), sedges (Cyperaceae), and rushes (Juncaceae).

graywacke An impure gray sandstone.

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, as well as 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.

groundwater recharge The process by which water flows or percolates from the ground surface to an aquifer—an underground water-bearing formation in bedrock or loose material such as sand or gravel.

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.

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 roofs, pavement, or compacted soils 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 spinal 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.

kettle A depression in the ground surface formed by the melting of a stranded block of glacial ice that was buried or partially buried by outwash drift.

limestone A fine-grained sedimentary rock composed of calcium carbonate.

mainstem The primary segment of a river or stream, as contrasted to the tributaries that feed the stream.

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.

microhabitat A very localized habitat 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.

NGO Non-governmental organization.

non-point source pollution Pollution emanating from a diffuse source such as unchannelized runoff from a paved parking lot or an agricultural field.

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.

old growth forest A forest ecosystem that has attained great age (e.g., 150+ years) without significant disturbance from human activities such as cutting, soil disturbance, or intentional burning. These systems are variable in appearance, structure, and development history, but are often distinguished by old trees, diverse vertical and horizontal vegetation structure, and accumulations of large standing snags and downwood.

organic duff The accumulation of organic matter on the forest floor, usually in many stages of decay.

palustrine The term applied to nontidal wetlands, and tidal wetlands with salinity less than 0.5 parts per thousand.

perennial stream A stream that typically flows year-round.

phyllite A fine-grained metamorphic rock intermediate in grade between slate and schist (Fisher 2006).

pioneering plant species Plant species that are the first to colonize areas of stripped, disturbed, or damaged soils or other substrate.

point source pollution Pollution emanating from a single *point*, such as an industrial chimney or discharge pipe from a sewage treatment plant. (See non-point source pollution.)

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.

quartzite A hard and durable medium-grained metamorphic rock derived from sandstone.

reach (as in "stream reach") A segment of stream or river defined by geographic markers, such as river miles, natural features, or political boundaries.

resiliency As used in this document, the capacity to withstand, recover from, and adapt to stresses such as those imposed by floods or climate change.

riparian Within or adjacent to a stream or river.

riprap Layer of rock placed along streambanks or shoreline to prevent erosion.

sandstone A sedimentary rock composed of sand-size grains of cemented mineral and rock particles.

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: a list drawn up by the DEC that includes 1) species on the federal list of endangered or threatened species that occur in New York; 2) species listed as NYS endangered, threatened, or special concern; 3) species with 20 or fewer elemental occurrences in the New York Natural Heritage Program database, and 4) other species deemed by the DEC to be of greatest conservation need due to their status, distribution, and vulnerability.

shale A fine-grained thinly layered sedimentary rock derived from silt and clay.

slate A fine-grained metamorphic rock derived from shale.

spring Concentrated groundwater discharge to the ground surface (Compare with "seep.")

spring ephemeral wildflower A perennial wildflower of forests that blooms in the spring before deciduous trees have developed leaves.

surficial deposits Loose material transported and deposited over bedrock. Material may be transported by glaciers (glacial till, glacial outwash) or by moving water (alluvium).

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 typically dries up at some time during the growing season. (See "intermittent woodland pool" for comparison.)

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.

Appendix B

Plants and Animals of Columbia County and New Lebanon

Table B-1. Plants of conservation concern in New Lebanon. Observations are from the Farmscape Ecology Program, Hudsonia, and McVaugh (1957). Scientific nomenclature primarily follows Weldy et al. (2017).

Common Name	**Scientific Name**	**Regional Rank[1]**	**NYNHP State Rank[2]**
aster, late purple	*Symphyotrichum patens* var. *patens*	U	
avens, spring	*Geum vernum*	U	S2S3
avens, water	*Geum rivale*	U	
azalea, rosebud	*Rhododendron prinophyllum*	R?	
baneberry, red	*Actaea rubra*	S	
bartonia	*Bartonia virginica*	U	
bedstraw, bog	*Galium labradoricum*	U	
bedstraw, northern	*Galium boreale*	R?	
bellwort, large-flowered	*Uvularia grandiflora*	S?	
bladderwort, common	*Utricularia vulgaris* ssp. *macrorhiza*	R?	
bladderwort, hidden-fruit	*Utricularia geminiscapa*	U	S3
bladderwort, lesser	*Utricularia minor*	U	S3
bloodroot	*Sanguinaria canadensis*	U	
breeches, Dutchman's	*Dicentra cucullaria*	S?	
buckthorn, alderleaf	*Rhamnus alnifolia*	R	
bunchberry	*Cornus canadensis*	U	
bur-reed, narrowleaf	*Sparganium angustifolium*	U	S3S4
bush-clover, hairy	*Lespedeza hirta*	U	
bush-clover, violet	*Lespedeza frutescens*	U	S3
butternut	*Juglans cinerea*	U	
calla, wild	*Calla palustris*	R?	
cancer-root	*Orobanche uniflora*	R	
carpenter's-square	*Scrophularia marilandica*	U	
chestnut, American	*Castanea dentata*	U	
cinquefoil, shrubby	*Dasiphora fruticosa* ssp. *floribunda*	U	
clematis, purple	*Clematis occidentalis* var. *occidentalis*	R?	
clubmoss, stiff	*Spinulum annotinum*	U	
cohosh, blue	*Caulophyllum thalictroides*	S	
coneflower, cutleaf	*Rudbeckia laciniata* var. *laciniata*	S	
coontail, spiny	*Ceratophyllum echinatum*	U	S3
coral-root, early	*Corallorhiza trifida*	U	
corydalis, pale	*Corydalis sempervirens*	U	
cranberry, highbush	*Viburnum opulus* var. *americanum*	R	
cranberry, large	*Vaccinium macrocarpon*	S	
cranberry, small	*Vaccinium oxycoccos*	R?	
dogwood, alternate-leaf	*Cornus alternifolia*	U	
dogwood, roundleaf	*Cornus rugosa*	R?	

(continued)

Table B-1. (cont.)

Common Name	Scientific Name	Regional Rank[1]	NYNHP State Rank[2]
everlasting, sweet	*Pseudognaphalium obtusifolium*	U	
false-foxglove, smooth yellow	*Aureolaria flava* var. *flava*	U	
fern, bog	*Thelypteris simulata*	U	S3S4
fern, broad beech	*Phegopteris hexagonoptera*	S	
fern, fragile	*Cystopteris fragilis*	U	
fern, glade	*Diplazium pycnocarpon*	U	
fern, Goldie's wood	*Dryopteris goldiana*	U	
fern, long beech fern	*Phegopteris connectilis*	R	
fern, maidenhair	*Adiantum pedatum*	U	
fern, oak	*Gymnocarpium dryopteris*	R?	
fern, ostrich	*Matteuccia struthiopteris*	U	
fern, silvery glade	*Deparia acrostichoides*	R	
fern, walking	*Asplenium rhizophyllum*	S	
gentian, greater fringed	*Gentianopsis crinita*	S	
ginseng, American	*Panax quinquefolius*	R	S3S4
goldenrod, showy	*Solidago speciosa*	R	
goldthread	*Coptis trifolia*	U	
gooseberry, hairystem	*Ribes hirtellum*	S	
grapefern, cutleaf	*Botrychium dissectum*	R?	
grapefern, lanceleaf	*Botrychium lanceolatum* ssp. *angustisegmentum*	U	
green-violet	*Hybanthus concolor*	U	S3S4
hawthorn, fleshy	*Crataegus succulenta*	U	
hawthorn, scarlet	*Crataegus coccinea*	U	
hawthorn, waxyfruit	*Crataegus pruinosa*	U	
hawthorn, dotted	*Crataegus punctata*	U	
hedge-nettle, smooth	*Stachys tenuifolia*	U	
hickory, mockernut	*Carya alba*	U	
hobblebush	*Viburnum lantanoides*	R?	
honeysuckle, American fly	*Lonicera canadensis*	R	
honeysuckle, glaucous	*Lonicera dioica* var. *dioica*	S?	
honeysuckle, hairy	*Lonicera hirsuta*	U	
honeysuckle, mountain	*Lonicera villosa*	U	S3?
honeysuckle, trumpet	*Lonicera sempervirens*	R?	
horse-gentian, orangefruit	*Triosteum aurantiacum*	U	
horsetail, woodland	*Equisetum sylvaticum*	S	
jewelweed, pale	*Impatiens pallida*	U	
Joe-Pye weed, sweet-scented	*Eutrochium purpureum* var. *purpureum*	U	
Labrador-tea	*Rhododendron groenlandicum*	R	
lady's-slipper, greater yellow	*Cypripedium parviflorum* var. *pubescens*	R	S3
leatherleaf	*Chamaedaphne calyculata*	U	

(continued)

Table B-1. (cont.)

