CHAPTER TWO

Why is it important to protect the Taghkanic Headwaters?

Natural resources of the Taghkanic Headwaters

As part of the planning process, CLC, stakeholders, and consultants searched for existing data and drew from local knowledge to aid in understanding of the forests and waters of the Taghkanic Headwaters. This section starts with forested land, then moves to streamside areas where land and water meet, and ends with the Taghkanic Creek and tributaries. The content of this section is guided by the primary conservation values set out in the vision statement for the plan.

This chapter describes key features and resources, including water bodies, forests, and wildlife. It also covers the important benefits the forests and waters provide to people, as well as other values such as connectivity of habitat for wildlife. It reports what is known about the condition of resources such as forest health and water quality. Important potential threats are described, too. A guiding question for this chapter came from a stakeholder midway through the process who asked, "What is changing, what are the threats, and what is needed to maintain connectivity and water quality?"

The watershed is heavily forested with both large roadless forests and extensive wooded wetlands.

Finally, the chapter wraps up highlighting several places within the watershed that are particularly important to achieving the vision. These places, with more detailed planning, could become priorities for local protection through strategies such as development restrictions or creation of new municipal policies. Each of the four towns has one or more of these places of special focus.

Because the amount and quality of water in a stream is influenced by all the land that drains to it, we begin with a look at the land area of the watershed. Before discussing the creek and other waters in detail, we address streamside areas, where the land and water mingle most obviously.

Forests of the Taghkanic Headwaters

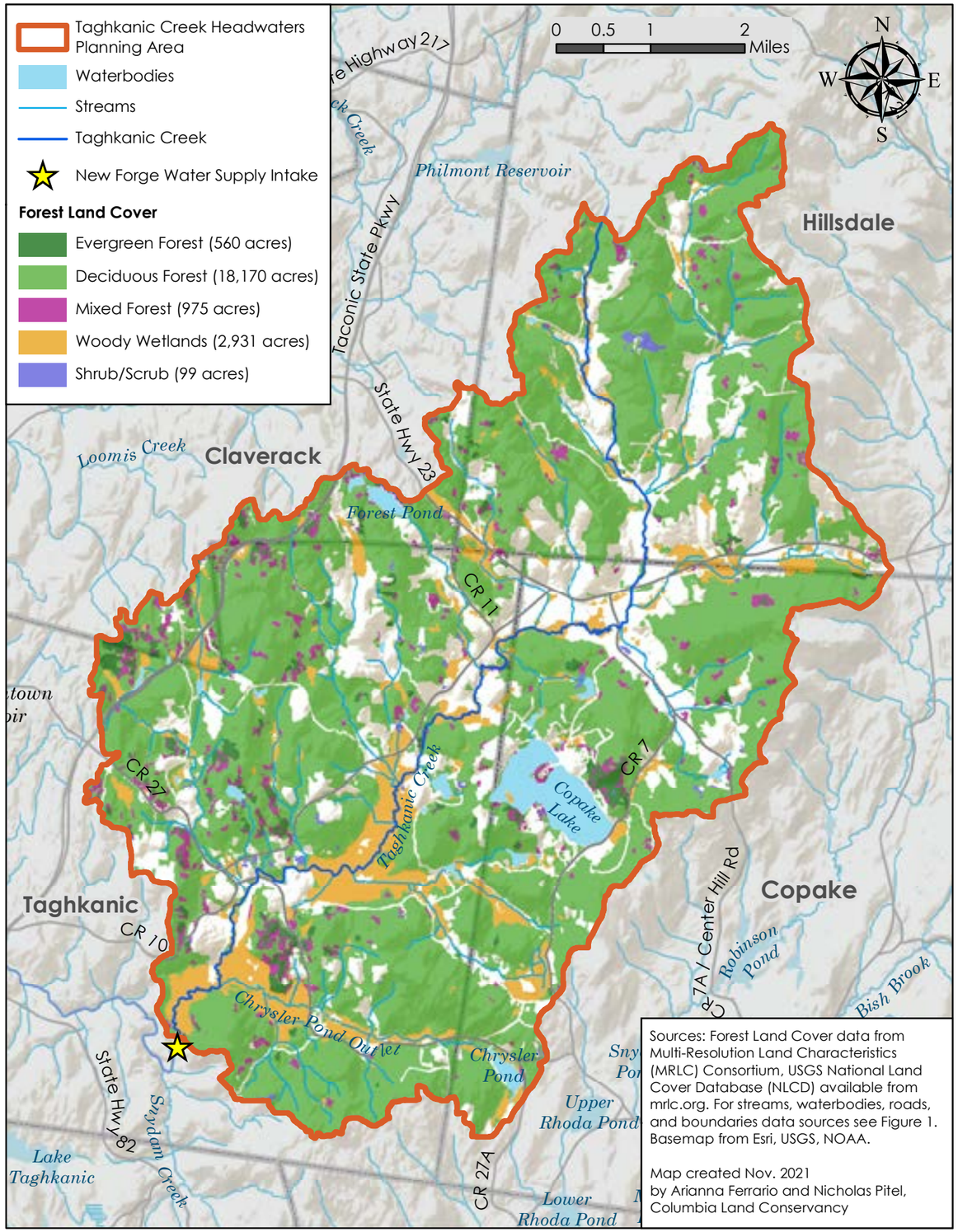
Though woods, fields, farms, wetlands, and development are all present in the Taghkanic Headwaters (Table 2), forests and woodlands dominate the watershed, covering an estimated 75% of the area (Figure 6). Agriculture covers an estimated 17% of the watershed, and the Taghkanic Creek and several tributary streams flow through farmland.

Many of the forests in the watershed are greater than 1,000 acres (Figure 7). Larger forested areas with few roads are more capable of rebounding following a major disturbance such as ice storms or insect damage. Smaller patches of forest (<500 acres) are less protected from these kinds of events, have a smaller bank of seeds for regeneration, and have more exposure to other influences that could impede regrowth of the forest, such as invasive species. Still, smaller forest areas are important stepping stones for wildlife, and can support water quality.

Most of the forested area in the watershed is one of two common forest types: hemlock-northern hardwood forest and Appalachian oak-hickory forest.[1] Hemlock-northern hardwood forests tend to be found on cooler areas on north-facing slopes and in ravines along streams. Appalachian oak-hickory forests are found on drier south and west-facing slopes. Different kinds of forests are at different risks to insects and climate change.

[1] Based on interpreted satellite data in Ferree, C and M. G. Anderson. 2013. A Map of Terrestrial Habitats of the Northeastern United States: Methods and Approach. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA.

Figure 6. Forest Land Cover



Sources: Forest Land Cover data from Multi-Resolution Land Characteristics (MRLC) Consortium, USGS National Land Cover Database (NLCD) available from mrlc.org. For streams, waterbodies, roads, and boundaries data sources see Figure 1. Basemap from Esri, USGS, NOAA.