Common Name	Scientific Name	Regional Rank[1]	NYNHP State Rank[2]
leatherwood	*Dirca palustris*	R	
lily, Canada	*Lilium canadense* ssp. *canadense*	S	
lobelia, great blue	*Lobelia siphilitica*	U	
loosestrife, tufted	*Lysimachia thyrsiflora*	U	
lopseed	*Phryma leptostachya*	R	
mannagrass, American	*Glyceria grandis* var. *grandis*	R	
maple, mountain	*Acer spicatum*	S	
may-apple	*Podophyllum peltatum*	S	
melic, false	*Schizachne purpurascens*	U	
mermaidweed, false	*Floerkea proserpinacoides*	R	
milkkwort, purple	*Polygala sanguinea*	S?	
milkweed, poke	*Asclepias exaltata*	R?	
mountain-holly	*Nemopanthus mucronatus*	S	
orchid, fen	*Liparis loeselii*	U	
orchid, green fringed	*Platanthera lacera*	R?	
orchid, lesser purple fringed	*Platanthera psycodes*	R	
orchid, northern green	*Platanthera aquilonis*	U	
orchid, showy	*Galearis spectabilis*	R?	
orchid, small green wood	*Platanthera clavellata*	U	
pepper-bush, sweet	*Clethra alnifolia*	U	
pine, red	*Pinus resinosa*	U	
pinesap	*Monotropa hypopithys*	U	
pipsissewa	*Chimaphila umbellata* ssp. *cisatlantica*	S	
pogonia, rose	*Pogonia ophioglossoides*	R	
pondweed, bluntleaf	*Potamogeton obtusifolius*	U	
pondweed, ribbonleaf	*Potamogeton epihydrus*	U	
poplar, balsam	*Populus balsamifera* ssp. *balsamifera*	U	
rattlesnake-plantain, downy	*Goodyera pubescens*	S?	
rush, toad	*Juncus bufonius* var. *bufonius*	R?	
saxifrage, golden	*Chrysosplenium americanum*	U	
saxifrage, swamp	*Saxifraga pensylvanica*	U	
scouring-rush, variegated	*Equisetum variegatum* ssp. *variegatum*	U	
sedge, American woolly-fruit	*Carex lasiocarpa* ssp. *americana*	U	
sedge, cattail	*Carex typhina*	U	S2
sedge, Crawford's	*Carex crawfordii*	U	
sedge, Dewey	*Carex deweyana* var. *deweyana*	U	
sedge, drooping	*Carex prasina*	U	
sedge, fescue	*Carex festucacea*	U	
sedge, hairy-fruit	*Carex trichocarpa*	O?	
sedge, hay	*Carex argyrantha*	U	

(continued)

Table B-1. (cont.)

Common Name	Scientific Name	Regional Rank[1]	NYNHP State Rank[2]
sedge, Hitchcock's	*Carex hitchcockiana*	U	S3
sedge, inland	*Carex interior*	U	
sedge, Muhlenberg's	*Carex muehlenbergii* var. *muehlenbergii*	R?	
sedge, New England	*Carex novae-angliae*	U	
sedge, parasol	*Carex umbellata*	O?	
sedge, plantain-leaf	*Carex plantaginea*	R	
sedge, softleaf	*Carex disperma*	U	
sedge, Sprengel's	*Carex sprengelii*	R?	
sedge, three-seeded	*Carex trisperma*	U	
sedge, troublesome	*Carex molesta*	U	S2S3
sedge, twisted	*Carex torta*	U	
serviceberry, roundleaf	*Amelanchier sanguinea*	U	
snowberry, creeping	*Gaultheria hispidula*	R	
Solomon's-seal, giant	*Polygonatum biflorum*	S	
Solomon's-seal, starry	*Maianthemum stellatum*	U	
spikenard, American	*Aralia 4anadens* ssp. *racemosa*	R	
spleenwort, maidenhair	*Asplenium trichomanes* ssp. *trichomanes*	U	
spring-beauty, Carolina	*Claytonia caroliniana*	U	
squirrel-corn	*Dicentra canadensis*	U	
St. Johnswort, Fraser's marsh	*Triadenum fraseri*	U	
St. Johnswort, shrubby	*Hypericum prolificum*	U	S2
stitchwort, longleaf	*Stellaria longifolia*	U	
sumac, poison	*Toxicodendron vernix*	U	
sundew, roundleaf	*Drosera rotundifolia* var. *rotundifolia*	U	
sweetflag, American	*Acorus americanus*	U	
tamarack	*Larix laricina*	S	
toadflax	*Nuttallanthus canadensis*	U	
toothwort, large	*Cardamine maxima*	U	
twisted-stalk, rosy	*Streptopus lanceolatus*	U	
violet	*Viola blanda/pallens*	U	
violet, alpine	*Viola labradorica*	U	S3S5
violet, arrowleaf	*Viola sagittata* var. *ovata*	U	
violet, Canadian white	*Viola 4anadensis* var. *canadensis*	U	
violet, roundleaf yellow	*Viola rotundifolia*	R?	
violet, white	*Viola renifolia*	U	
watermeal, Columbian	*Rhododendron groenlandicum*	U	
water-willow	*Decodon verticillatus*	U	
wedgescale, slender	*Sphenopholis intermedia*	U	
wheatgrass, slender	*Elymus trachycaulus* ssp. *subsecundus*	U	
wild-rye, hairy	*Elymus villosus* var. *villosus*	U	

(continued)

Table B-1. (cont.)

Common Name	Scientific Name	Regional Rank[1]	NYNHP State Rank[2]
wild-rye, Virginia	*Elymus virginicus* var. *virginicus*	U	
willow, autumn	*Salix serissima*	S	
willow, bog	*Salix pedicellaris*	U	
willow, meadow	*Salix petiolaris*	U	
willow, silky	*Salix sericea*	U	
wintergreen, one-flowered	*Moneses uniflora*	U	
wintergreen, one-sided	*Orthilia secunda*	U	
wintergreen, spotted	*Chimaphila maculata*	U	
wood-sorrel, mountain	*Oxalis montana*	U	
yew, Canada	*Taxus canadensis*	S	

[1] Regional status assigned by Hudsonia and the Farmscape Ecology Program: U = regionally uncommon; S = regionally scarce; R = regionally rare (see Appendix C).
[2] New York Natural Heritage Program ranks (see Appendix C].

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. All butterflies listed here have been observed by FEP or their collaborators, except for those marked as "unseen but possible" or "regionally extinct" or "rare*"; the latter (rare with an asterisk) 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. Flight time and foods are from Cech and Tudor (2005); habitat is from Cech and Tudor and FEP's own observations. Species that seem to have experienced a net regional increase over the last 150 years are indicated by "up"; those which have apparently experienced a decline are indicated by "down"; the remaining species have shown no obvious trends. These assessments of population dynamics are based upon recently published butterfly faunas from the Northeast and a review of historical literature dating back to 1853.

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY HESPERIIDAE						
broken-dash, northern		rare		early June-mid Aug	panic grasses	oldfields
cloudywing, northern		occasional		late May - early July	clovers, other legumes	"scrubby fields"
cloudywing, southern		rare*	up	early June-mid July	legumes	open areas
dash, black		occasional		late April - early June	sedges	sedgy wetlands
dash, long		occasional		early June-early July; Aug	grasses	open grassy often moist
duskywing, Columbine		unseen but possible	down	May-June, July	columbine	alcareous ledges
duskywing, dreamy		rare*		mid-May - June	willows, aspen, black locust	open forest & edges
duskywing, Horace's		rare*		May, June, Sept	oaks	dry, open oak woods
duskywing, Juvenal's		common		late April-early June	oaks	open upland habitats, usually undisturbed
duskywing, mottled	S1, SGCN[HP†]	rare*	down	May-June, July-August	New Jersey tea	open, dry forest