Map created Nov. 2021
by Arianna Ferrario and Nicholas Pitel, Columbia Land Conservancy

Table 2. Land Cover in the Taghkanic Creek Headwaters, 2016.[2]

Land Cover Category	Acres	Percent
Forest	22,730	75
Agriculture (cultivated crops and hay/pasture)	5,302	17
Wetlands	3,128	11
Developed	1,845	1
Water	620	2

Note: In this table, woody wetlands are counted in both the forest category and the wetlands category, resulting in a total percentage slightly over 100%. Wooded wetlands alone make up 10% of the watershed area.

The forests of the Taghkanic Headwaters provide vital connectivity for wildlife, but the connections are fragile.

Connectivity for wildlife is a primary conservation value for this plan. Today, the large forests of the watershed provide ample room for wildlife that range over large areas, such as bear, bobcat, and fisher. Over the long term, plants and animals also need the opportunity to find new homes in response to the warming climate. Species that require cooler conditions may find new homes on cooler northern slopes, at higher elevations, or by shifting northward. The large forests of the watershed offer these opportunities. But loss of forest could block wildlife from accessing more favorable habitats.

Forests in this watershed are large enough to function as connections among the largest forested areas in the northeastern United States. Figure 8 shows two local forest linkages bracketing the Taghkanic Headwaters. These linkage zones include many of the largest areas of forest in the watershed.

Forests are changing and are at risk

Although forests are still abundant, their future is fragile.

Forests and streams are central to human history in the Taghkanic Creek Headwaters, as elsewhere in the Hudson Valley. Indigenous people have lived sustainably on this land for thousands of years. Starting in the 1600s, European settlers cleared forests for fuel, building, manufacturing, and farming so that by 1900, Columbia County lost 80% of its forests.[3] The forest has mostly regrown since. However, it appears New York's forest cover peaked in the early 2000s, and now it is slowly declining; from 2001-2019, Columbia County had a net loss of about 300 acres of forest.[4]

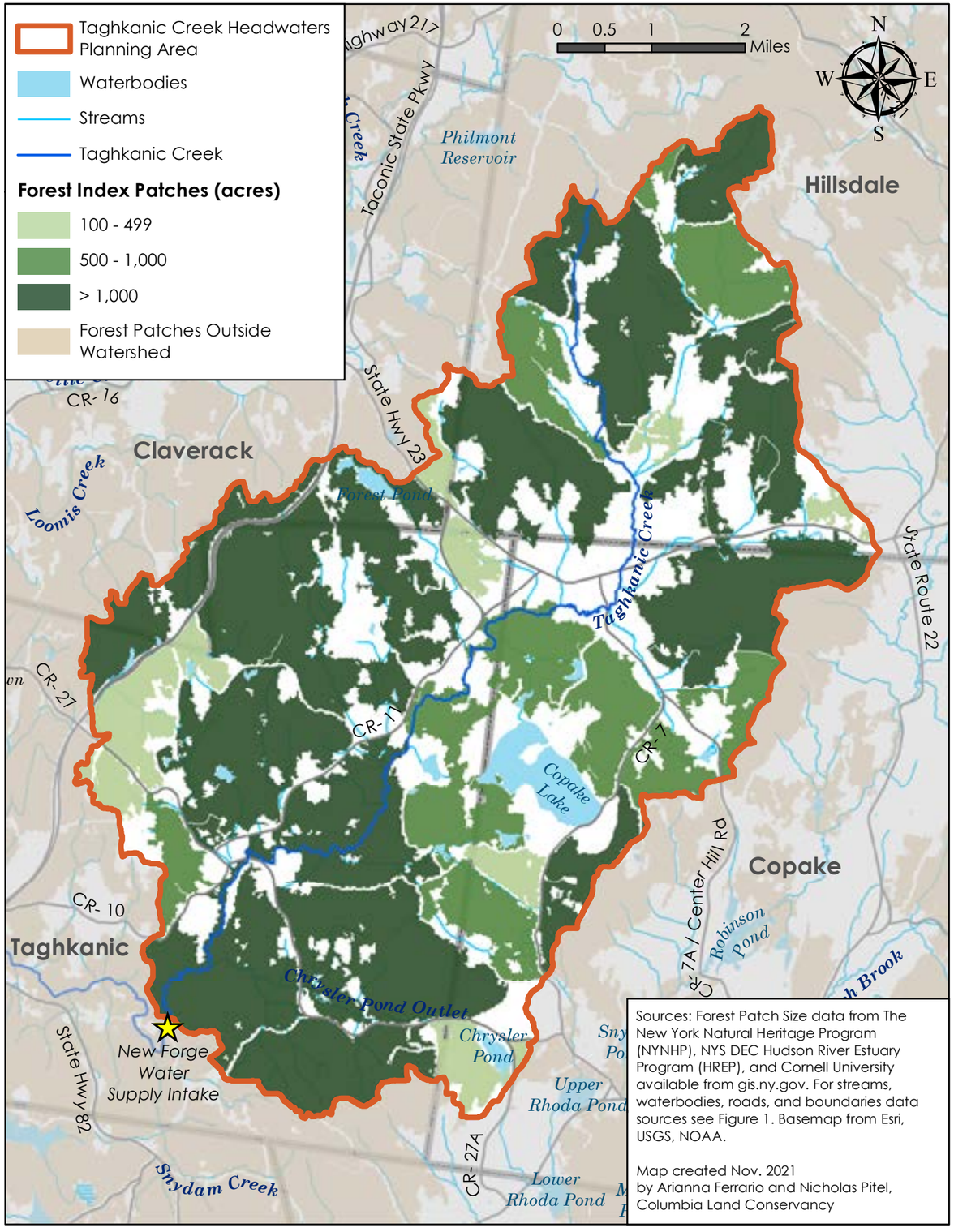
The forest is changing in other ways too. An analysis by the US Forest Service shows that the forest in Columbia County is becoming more fragmented over time. From 1990 to 2010, the areas where human

[2] Us Geological Survey. National Land Cover Data. The land cover data are derived from a satellite that captures images in 1000-square-foot blocks, which gives Figure 6 its boxy quality. Nationally, when these land cover data were compared to aerial photography, the data were correct about 86% of the time. That means people should not expect these data to be accurate at specific locations in the watershed. Wickham, J., S. Stehman, L. Gass, D. Sorenson, L. Gass, and J. Dewitz. 2021. Thematic accuracy assessment of the NLCD 2016 land cover for the conterminous United States. Remote Sensing of Environment, Vol. 257, 2021, 112357, ISSN 0034-4257, https://doi.org/10.1016/j.rse.2021.112357. Read more about the applications and limitations of these data on the National Land Cover Database factsheet.

[3] Vispo, Conrad. 2014. The Nature of Place: A History of Living with the Land in Columbia County, NY. Adonis, Hillsdale, NY; land use change data from www.mrlc.gov/eva/

[4] Albright, Thomas A.; et al. 2020. New York Forests 2017. Resource Bulletin NRS-121. Madison, WI: U.S. Department of Agriculture, Forest Service, Northern Research Station. 118 p. https://doi.org/10.2737/NRS-RB-121; Vispo, Conrad. 2014; Land cover change data from https://www.mrlc.gov/eva/

Figure 7. Forest Patch Size



development meets undeveloped vegetation in the county increased by more than 20%,[5] indicating that new building is happening in natural areas. Increased development has the potential to change how forests function.

Threats to forests

Development causes forest loss and fragmentation

Today, development is the biggest threat to forest connectivity in the Taghkanic Headwaters. It happens so slowly that it may not seem like there is an impact, but many small changes add up over time. The construction of roads, driveways, utility lines, and even recreational trails, which individually seem minor in a largely forested area, can have outsized impacts on wildlife. Animals move around to meet their needs. New construction splits habitat into smaller and smaller areas, a process called fragmentation. Impacts of new clearing and new development can extend 300 feet into the surrounding forest.[6] Evidence of the effect of fragmented forest on wildlife can be seen on wet nights in spring, when frogs and salamanders make the treacherous move from forest to wetlands: roads cutting across their path become high kill zones.

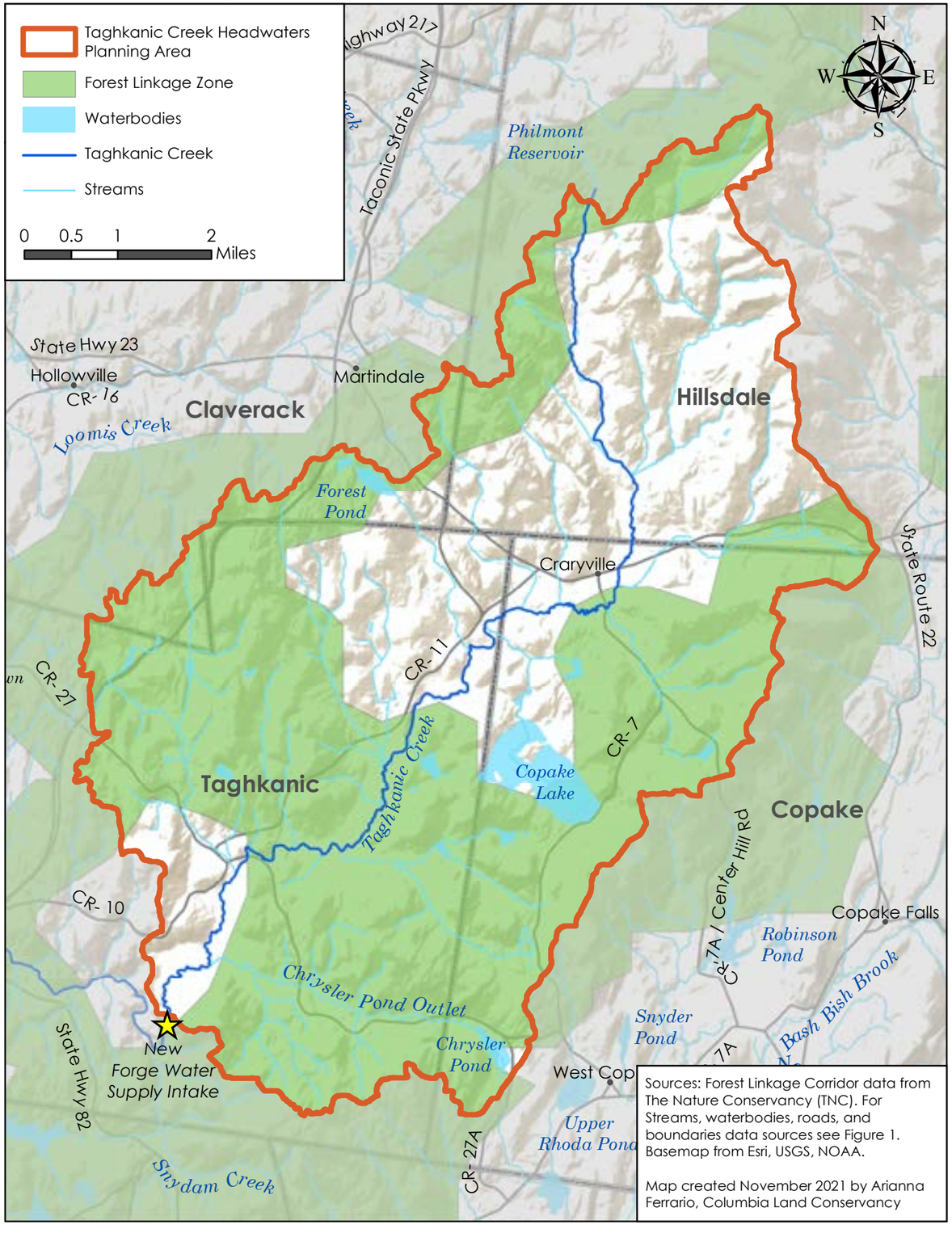
Eight percent of the watershed is protected from development by the state and conservation organizations (Figure 9). New York State owns and manages New Forge State Forest and Doodletown Wildlife Management Area. A number of private properties have voluntary preservation agreements with Columbia Land Conservancy which restricts future development. Although development is the greatest risk to forests, there are ways to site homes and driveways so that they have less impact on forests and wildlife.

Partners in regional conservation

Recognizing the crucial importance of the forest connections, many organizations have come together to work across boundaries on regional conservation. These efforts seek to restore and enhance landscape connections for the benefit of people and wildlife. CLC coordinates the Berkshire-Taconic Regional Conservation Partnership working with organizations in New York and three other states. The Staying Connected Initiative brings together organizations across the northern Appalachians in the eastern U.S. and Canada.

[5] Albright et al 2020.
[6] Vispo 2014

Figure 8. Localized View of Forest Linkage



Pests and pathogens weaken and kill forest trees

Forest pests and pathogens are a significant threat to forests in Columbia County and around the state. These include insects like emerald ash borer and hemlock wooly adelgid as well as beech bark disease, which is caused both by insects and a fungal pathogen. These pests represent a significant disturbance when they attack large numbers of trees, canopy species, and/or the trees which may make up a large portion of any one forested area.

Overbrowsing by deer prevents new growth

According to an analysis by The Nature Conservancy, New York State's forests are not regenerating well enough to become healthy, diverse woodlands in the future.[7] In the Hudson Valley, that is because there are too many white-tailed deer that eat most of the forest understory, including tree seedlings, which are essential to the future forest. The New York Forest Owners Association has concluded that deer browsing is the number one problem threatening the future of woodlands in New York.