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY HESPERIIDAE (cont.)						
duskywing, sleepy		unseen but possible		May	scrub oak	rocky balds, barrens
duskywing, wild indigo		occasional	up	May-Aug	wild indigo and vetch	in or near alfalfa fields
edge, hoary		rare*		June-July	legumes, e.g., tick trefoil	oldfield and field edges
glassywing, little		occasional	up	late June-July	purple top & ?? other grasses	oldfield, pasture
sachem		rare		vagrant; observed. once in Sept	wide range of grasses	In and near disturbed grassy area
skipper, arctic		rare		late May to Mid-June	grasses	grasses near forest
skipper, broadwing	S3	occasional	up	mid-July - Aug	reeds, sedges, wild rice	wet areas with *Phragmites*
skipper, cobweb		rare		May - June	bluestem	dry fields
skipper, common checkered		occasional	up	mid May - Sept	mallows	short, sparse fields & lawns
skipper, crossline		occasional		late June-early Aug	grasses	dry and moist fields
skipper, Delaware		rare	up	mainly July	little bluestem, switch grass, other grasses?	open habitats, dry or wet
skipper, dion		rare		July	sedges	wetlands
skipper, dun		occasional		July-Aug	sedges, maybe grasses	oldfields
skipper, dusted	S2S3	unseen but possible		May - June	bluestems	dry, open habitats
skipper, European		common	up	June-July	timothy, other introd grasses	fields

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY HESPERIIDAE (cont.)						
skipper, fiery		unseen but possible		Sept-Oct	grasses	sunny open uplands
skipper, Hobomok		common		late May - early July	grasses	oldfields
skipper, Indian		rare	up	May - June	grasses, including bluestem	dry, often shrubby, fields
skipper, least		common		June - Oct	grasses	Wet meadow, grassy marsh
skipper, Leonard's		rare	down	end of Aug/early Sept	native grasses such as little bluestem	dry upland grassland near wet area
skipper, Peck's		common		late May - Sept	grasses	fields
skipper, pepper & salt		rare		May - June	grasses	forest openings
skipper, roadside		rare*	down	late May-mid June	grasses	forest openings
skipper, silver-spotted		common		June-Aug	black locust	shrubby fields
skipper, tawny-edged		common	up	late May -mid July; early Aug - Sept	grasses	Grassy, often moist
skipper, two spotted		unseen but possible		late June-July	sedges, esp. 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

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY LYCAENIDAE						
azure, spring-summer		common		April-Sept	(lots)	mainly fields
blue, eastern tailed		common		May-Sept	legumes	open, disturbed low growth
blue, silvery		rare		April-June	legumes	openings in moist forest
copper, American		common		May-Sept	dock species	drier fields
copper, bog		unseen but possible	down	late June-July	cranberries	acidic wet meadows
copper, bronze		occasional		mid June-mid July; early Aug - mid Sept	docks	wetlands around ponds or streams
elfin, brown		unseen but possible	down	May	heath family (Ericaceae)	barrens, dry forest
elfin, eastern pine		rare		May-June	pines	near pine woods
hairstreak, Acadian		unseen but possible		July	willows	shrubby wet meadows and swamps
hairstreak, banded		occasional		May-Aug	oaks, hickories	edges, open habitats
hairstreak, coral		rare	up	June	cherries, plums	oldfield, second growth
hairstreak, early		unseen but possible	down	May-June, July-August	beechnuts	beech forests
hairstreak, Edward's	S3S4	unseen but possible		July	scrub oak	scrub oak forest, rocky barrens

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY LYCAENIDAE (cont.)						
hairstreak, gray		occasional		early May - mid June	various field/brush plants	open, weedy, disturbed habitats
hairstreak, hickory		occasional		late June-early Aug	hardwood trees	edges of rich, deciduous forests
hairstreak, juniper		rare		mid May - June; Aug	eastern red cedar	open uplands with red cedar
hairstreak, northern oak	S2S4, SGCN^{HP}	unseen but possible		June-July	oaks	oak forest
hairstreak, red-banded		rare	up	May-June; Aug-Sept	rotting leaves	open habitats
hairstreak, striped		rare		late June - mid July	roses, cherries, hawthorn, Ericacaeae, American hornbeam	forest openings and edges
hairstreak, white m	SU	rare	up	May, Sept	oaks	oak forest
harvester		rare		May-Sept	alder aphids	alder swamp
FAMILY NYMPHALIDAE						
admiral, red		occasional		May-Oct	nettles	moist forest and meadow, esp. floodplain forest
admiral, white		rare		mid June-early Aug; mid Aug-mid Sept	cherry	forests, edges, shrublands
brown, Appalachian		occasional		late June-Aug	sedges	forested wet areas, near sedges
brown, eyed		rare	down	late June-early Aug	sedges	sedgy habitats

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY NYMPHALIDAE (cont.)						
buckeye, common		occasional		July-Sept	plantains, Scrophulariaceae, vervains	open habitats with some bare ground
checkerspot, Baltimore		common		mid June-mid July	Turtlehead, English plantain	meadow
checkerspot, Harris'		rare*	down	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	up	3 flights, April – Sept?	elms, nettles	forest, especially floodplain forest
comma, green		unseen but possible		3 flights, April – Sept?	gooseberry, currant	"boreal woodlands"
comma, grey		rare		3 flights, April – Sept	gooseberry, currant	forest clearings
crescent, pearl		common		mid May-early Sept	asters	meadow
crescent, tawny	SH, SC	regionally extinct?	down	June-July	certain asters	rocky, scrubby areas
emperor, hackberry		rare	down	July-Aug	hackberry	floodplains with hackberry
emperor, tawny	S2S4	unseen but possible	down	July-Aug	hackberry	where hackberry

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY NYMPHALIDAE (cont.)						
eye, northern pearly		common		late June-early Aug	grasses	forests, often near water
fritillary, Aphrodite		rare		late June-early Sept	violets	Habitats on upland acidic soils, moist grasslands
fritillary, Atlantis		rare*	down	mid June-mid Sept	northern blue violet	forest openings
fritillary, great spangled		common		late June-early Sept	violets	forest edges
fritillary, meadow		common	down	May-Sept	violets	moist fields
fritillary, regal		regionally extinct?	down	late June-mid Sept	violets	extensive open areas with some wettness
fritillary, silver-bordered		rare*		June-Sept	wetland violets	overgrowing wet areas, marshes, bogs
fritillary, variegated		rare		July-Oct	violet, thyme, plaintain, purslane, others	open habitats
lady, American		occasional		mid May-late Oct	composites (asters, goldenrods, and related plants)	circa anywhere
lady, painted		common		May-Oct	various field plants	open habitats
mark, question		occasional		late June-Oct	elms	forests and edges
monarch		common		mid June-Sept	milkweeds	oldfields, edges
nymph, common wood		common		July-early Sept	grasses	meadows with shrubs or other tall vegetation
purple, red-spotted		occasional		mid June-early Aug; mid Aug-mid Sept	cherries	near deciduous, often moist forest

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY NYMPHALIDAE (cont.)						
ringlet, common		common	up	late May-early July; late July-Aug	grasses	oldfields
satyr, little wood		common		late May-early Aug	grasses	edges, forest openings
snout, American		rare		late June-mid Oct	hackberry	wooded stream edges
tortoiseshell, Compton		occasional		March-fall	birches, willows	forest openings and edges
tortoiseshell, Milbert's		occasional		mid June-Oct?	nettles	wet/moist habitats near forest
viceroy		common		late May-early Oct	willow	moist, shrubby habitats
FAMILY PAPILIONIDAE						
swallowtail, black		common	down	May-Sept	parsley, carrot, and 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, tuliptree, ash	near deciduous trees
swallowtail, giant		rare		May –Sept	rue family (Rutaceae)	various or semi-open habitats
swallowtail, pipevine		unseen but possible		June-early Oct	pipevine	gardens, rocky forested uplands
swallowtail, spicebush		occasional		May-Aug	spicebush	varied open habitats, usually near forest

(continued)

Table B-2. (cont.)

Common Name	Statewide Status†	Apparent Status in County*	Regional Trend	Flight Time	Caterpillar Food	Habitat
FAMILY PIERIDAE						
orange-tip, falcate		unseen but possible	down	May	mustards, rock cresses, two-leaved toothwort	"trap rock hills"
sulphur, clouded		common	up	May-mid Oct	legumes	open habitats
sulphur, cloudless		unseen but possible		Aug-Oct migrant	legumes	open habitats
sulphur, orange		common		mid May - early Oct	alfalfa, other legumes	open habitats, weedy, alfalfa fields
white, cabbage		common	up	May-Oct	Brassicaceae	pastures or cultivated meadows
white, checkered	S1, SC	unseen but possible	down	late Aug-Sept	Brassicaceae	weedy, open habitats
white, mustard		unseen but possible	down	as early as late April - Aug	mustards, e.g., *Dentaria, Arabis, Cardamine*	edges, streamside habitats, oldfields
white, West Virginia		rare	down	early April-late May	mainly *Dentaria, Arabis, Cardamine*	rich moist woods
yellow, little		rare	down	mid Aug-early Sept	legumes	meadows and waste areas
FAMILY RIONIDAE						
metalmark, northern		unseen but possible		July	round-leaved ragwort	limestone outcrops

† SGCN = NYS Species of Greatest Conservation Need; SC = NYS Species of Special Concern; S1, S2, S3, S4, SH SU= NYNHP ranks; see Appendix C for explanation of all..