Invasive plants

Invasive plants are another threat to forests. Non-native plants are tolerant of a wide range of conditions and thrive where soil has been disturbed. With few natural predators, they can grow unchecked, crowding native plants that provide food and cover to native wildlife. Plants like tree-of-heaven, Japanese barberry, and Oriental bittersweet can spread easily along wildlife and human corridors, often moved accidentally by people via nursery plants, clothes, footwear, or firewood. Driveways, trails, and other openings in the forests also become opportunities for invasive species that take advantage of disturbed ground.

Climate change

Climate change will affect all natural and human ecosystems and will exacerbate other threats. Forests have different abilities to adapt to the changes based on forest type and condition. The most common forest types in the Taghkanic Headwaters are expected to have low to moderate vulnerability to these changes overall, with drier oak forests experiencing fewer impacts from climate change than northern hardwood forests. Both these forest types are more resilient to change than the red-maple swamps along Taghkanic Creek.[8] Size, condition, and impact of other threats affect the ability of forests to adapt.

Streamside areas and wetlands

Streamside (or riparian) areas are dynamic. This can sometimes become obvious, as the photograph of the stream starting to undercut the foundation of the barn illustrates. A stream is more than the water flowing in the channel at any one time. At different times, water flows through the stream channel, across the wider floodplain, and sometimes onto higher ground. Streamside areas are critical to water quality, and to the quality of the habitat in the stream.

[7] Shirer, R., Zimmerman, C., 2010. Forest Regeneration in New York State. The Nature Conservancy, Eastern New York Chapter, Albany, NY.

[8] Janowiak, M.K.; D'Amato, A.W.; Swanston, C.W.; Iverson, L.; Thompson, F.R., III. [et al.]. 2018. New England and northern New York forest ecosystem vulnerability assessment and synthesis: a report from the New England Climate Change Response Framework project. Gen. Tech. Rep. NRS-173. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 234 p. https://doi.org/10.2737/NRS-GTR-173

Pied Billed Grebe
Attribution: Dori, CC BY-SA 3.0, creativecommons.org/licenses/by-sa/3.0, via Wikimedia Commons

Stinkpot Turtle
Photo by Bruce Hallman/USFWS

Brook Trout
United States Fish and Wildlife Services, Public domain, via Wikimedia Commons

Smooth Greensnake
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Streamside areas are places of transition, and there is a lot of interplay between water and land in these areas. Woody vegetation along streams is especially important for stream health. Trees and shrubs have deep roots that stabilize streambanks, filter polluted runoff, and shade the stream, keeping it cooler. Recent studies suggest good water quality is likely if at least 70% of streams have forested buffers and 60% of the watershed is forested.[9]

Wetlands make up 11% of the Taghkanic Headwaters area. Most are woody wetlands found along the Taghkanic Creek and its tributaries. This type of wetland declined faster than any other land cover in Columbia County from 1996-2016, with a loss of 120 acres or about 2% of their total area. Figure 6 shows extensive areas of wooded wetlands in a light shade of orange. Large areas of streamside wetlands are found in Craryville (Copake and Hillsdale), Pumpkin Hollow (Taghkanic), and near New Forge State Forest (Taghkanic). These same areas also show up clearly in wetland maps (Figure 10).

The large, wooded wetland areas are most likely to be red-maple hardwood swamp. Not only does remote sensing indicate this type of wetland, but the New York Natural Heritage Program documented a very high-quality example of this natural community at New Forge State Forest. Smaller high-quality wetlands in the area include floodplain forest, emergent marsh, and temporary woodland pools called vernal pools.

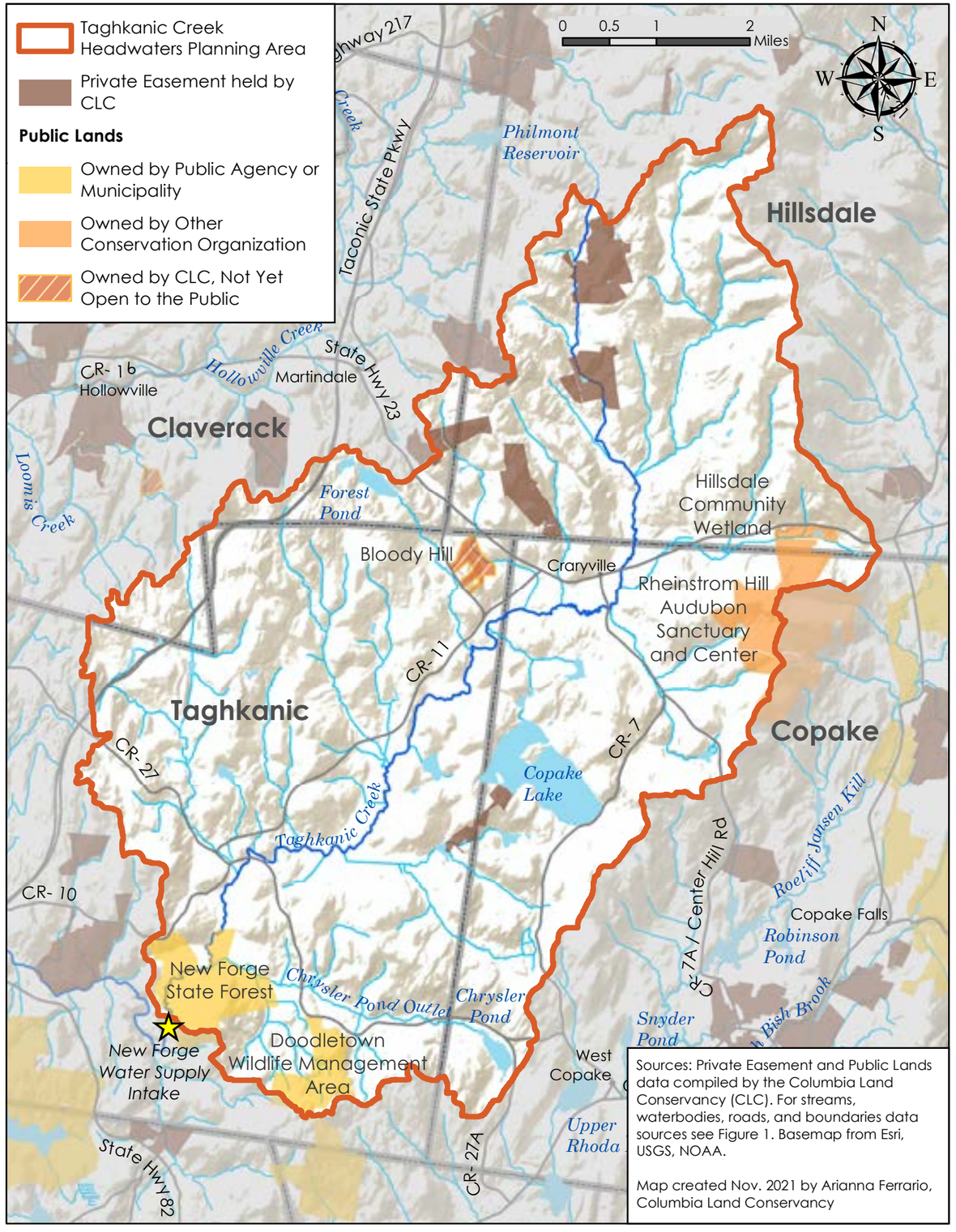
Streamside areas are where we find "ancient" floodplain forests. "Ancient" refers to the fact that these are the oldest forested floodplains in the area. the trees in these areas date to at least the 1940s. A Columbia County study of floodplain forests found that these areas are likely to be home to a greater variety of native plant species and to have fewer non-native or invasive plant species. The ancient floodplain forests of were found to be not only rare, but also "ecologically unique and potentially irreplaceable."[10]

Figures (L): Wetland and streamside habitats are important for rare and threatened species.

[9] Morse et al 2018

[10] Knab-Vispo, C. and C. Vispo. 2010. Floodplain forests of Columbia and Dutchess counties, NY: Distribution, biodiversity, classification, and conservation. Hawthorne Valley Farmscape Ecology Program, Ghent, NY. 67 p. + appendices.

Figure 9: Protected Lands



Rare plants and animals of streamside areas

Rare plants and animals documented in the Taghkanic Headwaters region are associated with wetlands and streamside areas, including the Least Bittern and Pied-billed Grebe. These wetland specialist birds inhabit marshes with clean water and plenty of small animal prey.

Rare plants

There are two plants considered to be rare in New York State that have been documented in the watershed. Dragon's mouth orchid, *Arethusa bulbosa* is a wetland plant, is considered threatened in New York. Schweinitz's flatsedge, *Cyperus schweinitzii* is found in sandy soils and requires disturbance to persist. Landowners can learn about these and other rare plants by consulting the New York Natural Heritage Program.

Several other animals that are considered by New York State to be at risk of endangerment or have another welfare concern (New York-designated "species of special concern") are found here. The smooth greensnake, snapping turtle, spotted turtle, stinkpot (or musk turtle), and wood turtle all depend on wetland areas. Habitat destruction is a main threat to these species in New York. Appendix B provides a list of species found in the watershed that have conservation status and their habitats.

Areas in the Taghkanic Headwaters that are known to be important to rare plants, rare animals, and significant natural communities are shown on a map in Appendix B.

Threats to streamside areas and wetlands

Streamside areas and wetlands are vulnerable to filling, clearing, and grading, as well as influences from activities nearby. A patchwork of local, state, and federal rules applies, which may provide limited protection to these sensitive areas.

The creek and tributaries support trout and, in some places, rare animals.

Figure 10. Taghkanic Creek, Tributaries, and Wetlands

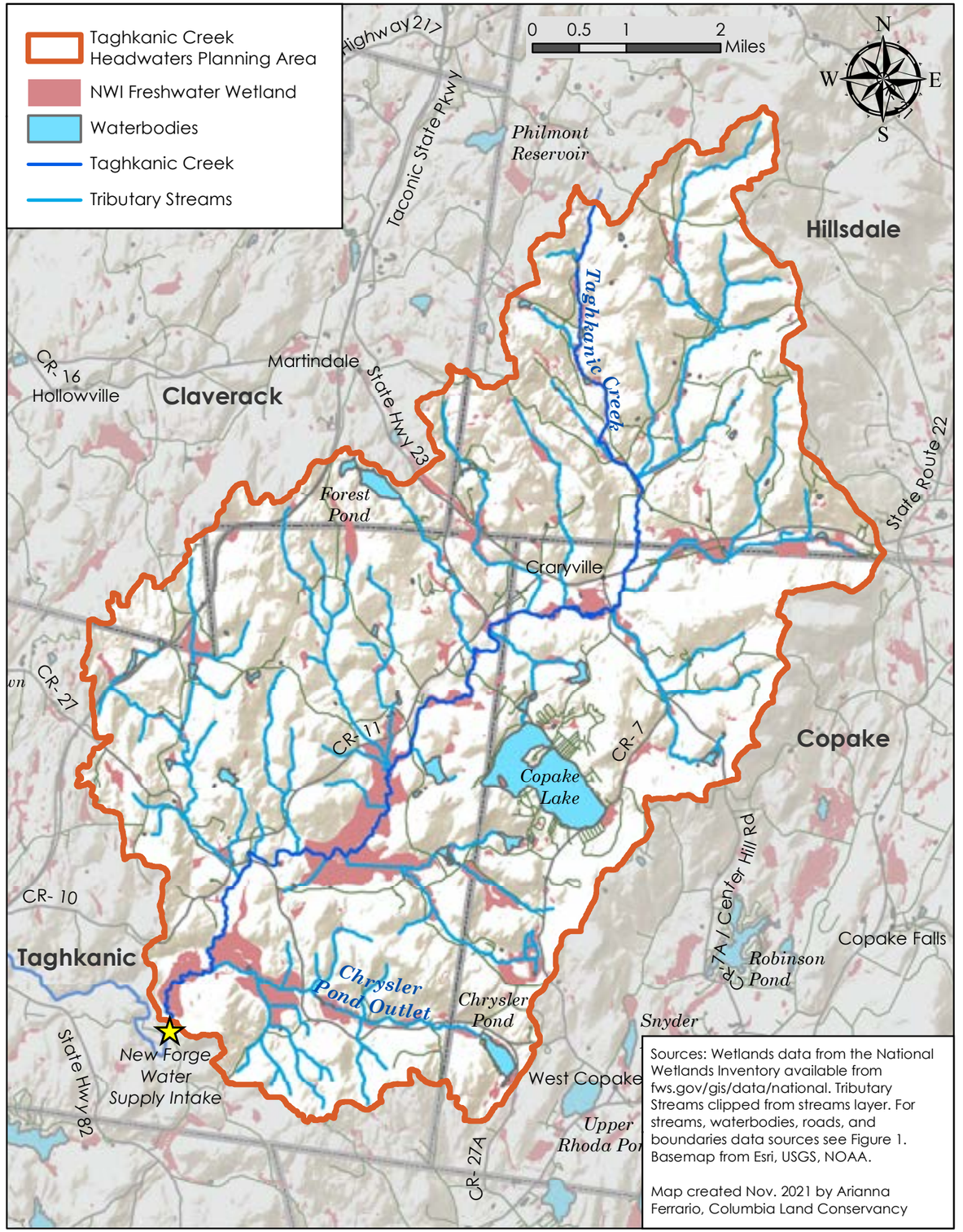
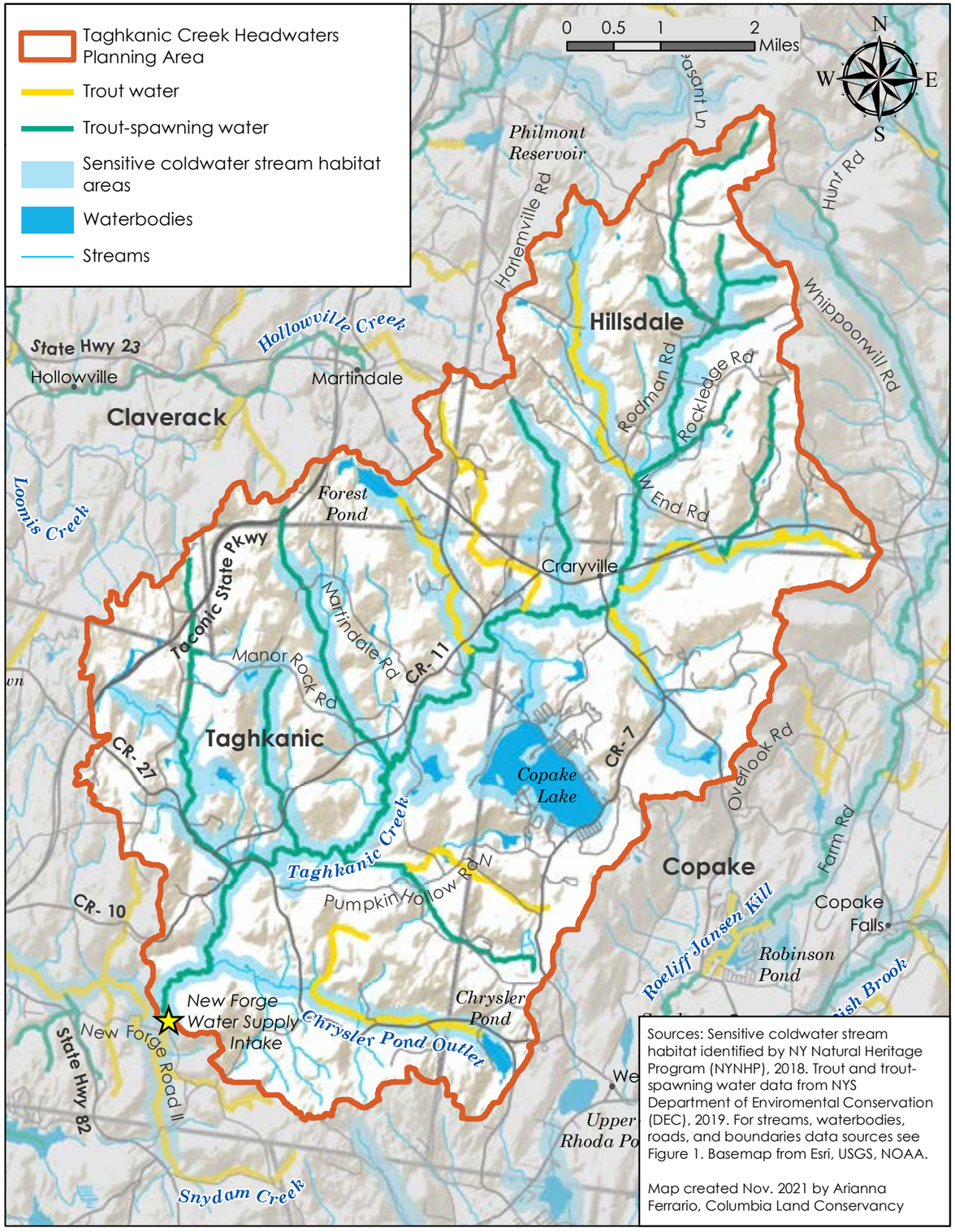