Table B-3. Dragonflies and damselflies of New Lebanon and Columbia County.

Data are from the NYSDEC 2005-2009 statewide survey (White et al. 2010) and from observations by the Hawthorne Valley Farmscape Ecology Program (FEP). Statewide rarity ranks are explained in Appendix C. An asterisk indicates countywide rarity assigned by FEP. Shading indicates species observed by FEP in New Lebanon.

Common Name	**Scientific Name**	**Statewide status**	**Columbia Co rare or uncommon[1]**
amber-winged spreadwing	*Lestes eurinus*	S3S4	
American emerald	*Cordulia shurtleffii*		
American rubyspot	*Hetaerina americana*	S3	*
arrow clubtail	*Stylurus spiniceps*	SGCN, S3	*
ashy clubtail	*Gomphus lividus*		*
aurora damselfly	*Chromagrion furcillata*		
azure bluet	*Enallagma aspersum*		
banded pennant	*Celithemis fasciata*	S3	*
band-winged meadowhawk	*Sympetrum semicinctum*		
beaverpond baskettail	*Epitheca canis*		*
big bluet	*Enallagma durum*	S3	
black saddlebags	*Tramea lacerata*		
black-shouldered spinyleg	*Dromogomphus spinosus*		*
black-tipped darner	*Aeshna tuberculifera*		*
blue dasher	*Pachydiplax longipennis*		
blue-fronted dancer	*Argia apicalis*	S3	
boreal snaketail	*Ophiogomphus colubrinus*	SGCN[HP], S1	*
brook snaketail	*Ophiogomphus aspersus*	SGCN, S3	
brush-tipped emerald	*Somatochlora walshii*	S3	*
calico pennant	*Celithemis elisa*		
Canada darner	*Aeshna canadensis*		
chalk-fronted corporal	*Ladona julia*		
cherry-faced meadowhawk	*Sympetrum internum*		*
clamp-tailed emerald	*Somatochlora tenebrosa*		*
comet darner	*Anax longipes*	SGCN, S2S3	*
common baskettail	*Epitheca cynosura*		
common green darner	*Anax junius*		
common spreadwing	*Lestes disjunctus*		*
common whitetail	*Plathemis lydia*		
delta-spotted spiketail	*Cordulegaster diastatops*		*
dot-tailed whiteface	*Leucorrhinia intacta*		
double-striped bluet	*Enallagma basidens*	S3	

(continued)

Table B-3 (cont.)

Common Name	Scientific Name	Statewide status	Columbia Co rare or uncommon[1]
dragonhunter	*Hagenius brevistylus*		*
dusky clubtail	*Gomphus spicatus*		*
eastern amberwing	*Perithemis tenera*		
eastern forktail	*Ischnura verticalis*		
eastern pondhawk	*Erythemis simplicicollis*		
eastern red damselfly	*Amphiagrion saucium*		*
ebony jewelwing	*Calopteryx maculata*		
elegant spreadwing	*Lestes inaequalis*		*
familiar bluet	*Enallagma civile*		
fawn darner	*Boyeria vinosa*		*
four-spotted skimmer	*Libellula quadrimaculata*		*
fragile forktail	*Ischnura posita*		
frosted whiteface	*Leucorrhinia frigida*		*
green-striped darner	*Aeshna verticalis*		*
Hagen's bluet	*Enallagma hageni*		
Halloween pennant	*Celithemis eponina*		
harlequin darner	*Gomphaeschna furcillata*		*
harpoon clubtail	*Gomphus descriptus*	S3	*
Illinois river cruiser	*Macromia illinoiensis*		
Kennedy emerald	*Somatochlora kennedyi*	SNA	*
lancet clubtail	*Gomphus exilis*		
lance-tipped darner	*Aeshna constricta*		
least clubtail	*Stylogomphus albistylus*		
lilypad clubtail	*Arigomphus furcifer*	*	*
marsh bluet	*Enallagma ebrium*		*
mocha emerald	*Somatochlora linearis*	SGCN, S1	*
mustached clubtail	*Gomphus adelphus*	S2S3	*
northern bluet	*Enallagma annexum*		*
northern pygmy clubtail	*Lanthus parvulus*	S3	*
orange bluet	*Enallagma signatum*		
painted skimmer	*Libellula semifasciata*		
powdered dancer	*Argia moesta*		*
prince baskettail	*Epicordulia princeps*		*
racket-tailed emerald	*Dorocordulia libera*		*
red-waisted whiteface	*Leucorrhinia proxima*		*
riffle snaketail	*Ophiogomphus carolus*	S2S3	*
river jewelwing	*Calopteryx aequabilis*		*

(continued)

Table B-3 (cont.)

Common Name	Scientific Name	Statewide status	Columbia Co rare or uncommon[1]
ruby meadowhawk	*Sympetrum rubicundulum*	S3	
russet-tipped clubtail	*Stylurus plagiatus*	SGCN, S1	*
rusty snaketail	*Ophiogomphus rupinsulensis*		*
sedge sprite	*Nehalennia irene*		
shadow darner	*Aeshna umbrosa*		
skimming bluet	*Enallagma geminatum*		
slaty skimmer	*Libellula incesta*		
slender spreadwing	*Lestes rectangularis*		
southern spreadwing	*Lestes australis*	S2S3	*
spangled skimmer	*Libellula cyanea*		
sphagnum sprite	*Nehalennia gracilis*		*
spine-crowned clubtail	*Gomphus abbreviatus*	SGCN, S1	*
spotted spreadwing	*Lestes congener*		
spot-winged glider	*Pantala hymenaea*		*
stream bluet	*Enallagma exsulans*		
stream cruiser	*Didymops transversa*		*
superb jewelwing	*Calopteryx amata*	S3	*
swamp darner	*Epiaeschna heros*	S3	*
swamp spreadwing	*Lestes vigilax*		
sweetflag spreadwing	*Lestes forcipatus*		
tule bluet[2]	*Enallagma carunculatum*		*
turquoise bluet	*Enallagma divagans*	S3	*
twelve-spotted skimmer	*Libellula pulchella*		
twin-spotted spiketail	*Cordulegaster maculata*		*
umber shadowdragon	*Neurocordulia obsoleta*	SGCN, S1	*
unicorn clubtail	*Arigomphus villosipes*		*
variable dancer	*Argia fumipennis violacea*		
vesper bluet	*Enallagma vesperum*	S4	*
wandering glider	*Pantala flavescens*		
white-faced meadowhawk	*Sympetrum obtrusum*		*
widow skimmer	*Libellula luctuosa*		
yellow-legged meadowhawk	*Sympetrum vicinum*		*
zebra clubtail	*Stylurus scudderi*	S3	*

[1] An asterisk indicates a species known from five or fewer locations in the county (Conrad Vispo, pers. comm.).

[2] Occurrence of tule bluet in New Lebanon is uncertain.

Table B-4. Amphibians and reptiles of Columbia County, New York.

Occurrence data are from the New York State Reptile and Amphibian Atlas. Rarity ranks: E = NYS Endangered; T = NYS Threatened; SC = NYS Special Concern; SGCN = NYS Species of Greatest Conservation Need. (SGCN rank is noted only for species not assigned E, T, or SC.) Rarity ranks are explained in Appendix C.

Common Name	Scientific Name	Statewide Status	Habitats
SALAMANDERS			
mudpuppy	*Necturus maculosus*	SC	perennial stream
Jefferson salamander	*Ambystoma jeffersonianum*	SC	vernal pool, upland forest
blue-spotted salamander	*Ambystoma laterale*	SC	swamp, vernal pool, upland forest
spotted salamander	*Ambystoma maculatum*		vernal pool, upland forest
marbled salamander	*Ambystoma opacum*	SC	vernal pool, upland forest
eastern newt	*Notophthalmus viridescens*		perennial pond, other wetland, upland forest
northern dusky salamander	*Desmognathus fuscus*		cool stream
Allegheny mountain dusky salamander	*Desmognathus ochrophaeus*		cool stream
northern two-lined salamander	*Eurycea bislineata*		small forested stream
spring salamander	*Gyrinophilus porphyriticus*		rocky stream, forested seep
four-toed salamander	*Hemidactylium scutatum*	SGCN^{HP}	swamp, upland forest
eastern red-backed salamander	*Plethodon cinereus*		upland forest
northern slimy salamander	*Plethodon glutinosus*		talus, upland forest
TOADS & FROGS			
American toad	*Bufo americanus*		everywhere
Fowler's toad	*Bufo fowleri*	SGCN	sandy or rocky forest
gray treefrog	*Hyla versicolor*		shallow pool, upland forest
spring peeper	*Pseudacris crucifer*		upland forest, wetland
bullfrog	*Rana catesbeiana*		forest, meadow
green frog	*Rana clamitans*		pond, marsh
pickerel frog	*Rana palustris*		meadow, forest, wetland
northern leopard frog	*Rana pipiens*		pond, marsh, meadow
wood frog	*Rana sylvatica*		vernal pool, upland forest

(continued)

Table B-4. (cont.)