Figure 11. Sensitive Stream Habitat and Trout Waters



Sources: Sensitive coldwater stream habitat identified by NY Natural Heritage Program (NYNHP), 2018. Trout and trout-spawning water data from NYS Department of Enviromental Conservation (DEC), 2019. For streams, waterbodies, roads, and boundaries data sources see Figure 1. Basemap from Esri, USGS, NOAA.

Map created Nov. 2021 by Arianna Ferrario, Columbia Land Conservancy

Taghkanic Creek and tributaries

The Taghkanic Creek receives water, nutrients, and sediment from of a network of creeks and headwater streams, including both those that flow seasonally and year-round (Figure 10). People rely on these waters, from the unmapped springs and seeps that contribute clear, cool groundwater, to ponds and lakes. Copake Lake, which at 432 acres is the largest water body in all of Columbia County, and the nucleus of the densest development in the watershed. The City of Hudson relies on the creek to supply its residents with drinking water.

The watershed has streams in steep areas with swift-moving waters, and others that are lower-gradient, with slower water flow. The streams that flow to the Taghkanic Creek are largely unnamed, except for Chrysler Pond Outlet, which flows through Copake and Taghkanic. The other named water bodies include Copake Lake (Copake), Forest Pond (Claverack), and Melcher Pond (Copake). In headwater areas like this one, intermittent streams that flow only occasionally make up a significant proportion of the total network. These streams are often missed on existing maps and protection is overlooked. Springs and seeps are often unmapped as well, increasing their vulnerability to degradation, which can affect the Taghkanic Creek.


Taghkanic Creek

Streams are habitats for fish

The New York Natural Heritage Program has identified nearly all the streams in the Taghkanic Headwaters as “sensitive cold water stream habitat areas” (Figure 11). Cold water streams are sensitive to increased temperatures and stay cooler when trees remain in place. Available data suggest there is good quality habitat in the Taghkanic Creek and the other headwater streams. While brown trout are more tolerant of a range of temperatures, native brook trout prefer cooler temperatures and are more sensitive to pollution, and thus these fish are generally restricted to the upper reaches of the Taghkanic Creek and its tributaries.

Groundwater

The Taghkanic Creek and its tributaries receive water from the ground. In dry periods, groundwater entering the stream can be a significant amount of the total water flowing.[11] Groundwater stored in **aquifers** are found in several areas along the Taghkanic Creek and some of the tributary streams (Figure 12). A high-yield aquifer is mapped in the hamlet of Craryville in yellow. The potential to draw significant amounts of water from other aquifers, such as to supply a public drinking water system, has not been assessed for most aquifers in the watershed.[12]

The Taghkanic Headwaters provides drinking water

Throughout the watershed, residences, farms, and businesses rely on groundwater supplied by private wells or public water systems.[13] These wells draw water from relatively shallow aquifers or from deeper

[11] Winter, T.C., J.W. Harvey, O.L. Franke, and W.M. Alley. 1998. Ground water and surface water: A single resource. U.S. Geological Survey Circular 1139. 53pp. https://pubs.er.usgs.gov/publication/cir1139

[12] More information about groundwater sources is found in the municipal groundwater reports prepared by the New York Rural Water Association, and the Columbia County Natural Resources Inventory.

[13] Any system having at least 5 service connections or that regularly serves an average of at least 25 people daily for at least 60 days out of the year is considered a public water system.

sources in bedrock. Based on the towns' groundwater studies, most residents in the watershed are using wells that tap into bedrock. The towns of Copake, Hillsdale, and Taghkanic each have reports produced by the New York Rural Water Association that both describe the sources, quality, and quantity of groundwater and recommend ways communities may protect this important resource.

Residents of the City of Hudson rely on drinking water from the Taghkanic Creek. At New Forge, water is diverted from the Taghkanic Creek to supply the drinking water for the City of Hudson. The water flows through a pipe to the Churchtown Reservoir, where it is stored before being piped to a water treatment plant on Academy Hill in Hudson. If more water is needed, the City of Hudson can increase the flow of water from Copake Lake into a tributary to the Taghkanic Creek to supply adequate water to the city, which has happened at least once. [14]

Water quality in the Taghkanic Headwaters

The Taghkanic Headwaters provides clean water

The mix of land use in the watershed suggest that the water in the headwaters of the Taghkanic Creek will be good quality. The limited data we have about the water quality of the Taghkanic Creek also indicate that it is good. The NYS DEC collects water quality data in many streams throughout the state on a rotating basis. The lower and middle sections of the Taghkanic Creek and tributaries were sampled in 2002 and an assessment was published in 2007 (Appendix A). There are insufficient data to determine water quality in the headwaters of the Taghkanic Creek, which includes numerous tributaries, thus NYS DEC lists it as "unassessed." The portion of the Creek the closest to the New Forge intake has no known impacts based on a few samples. The water quality reports produced by the City of Hudson indicates the water in their system, once treated, meets all drinking water standards.

Copake Lake, Erin Philip

[14] personal communication, Rob Perry, September 4, 2019; Winkley, S. 2008. Draft Groundwater Protection Plan for the Town of Taghkanic, Columbia County, New York. NY Rural Water Association. Hudson, NY.

Figure 12. Aquifers

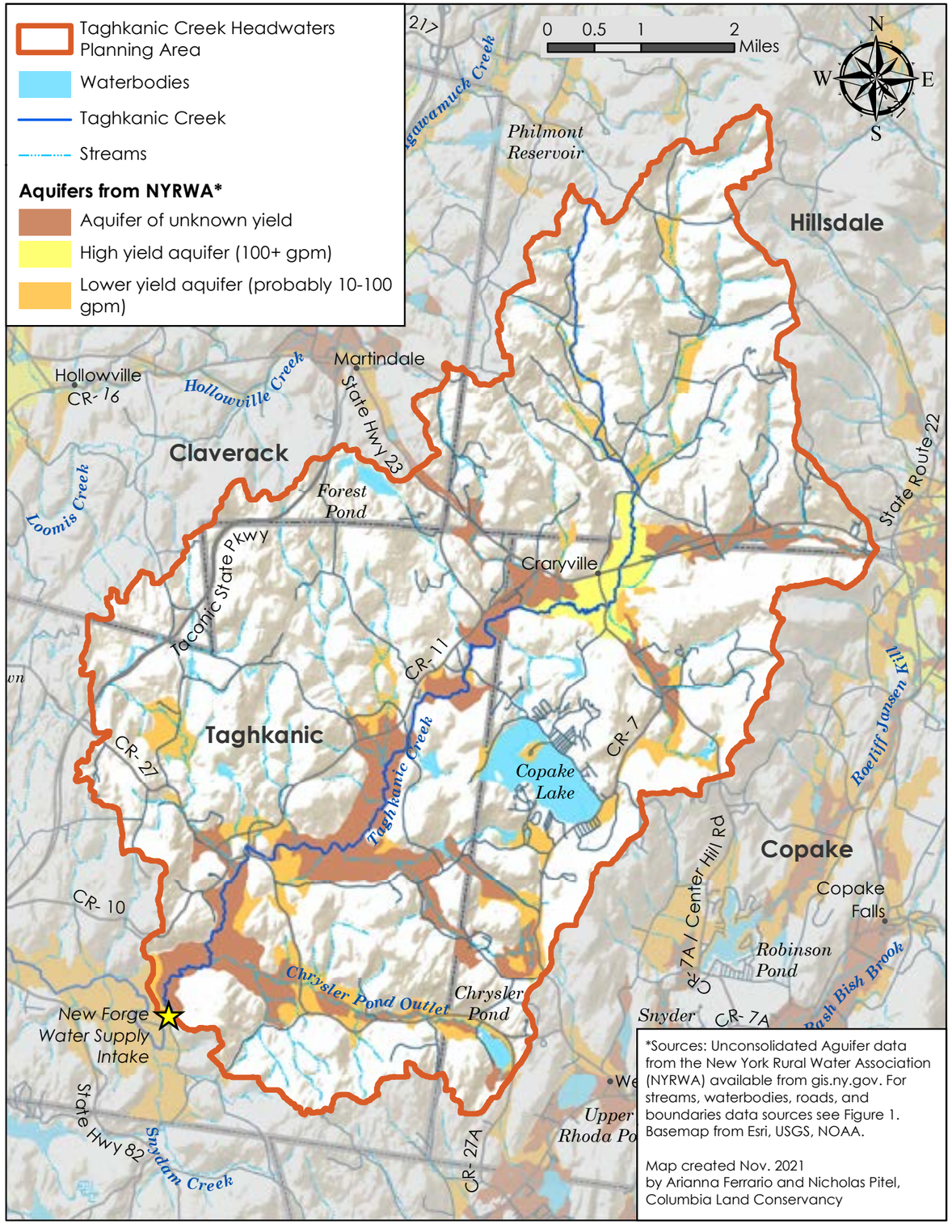
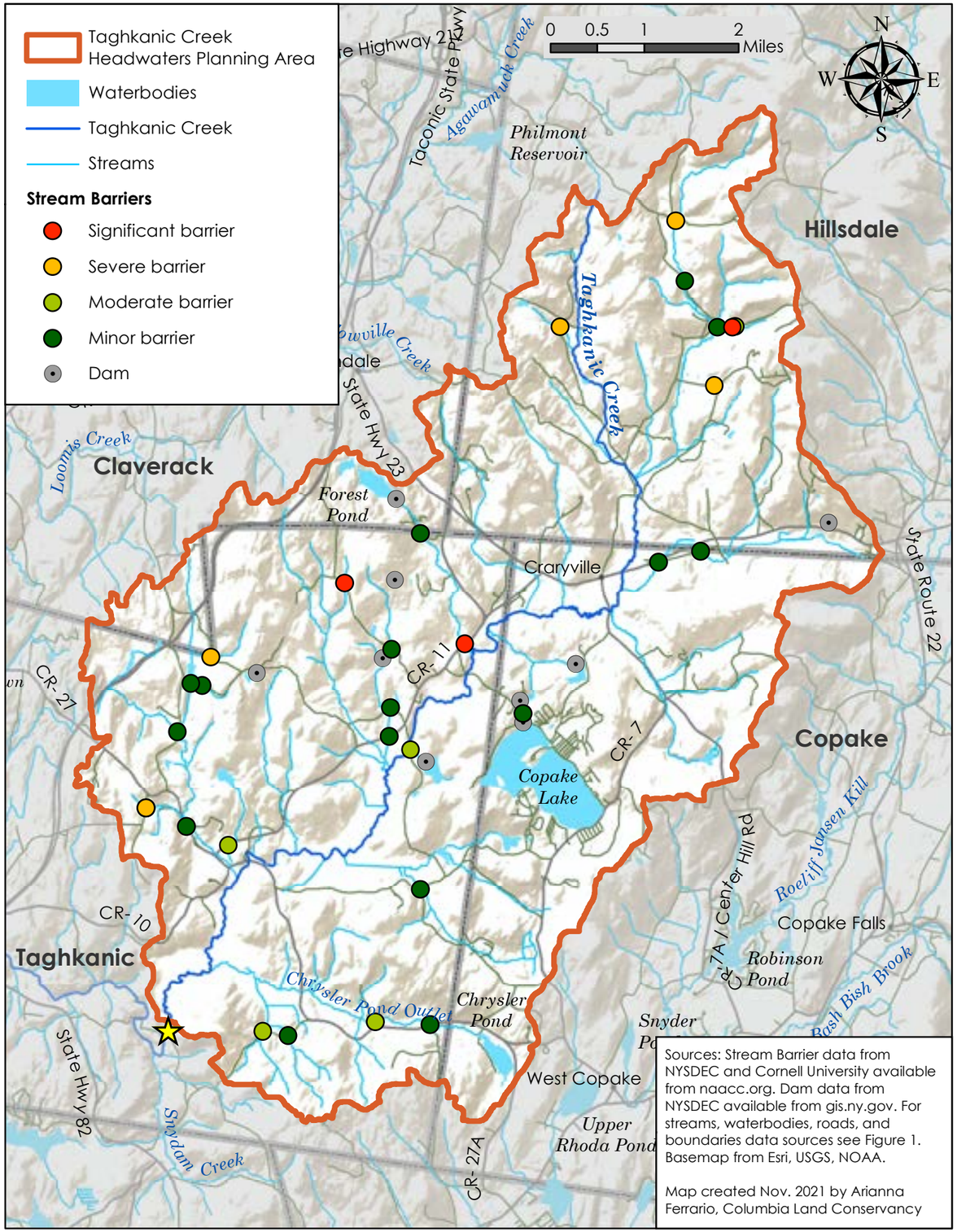