Common Name	Scientific Name	Statewide Status	Habitats
TURTLES			
snapping turtle	*Chelydra serpentina*	SGCN	pond, lake, wetland, meadow
musk turtle (stinkpot)	*Sternotherus odoratum*	SGCN^{HP}	stream, lake
painted turtle	*Chrysemys picta*		pond, marsh, stream
spotted turtle	*Clemmys guttata*	SC	wetland, upland forest
wood turtle	*Glyptemys insculpta*	SC	perennial stream, upland forest, meadow
bog turtle	*Glyptemys muhlenbergii*	E	fen, nearby wetland
northern map turtle	*Graptemys geographica*	SGCN	Hudson River
eastern box turtle	*Terrapene carolina*	SC	upland forest, meadow
SNAKES			
eastern racer	*Coluber constrictor*	SGCN	forest, meadow, ledge, talus
ring-necked snake	*Diadophis punctatus*		forest, forest opening
eastern ratsnake	*Elaphe alleghaniensis*	SGCN	forest, ledge, talus
milksnake	*Lampropeltis triangulum*		meadow, forest, barnyard
smooth greensnake	*Liochlorophis vernalis*	SGCN	wet meadow, other wetland, open forest
northern watersnake	*Nerodia sipedon*		pond, lake, wetland, stream
Dekay's brownsnake	*Storeria dekayi*		forest, meadow, wetland, yard
red-bellied snake	*Storeria occipitomaculata*		forest, meadow, wetland, yard
eastern ribbonsnake	*Thamnophis sauritus*	SGCN	open wetland
common gartersnake	*Thamnophis sirtalis*		everywhere
copperhead	*Agkistrodon contortrix*	SGCN	forest, ledge, meadow
timber rattlesnake	*Crotalus horridus*	T	forest, meadow, ledge, talus

Table B-5. Inland fishes of Columbia County, New York.

Data are mainly from the New York State Fish Atlas, 1934-2011, reviewed and updated by Robert E. Schmidt. Hudson River fishes are excluded unless they also inhabit non-tidal waterbodies of Columbia County. NYS Species of Greatest Conservation Need (SGCN) listing is explained in Appendix C. Columbia County status assigned by Hudsonia: C = common; U = uncommon; R = rare; E = extirpated.

Common Name	Scientific Name	Native? (Yes/No)	Statewide Status	County Status	Streams	Ponds/ Lakes
alewife	*Alosa pseudoharengus*	Y	SGCN	U	x	x
American eel	*Anguilla rostrata*	Y	SGCN[HP]	C	x	x
banded killifish	*Fundulus diaphanus*	Y		U	x	x
black crappie	*Pomoxis nigromaculatus*	N		U	x	x
blueback herring	*Alosa aestivalis*	Y	SGCN	U		
bluegill	*Lepomis macrochirus*	N		U	x	x
bluntnose minnow	*Pimephales notatus*	Y		U	x	x
bridle shiner	*Notropis bifrenatus*	Y	SGCN	E	x	x
brook silverside	*Labidesthes sicculus*	N		R	x	
brook trout	*Salvelinus fontinalis*	Y		U	x	x
brown bullhead	*Ameiurus nebulosus*	Y	SGCN	U	x	x
brown trout	*Salmo trutta*	N		C	x	x
central mudminnow	*Umbra limi*	N		R	x	
chain pickerel	*Esox niger*	Y		U	x	x
channel catfish	*Ictalurus punctatus*	N		U		x
cisco	*Coregonus artedi*	N	SGCN	R		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
cutlip minnow	*Exoglossum maxillingua*	Y		U	x	
eastern blacknose dace	*Rhinichthys atratulus*	Y		C	x	x
eastern creek chubsucker	*Erimyzon oblongus*	Y		R	x	x
eastern silvery minnow	*Hybognathus regius*	Y		R	x	
emerald shiner	*Notropis atherinoides*	N		R	x	x
fallfish	*Semotilus corporalis*	Y		C	x	x
fathead minnow	*Pimephales promelas*	N		U	x	x
fourspine stickleback	*Apeltes quadracus*	Y	SGCN[HP]	U	x	x
gizzard shad	*Dorosoma cepedianum*	N		U	x	
golden shiner	*Notemigonus crysoleucas*	Y		C	x	x
goldfish	*Carassius auratus*	N		U	x	x
grass carp	*Ctenopharyngodon idella*	N		U		x

(continued)

Table B-5. (cont.)

Common Name	Scientific Name	Native (Yes/No)	Statewide Status	County Status	Streams	Ponds/ Lakes
green sunfish	*Lepomis cyanellus*	N		U	x	x
largemouth bass	*Micropterus salmoides*	N		U	x	x
longnose dace	*Rhinichthys cataractae*	Y		U	x	
longnose sucker	*Catostomus catostomus*	Y	SGCN	R	x	
mummichog	*Fundulus heteroclitus*	Y	SGCN	C	x	x
northern hog sucker	*Hypentelium nigricans*	Y		U	x	
northern pike	*Esox lucius*	N		R	x	x
pumpkinseed	*Lepomis gibbosus*	Y		U	x	x
rainbow trout	*Oncorhynchus mykiss*	N		R	x	x
redbreast sunfish	*Lepomis auritus*	Y		C	x	x
redfin pickerel	*Esox americanus americanus*	Y		U	x	
rock bass	*Ambloplites rupestris*	N		U	x	x
rudd	*Scardinius erythrophthalmus*	N		R	x	x
satinfin shiner	*Cyprinella analostana*	Y		R	x	
sea lamprey	*Petromyzon marinus*	Y		R	x	
slimy sculpin	*Cottus cognatus*	Y		R	x	
smallmouth bass	*Micropterus dolomieu*	N		C	x	x
splake	*Salvelinus fontinalis* x *namaycush*	N		C		x
spotfin shiner	*Cyprinella spiloptera*	Y		U	x	x
spottail shiner	*Notropis hudsonius*	Y		C	x	
tadpole madtom	*Noturus gyrinus*	Y		E	x	
tessellated darter	*Etheostoma olmstedi*	Y		C	x	x
tiger musky	*Esox lucius* x *masquinongy*	N		C		x
walleye	*Sander vitreus*	N		R	x	x
white catfish	*Ameiurus catus*	Y		R		x
white crappie	*Pomoxis annularis*	N		R		x
white perch	*Morone americana*	Y		U	x	x
white sucker	*Catostomus commersonii*	Y		C	x	x
yellow bullhead	*Ameiurus natalis*	Y		C	x	x
yellow perch	*Perca flavescens*	Y		U	x	x

Table B-6. Columbia County breeding birds of conservation concern.

Data are from the NYS Breeding Bird Atlas (BBA) (Andrle and Carroll 1988, McGowan and Corwin 2008). Bird species reported in either BBA survey from survey blocks that were more than 50% in New Lebanon are shaded. Rarity ranks (NYNHP and NYS) and the Audubon New York Hudson Valley Priority Bird List are explained in Appendix C.

Group	Species	NYNHP rank[1]	NYS rank[2]	Audubon Priority List (A)	BBA 1980-85[3]	BBA 2000-05[3]	Trend[4]
GREBES	pied-billed grebe	S3B, S1N	T	A	y	y	s
HERONS	American bittern		SC	A	y	y	s
	least bittern	S3B, S1N	T	A	y	y	i
WATERFOWL	American black duck		SGCN[HP]		y	y	d
	blue-winged teal		SGCN		y	n	d
RAPTORS	bald eagle	S2S3B, S2N	T	A	n	y	i
	northern harrier	S3B, S3N	T	A	y	y	s
	sharp-shinned hawk			A	y	y	s
	Cooper's hawk			A	y	y	i
	northern goshawk		SC	A	n	y	s
	red-shouldered hawk		SC	A	n	y	s
	broad-winged hawk			A	y	y	s
	American kestrel		SGCN	A	y	y	d
	peregrine falcon	S3B	E	A	n	y	i
GALLINACEOUS BIRDS	ruffed grouse		SGCN		y	y	d
	northern bobwhite		SGCN[HP]		y	y	s
	American woodcock		SGCN	A	y	y	d
CUCKOOS	black-billed cuckoo		SGCN	A	y	y	s
OWLS	barn owl	S1S2	SGCN[HP]		y	n	d
	northern saw-whet owl			A	y	n	d
NIGHTJARS	whip-poor-will	S3B	SC	A	y	y	d
SWIFTS	chimney swift			A	y	y	s
KINGFISHERS	belted kingfisher			A	y	y	s

(continued)

Table B-6. (cont.)

Group	Species	NYNHP[1]	NYS rank[2]		BBA 1980-85[3]	BBA 2000-05[3]	Trend[4]
WOODPECKERS	red-headed woodpecker	S2?B	SC	A	n	y	i
	downy woodpecker			A	y	y	s
	northern flicker			A	y	y	s
PERCHING BIRDS	eastern wood-pewee			A	y	y	s
	willow flycatcher			A	y	y	i
	eastern kingbird			A	y	y	s
	blue-headed vireo			A	y	y	s
	yellow-throated vireo			A	y	y	s
	horned lark		SC	A	y	n	d
	purple martin			A	y	n	d
	marsh wren			A	y	y	s
	veery			A	y	y	s
	wood thrush		SGCN	A	y	y	s
	brown thrasher		SGCN[HP]	A	y	y	d
	blue-winged warbler		SGCN	A	y	y	s
	golden-winged warbler		SC	A	y	y	d
	magnolia warbler			A	y	y	i
	black-throated blue warbler		SGCN	A	y	y	i
	black-throated green warbler			A	y	y	i
	Blackburnian warbler			A	y	y	s
	prairie warbler		SGCN	A	y	y	s
	cerulean warbler		SC	A	n	y	i
	black-and-white warbler			A	y	y	s
	American redstart			A	y	y	s
	worm-eating warbler		SGCN	A	y	y	i
	Louisiana waterthrush		SGCN	A	y	y	s

(continued)

Table B-6. (cont.)

Group	Species	NYNHP[1]	NYS rank[2]		BBA 1980-85[3]	BBA 2000-05[3]	Trend[4]
PERCHING BIRDS (cont.)	hooded warbler			A	n	y	i
	Canada warbler		SGCN^{HP}	A	y	y	d
	scarlet tanager		SGCN	A	y	y	s
	eastern towhee			A	y	y	s
	field sparrow			A	y	y	d
	vesper sparrow		SC	A	y	y	d
	savannah sparrow			A	y	y	s
	grasshopper sparrow		SC	A	y	y	s
	white-throated sparrow			A	y	y	d
	rose-breasted grosbeak			A	y	y	s
	indigo bunting			A	y	y	s
	bobolink		SGCN^{HP}	A	y	y	s
	eastern meadowlark		SGCN^{HP}	A	y	y	d
	Baltimore oriole			A	y	y	d
	purple finch			A	y	y	s

[1] New York Natural Heritage Program ranks are explained in Appendix C.

[2] 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, T, or SC .)

[3] NYS Breeding Bird Atlas data for survey periods 1980-85 and 2000-05: y = recorded in Columbia County; n = not recorded in Columbia County

[4] Trend in BBA data between the two survey periods: I = increasing; d = declining; s = similar; ? = trend uncertain

Table B-7. Mammals of Columbia County, New York.

Occurrence data from Whitaker (in prep), Hawthorne Valley Farmscape Ecology Program, and Hudsonia Ltd.

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*	
water shrew[2]	*Sorex palustris*	
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
hoary bat	*Lasiurus cinereus*	SGCN
Indiana bat[1]	*Myotis sodalis*	E
little brown bat	*Myotis lucifugus*	SGCN[HP]
northern long-eared bat	*Myotis septentrionalis*	T
silver-haired bat	*Lasionycteris noctivagans*	SGCN
tri-colored bat	*Perimyotis subflavus*	SGCN[HP]
CARNIVORES		
black bear	*Ursus americanus*	Reg-S
raccoon	*Procyon lotor*	
ermine	*Mustela erminea*	
fisher	*Martes pennanti*	
long-tailed weasel	*Mustela frenata*	
mink	*Mustela vison*	
river otter	*Lutra canadensis*	Reg-U
striped skunk	*Mephitis mephitis*	
eastern coyote	*Canis latrans*	
gray fox	*Urocyon cinereoargenteus*	
red fox	*Vulpes vulpes*	
bobcat	*Lynx rufus*	

(continued)

Table B-7. (cont.)

Common Name	Scientific Name	Status[1]
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*	
American beaver	*Castor canadensis*	
deer mouse	*Peromyscus maniculatus gracilis*	
white-footed mouse	*Peromyscus leucopus*	
southern bog lemming[2]	*Synaptomys cooperi*	Reg-R
meadow vole	*Microtus pennsylvanicus*	
southern red-backed vole	*Clethrionomys gapperi*	Reg-S
woodland vole	*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*	Reg-R
common porcupine	*Erethizon dorsatum*	Reg-U
HARES & RABBITS		
snowshoe hare	*Lepus americanus*	Reg-U
eastern cottontail	*Sylvilagus floridanus*	
New England cottontail	*Sylvilagus transitionalis*	SC
HOOFED MAMMALS		
white-tailed deer	*Odocoileus virginianus*	
moose[3]	*Alces alces*	SGCN

[1] Rarity status in New York State or the Hudson Valley region: E=NYS Endangered; T=NYS Threatened; SC=NYS Special Concern; SGCN= NYS Species of Greatest Conservation Need (HP = high priority SGCN); Reg=regional rank: R=rare; S=scarce; U=uncommon. (See Appendix C for explanation of rarity ranks.)

[2] Occurrence in Columbia County is uncertain.

[3] Not known to breed in Columbia County.

Table B-8. Vascular plants mentioned in the Natural Resource Conservation Plan. Scientific nomenclature follows Weldy et al. 2017.

Common Name	Scientific Name	Common Name	Scientific Name
alder	*Alnus*	cliffbrake, purple-stemmed	*Pellaea atropurpurea*
arrow-arum	*Peltandra virginica*	cliffbrake, smooth	*Pellaea glabella* ssp. *glabella*
arrowhead, broadleaved	*Sagittaria latifolia*	cohosh, blue	*Caulophyllum thalictroides*
ash	*Fraxinus*	columbine, wild	*Aquilegia canadensis*
ash, black	*Fraxinus nigra*	corydalis, pale	*Corydalis sempervirens*
ash, green	*Fraxinus pennsylvanica*	cranberry, large	*Vaccinium macrocarpon*
ash, white	*Fraxinus americana*	dodder, field	*Cuscuta campestris*
aster, late purple	*Symphyotrichum patens* var. *patens*	dogbanes	*Apocynum*
avens, spring	*Geum vernum*	duckweed	*Lemna* or *Spirodela*
barberry, Japanese	*Berberis thunbergii*	elder, red-berried	*Sambucus racemosa* var. *racemosa*
basswood, American	*Tilia americana* var. *americana*	fern, fragile	*Cystopteris fragilis*
bee-balm, domestic	*Monarda*	fern, northern maidenhair	*Adiantum pedatum*
beech, American	*Fagus grandifolia*	fern, walking	*Asplenium rhizophyllum*
beech-drops	*Epifagus virginiana*	gaywings	*Polygala paucifolia*
birch	*Betula*	ginger, wild	*Asarum canadense*
birch, yellow	*Betula alleghaniensis*	ginseng, American	*Panax quinquefolius*
bladdernut	*Staphylea trifolia*	golden-saxifrage, American	*Chrysosplenium americanum*
bladderwort, hidden-fruit	*Utricularia geminiscapa*	goldenseal	*Hydrastis canadensis*
bloodroot	*Sanguinaria canadensis*	hairgrass, common	*Avenella flexuosa*
blueberry, early lowbush	*Vaccinium angustifolium*	hemlock, eastern	*Tsuga canadensis*
blueberry, late lowbush	*Vaccinium pallidum*	hepatica	*Hepatica*
bluestem, little	*Schizachyrium scoparium* var. *scoparium*	hickory, shagbark	*Carya ovata*
breeches, Dutchman's	*Dicentra cucullaria*	hobblebush	*Viburnum lantanoides*
buckthorn, common	*Rhamnus cathartica*	honeysuckle, Bell's	*Lonicera* × *bella*
bur-reed	*Sparganium*	horsetail, variegated	*Equisetum variegatum*
bush-clover, violet	*Lespedeza frutescens*	knotweed, Japanese	*Fallopia japonica*
bush-honeysuckle, northern	*Diervilla lonicera*	knotweed, slender	*Polygonum tenue*
butternut	*Juglans cinerea*	lady's-slipper, yellow	*Cypripedium parviflorum* var. *pubescens*
buttonbush, common	*Cephalanthus occidentalis*	leatherleaf	*Chamaedaphne calyculata*
canary-grass, reed	*Phalaris arundinacea*	leatherwood, eastern	*Dirca palustris*
cattail	*Typha*	locust, black	*Robinia pseudoacacia*
cedar, eastern red	*Juniperus virginiana* var. *virginiana*	loosestrife, purple	*Lythrum salicaria*
chestnut, American	*Castanea dentata*	maple, mountain	*Acer spicatum*

(continued)

Table B-8. (cont.)

Common Name	Scientific Name	Common Name	Scientific Name
maple, red	*Acer rubrum* var. *rubrum*	sedge, Davis'	*Carex davisii*
maple, striped	*Acer pensylvanicum*	sedge, false hop	*Carex lupuliformis*
maple, sugar	*Acer saccharum* var. *saccharum*	sedge, Pennsylvania	*Carex pensylvanica*
marsh-marigold	*Caltha palustris*	sedge, tussock	*Carex stricta*
may-apple	*Podophyllum peltatum*	Solomon's seal, starry	*Maianthemum stellatum*
mile-a-minute-weed	*Persicaria perfoliata*	spikenard, American	*Aralia racemosa* ssp. *racemosa*
milkweeds	*Asclepias*	spleenwort, ebony	*Asplenium platyneuron* var. *platyneuron*
milkwort, purple	*Polygala sanguinea*	spleenwort, maidenhair	*Asplenium trichomanes* ssp. *trichomanes*
nettle, American stinging	*Urtica dioica* ssp. *gracilis*	spleenwort, mountain	*Asplenium montanum*
oak	*Quercus*	spring-beauty, Virginia	*Claytonia virginica* var. *virginica*
oak, chestnut	*Quercus montana*	squirrel-corn	*Dicentra canadensis*
oak, red	*Quercus rubra*	stiltgrass, Japanese	*Microstegium vimineum*
oak, scrub	*Quercus ilicifolia*	sundew, round-leaved	*Drosera rotundifolia* var. *rotundifolia*
pine	*Pinus*	swallow-wort, black	*Cynanchum louiseae*
pine, eastern white	*Pinus strobus*	tamarack	*Larix*
pinweed, slender	*Lechea tenuifolia*	toothwort, cut-leaved	*Cardamine concatenata*
pitcher-plant	*Sarracenia purpurea*	toothwort, two-leaved	*Cardamine diphylla*
pogonia, rose	*Pogonia ophioglossoides*	tree-of-heaven	*Ailanthus altissima*
polypody, rock	*Polypodium virginianum*	twayblade, Loesel's	*Liparis loeselii*
pond-lily	*Nuphar* or *Nymphaea*	violet, Canada	*Viola canadensis* var. *canadensis*
prickly-ash, American	*Zanthoxylum americanum*	wall-rue	*Asplenium ruta-muraria*
ragweed, common	*Ambrosia artemisiifolia*	water-chestnut	*Trapa natans*
rattlebox	*Crotalaria sagittalis*	water-lily, fragrant	*Nymphaea odorata* ssp. *odorata*
reed, European common	*Phragmites australis*	watermilfoil, Eurasian	*Myriophyllum spicatum*
rose, multiflora	*Rosa multiflora*	water-plantain, broad-leaved	*Alisma subcordatum*
sarsaparilla, bristly	*Aralia hispida*	water-shield	*Brasenia schreberi*
sedge, brome-like	*Carex bromoides* ssp. *bromoides*	water-willow	*Decodon verticillatus*
sedge, cattail	*Carex typhina*	witch-hazel, American	*Hamamelis virginiana*
sedge, clustered	*Carex cumulata*	yew, Canada	*Taxus canadensis*

Appendix C

Explanation of Rarity Ranks

Explanation of Rarity Ranks

This section explains the federal, state, and regional rarity ranks used in the Natural Resources Conservation Plan. The New York legal status information is reproduced here from the New York Natural Heritage Program website at http://www.acris.nynhp.org/ranks.php, accessed in March 2017. The SGCN information was obtained from the Hudson River Estuary Wildlife and Habitat Conservation Strategy (Penhollow et al. 2005), and updated with the revised list in the New York State Wildlife Action Plan (NYSDEC 2015). The regional status information was obtained from Kiviat and Stevens (2001). The Audubon New York priority bird list was obtained from the Audubon New York website at (http://ny.audubon.org/conservation/hudson-river-valley-conservation)

NY LEGAL STATUS - Animals
Categories of Endangered and Threatened species are defined in New York State Environmental Conservation Law section 11-0535. Endangered, Threatened, and Special Concern species are listed in regulation 6NYCRR 182.5.

E - Endangered Species: any species which meet one of the following criteria:

- Any native species in imminent danger of extirpation or extinction in New York.
- Any species listed as endangered by the United States Department of the Interior, as enumerated in the Code of Federal Regulations 50 CFR 17.11.

T - Threatened Species: any species which meet one of the following criteria:

- Any native species likely to become an endangered species within the foreseeable future in NY.
- Any species listed as threatened by the U.S. Department of the Interior, as enumerated in the Code of the Federal Regulations 50 CFR 17.11.

SC - Special Concern Species: those species which are not yet recognized as endangered or threatened, but for which documented concern exists for their continued welfare in New York.

P - Protected Wildlife (defined in Environmental Conservation Law section 11-0103): wild game, protected wild birds, and endangered species of wildlife.

U - Unprotected (defined in Environmental Conservation Law section 11-0103): the species may be taken at any time without limit; however a license to take may be required.
G - Game (defined in Environmental Conservation Law section 11-0103): any of a variety of big game or small game species as stated in the Environmental Conservation Law; many normally have an open season for at least part of the year, and are protected at other times.

(continued)

NY LEGAL STATUS – Plants
The following categories are defined in regulation 6NYCRR part 193.3 and apply to NYS Environmental Conservation Law section 9- 1503.

E – Endangered Species: listed species are those with:
- 5 or fewer extant sites, or
- fewer than 1,000 individuals, or
- restricted to fewer than 4 U.S.G.S. 7 ½ minute topographical maps, or
- species listed as endangered by U.S. Department of Interior, as enumerated in Code of Federal Regulations 50 CFR 17.11.

T – Threatened: listed species are those with:
- 6 to fewer than 20 extant sites, or
- 1,000 to fewer than 3,000 individuals, or
- restricted to not less than 4 or more than 7 U.S.G.S. 7 and ½ minute topographical maps, or
- listed as threatened by U.S. Department of Interior, as enumerated in Code of Federal Regulations 50 CFR 17.11.

R – Rare: listed species have:
- 20 to 35 extant sites, or
- 3,000 to 5,000 individuals statewide.

V – Exploitably Vulnerable: listed species are likely to become threatened in the near future throughout all or a significant portion of their range within the state if causal factors continue unchecked.

U – Unprotected: no state status.

NYS SPECIES OF GREATEST CONSERVATION NEED (SGCN) - ANIMALS
Species that meet one or more of the following criteria (New York State Department of Environmental Conservation 2015):
- Species on the current federal list of endangered or threatened species that occur in New York.
- Species that are currently state-listed as endangered, threatened, or of special concern.
- Species with 20 or fewer elemental occurrences in the New York Natural Heritage Program database.
- Estuarine and marine species of greatest conservation need as determined by the DEC Bureau of Marine Resources staff.
- Other species determined by the DEC to be in great conservation need due to status, distribution, vulnerability, or disease.

(continued)

For those on the "high priority" SGCN list, the status of the 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.

For those on the rest of the SGCN list, the status of the 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.

For those on the list of Species of Potential Conservation Need, the status of the species 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.

REGIONAL STATUS (HUDSON VALLEY) – ANIMALS AND PLANTS

Hudsonia has compiled lists of native plants and animals that are rare in the Hudson Valley but do not appear on statewide or federal lists of rarities (Kiviat and Stevens 2001). We use ranking criteria similar to those used by the NYNHP, but we apply those criteria to the Hudson Valley below the Troy Dam. Our regional lists are based on the extensive field experience of biologists associated with Hudsonia and communications with other biologists working in the Hudson Valley. These lists are subject to change as we gather more information about species occurrences in the region. Species that have been assigned federal, state, or Natural Heritage Program (S1 or S2) rarity ranks are also presumed to be regionally rare, but are not assigned a regional rank. For birds, the regional rank sometimes refers specifically to their breeding status in the region.

AUDUBON NEW YORK – HUDSON RIVER VALLEY PRIORITY BIRDS

Audubon New York has compiled a list of "priority birds" that are experiencing considerable threats, population declines, and/or have very small populations or limited ranges. The species were identified by assessing from continental, national, and regional bird planning initiatives and state and federal lists of threatened and endangered species.

A species is included on the Hudson River Valley Priority Bird list if it is found in the Hudson Valley and on one of the following priority lists: State-listed Endangered, Threatened, or Special Concern; Audubon Watchlist (2007); Partners In Flight (PIF, 2005) - Continental Concern, Regional Concern, Continental Stewardship, Regional Stewardship in any of the Bird Conservation Regions in the Hudson Valley (BCRs 13, 14, 28, and 30); North Atlantic Shorebird Plan - Highly Imperiled or Species of High Concern; Mid-Atlantic, New England, Maritime Waterbird Working Group - High Concern, Moderate Concern.

(http://ny.audubon.org/conservation/hudson-river-valley-conservation)

Appendix D

Summary of Conservation Measures

General Measures for Water Resource Conservation

Landowner Actions

- M**aintain forests** with intact vegetation and undisturbed forest floors wherever possible to promote infiltration of rainwater and snowmelt to the soils.
- **Minimize applications of polluting substance**s, such as de-icing salts to driveways, and pesticides and fertilizers to lawns, gardens, and agricultural fields. Any of those substances might end up in streams, ponds, or groundwater.
- On land development sites, **minimize impervious surfaces and manage stormwater** in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.
- **Direct runoff from agricultural fields into basins and well-vegetated swales**, instead of directly into streams or wetlands, to maximize infiltration to the soils, and prevent the introduction of excess nutrients and toxins to streams and wetlands.
- **Consider the 100-year floodplain** when considering land management and land uses along streams. (Consider the 500-year floodplain once the data become available from FEMA.)
- **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.
- In floodplains, **shift to resilient land use**s that can withstand moderate to severe flooding; for example, pastures, hayfields, or forests.

Municipal Actions

- Adopt local legislation to **protect small and isolated wetlands** that are unprotected by state and federal wetland regulatory programs.
- Adopt local legislation to **protect streams (including intermittent streams)** from direct disturbance, and establish **broad buffer zones** of undisturbed vegetation and soils along streams.
- Adopt local legislation to **protect unconsolidated aquifers**.
- **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.

Municipal Actions (cont.)

- Design any new culverts and bridges and retrofit existing ones to **accommodate storms of 100-year intensity** or greater, 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**.

- In floodplains, **shift to resilient land uses**; i.e., uses that can withstand moderate to severe flooding, such as parks, ballfields, hiking trails, picnic areas, fishing access sites, pastures, hayfields, or undisturbed buffer zones.

- **Prohibit the building of new structures in 100-year floodplains**. (Upgrade this to 500-year floodplains when the FEMA data becomes available.)

- On land development sites, **minimize impervious surfaces and manage stormwater** in ways that maintain pre-development patterns and volumes of surface runoff and infiltration to the soils.

- **Minimize applications of polluting substance**s, such as de-icing salts to roads and parking lots and pesticides and fertilizers to lawns. Any of those substances might end up in streams, ponds, or groundwater.

- In areas of coarse glacial deposits (sand and gravel) or carbonate bedrock (marble or limestone), **avoid siting land uses with potential for contaminating soils and water.** Educate landowners in those areas about the vulnerability of groundwater resources.

- **Regulate and monitor extractive commercial uses of water** to ensure that water withdrawals from groundwater or surface water sources do not exceed sustainable levels.

(continued)

General Measures for Biological Resource Conservation

- For townwide planning, consider ways to protect areas **representing all significant landforms** and the full array of elevations, bedrock geology, and surficial geology that occur in New Lebanon.
- **Direct human uses toward the least sensitive areas**, and minimize alteration of natural features, including vegetation, soils, bedrock, and waterways.
- Protect habitat areas in **large, broad configurations** wherever possible, with broad connections to other habitat areas.
- Maintain and restore **landscape connectivity** between large habitat areas wherever possible.
- **Avoid fragmentation of large forest patches** by roads, driveways, clearings, and other disturbances that open the forest canopy.
- **Avoid fragmentation of large meadow and contiguous farmland** by roads, driveways, or other non-farm uses.
- **Maintain broad buffer zones** of undisturbed vegetation and soils around ecologically sensitive areas.
- **Protect habitat complexes for species of conservation concern** wherever possible.
- **Minimize impervious surfaces** and design new land uses (and retrofit existing uses wherever possible) to ensure that surface runoff of precipitation and snowmelt does not exceed pre-development patterns and volumes of runoff.
- **Concentrate new development along existing roads**; discourage construction of new roads in undeveloped areas.
- In working forests, **employ sustainable forestry practices that promote tree species diversity and structural diversity**, protect soils from erosion, and protect streams from direct disturbance or siltation.
- **Employ sustainable agricultural practices that build living soils and conserve water**.
- **Where possible, promote wildlife-friendly agricultural practices**, such as late mowing to accommodate ground-nesting grassland birds, leaving unmowed strips and fallow rotations to support pollinators and other invertebrates, and minimizing applications of pesticides and fertilizers.
- **Consider environmental concerns early in the planning process** for new development projects, and incorporate conservation principles into the choice of development sites, site design, stormwater management, and construction practices.

General Measures for Farmland Resource Conservation

Municipal Actions

- Adopt **farm-friendly policies** and programs; for example, lowering tax assessments for active farmland, and allowing density bonuses for cluster designs that permanently protect farmland.
- Revise the Use Table (205 Sect 2 of the Zoning Law) to **allow wind turbines** for on-farm electricity use.
- Require that new subdivisions and development sites be designed in ways that **preserve the areas of best farmland soils intact and unfragmented** as much as possible.
- **Appoint farmers** to serve on the Planning Board, Zoning Board of Appeals, Zoning Rewrite Committee, and other town commissions dealing with land use policy and regulations.
- Establish a **Community Preservation Fund** to protect important agricultural lands, funded through grants, donations, budget appropriations, bond allocations, and a real estate transfer tax (through the Community Preservation Act).
- **Promote local markets for agricultural products**, including uses by restaurants and institutions such as schools.

Farmers' Actions

- **Join municipal agencies and commissions** (Planning Board, Zoning Board of Appeals, Zoning Rewrite Committee, etc.) dealing with land use policy and regulations.
- Where possible, **shift tilled land in floodplains to other uses** (such as pastures, hayfields, or perennial crops) more resilient to flooding.
- Adopt farm practices that **conserve water, prevent soil erosion and soil loss, and build living soils.**
- **Minimize applications of fertilizers and pesticides**, and especially in the more sensitive areas such as floodplain fields and near wetlands and streams.
- **Maintain cover crops and thatch** to reduce soil loss during heavy precipitation or flood events.
- **Maintain intact habitats** in and near hayfields, cropland, orchards, and pastures where possible, and adopt farm practices (such as mowing schedules and patterns) that accommodate the needs of native pollinators, birds, and other wildlife.

General Measures for Scenic Resource Conservation

- **Complete an inventory and map** of scenic resources throughout the town.
- When reviewing site plans and subdivision proposals, and the location and design of any new structure or new land use in the town, **consider the impacts on the entire viewshed** of those features.
- **Maintain intact natural areas and farmland visible from public roads and public-access lands** wherever possible.
- **Maintain intact (undeveloped) hilltops and sideslopes** wherever possible.
- **Minimize outdoor lighting,** and design any necessary outdoor lighting to minimize visibility of lights in nearby habitat areas and offsite areas throughout the viewshed.
- Develop town policies that **support working landscapes and land-dependent uses** (e.g., farming, logging, recreation) that employ sustainable practices.
- Adopt environmental review standards that consider impacts on scenic resources.

General Measures for Expansion of Recreation Resources

- Promote the **extension of the Corkscrew Rail Trail** through agreements with willing landowners.
- Adopt the **Complete Streets** approach to enhancing the quality and safety of New Lebanon's roads for biking, walking, and other uses.
- Develop additional **public access sites for fishing** on New Lebanon's streams.
- Collaborate with the Shaker Swamp Conservancy in efforts to develop **public access to Shaker Swamp**.