Figure 13. Stream Barriers



Water in Copake Lake, which flows to the Taghkanic Creek via a small stream, is impaired and being managed.

Copake Lake is listed as an impaired water body by the NYS DEC due to excessive nutrients.

Water quality is a challenge at Copake Lake. Partly natural and partly human-made, Copake Lake is the largest waterbody in the watershed. The community around the lake is the largest, most densely settled place in the watershed. The Copake Country Club relies on a private sewer system that discharges to Copake Lake.[15] Copake Lake is listed as an impaired water body by the NYS DEC due to excessive nutrients, which leads to large algal blooms and reduced levels of oxygen in the water, threatening the organisms living in the lake. These problems are attributed to development around the lake and associated runoff, as well as failures of septic systems. Recreation is affected by reduced water clarity and algal and weed growth in the lake.[16] The Copake Lake Conservation Society works to reduce phosphorous in the lake and to manage aquatic plants, leading to improvements in water quality.[17]

The Lower Taghkanic Creek is listed as threatened because the reduced water flow caused by the water withdrawals by the City of Hudson has the potential to increase temperatures in the creek. Higher temperatures may cause stress for trout, especially during the summer.[18] There has been little water quality sampling of the Taghkanic Creek, but the few samples, taken further downstream, have shown no impact or slight impact.[19]

Threats to the Taghkanic Creek and its tributaries

Any development close to a stream has the potential to impact water quality and habitats and near the stream. When stream banks are armored with rocky material (rip rap) or concrete, it can change the flow of water, which can have effects downstream, possibly increasing erosion and sediment entering the stream, degrading habitat quality. Cold water streams are sensitive to increased temperatures and stay cooler when trees remain in place.

Water withdrawals

According to the City of Hudson's acquisition of water rights in the early 1900s, the city may divert as much as 2.25 million gallons per day from the Taghkanic Creek at New Forge to secure a safe public water supply. On average, the City of Hudson presently delivers about 1 million gallons per day. However, it is not known how much water is taken or used with any precision. No one measures stream flow in the Taghkanic, the amount of water captured at the intake, nor water usage in the City.[20]

The lower Taghkanic is listed as threatened due to the potential impact of water withdrawals, and additional study is needed to know if the fish or aquatic life are affected.

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[15] (Town of Hillsdale Wastewater Collection & Treatment System Site Plan, Clark Engineering. https://hillsdaleny.com/wp-content/uploads/2019/12/Sewer-District-as-Built.pdf accessed July 9, 2021

[16] Stevens, G. and K.B. Travis. 2018. Natural Resources Inventory of Columbia County, New York Columbia County Environmental Management Council and NYS DEC Data sheet for Copake Lake, see Appendix A).

[17] Copake Lake Conservation Society website and NYS DEC Data sheet, Taghkanic Creek, Lower and tribs, see Appendix A).

[18] NYS DEC Data sheet, Taghkanic Creek, Lower and tribs, Appendix A.

[19] One NYS DEC sample from 2013 in West Taghkanic 2013 showed slight impacts. WAVE samples taken in West Taghkanic by volunteers in 2014, 2015, and 2016 showed no known impact. The Farmscape Ecology Program at Hawthorne Valley Farm reports a sample of benthic macroinvertebrates taken from the Taghkanic Creek at the western town boundary that showed no negative impacts.

[20] (personal communication with Rob Perry, Hudson Public Works Director, August 25, 2021)

Stakeholders expressed concern about growth in the City of Hudson and the potential impact on water demand. Though the City of Hudson's population declined from 6,713 in 2010 to 5,894 in 2020, population data do not tell the full story of potential water use. Businesses are also served by the water system, and part-time residents are not counted during the decennial census. Housing data show there has been an increase in housing units that are dedicated to seasonal or occasional use in Hudson in the past five years.[21]

Runoff from the land

Much of the development in the Taghkanic Headwaters has low levels of impervious surfaces. Roofs, roads, driveways, and other impervious surfaces negatively influence water quality, an effect that may become evident even when such surfaces cover a very low percent of the watershed (3% or even lower).[22] Water flowing across these surfaces picks up materials such as animal waste, litter, nutrients, and pollutants such as motor oil. These inputs to the stream degrade water quality and can harm the plants and animals living in and near the stream.[23] Although the threat to water is currently low, the Taghkanic Creek water quality is most likely affected to some degree by runoff from lawns, roads, and farms.

In some places in the watershed where good soils for farming are found, people are farming in valleys near the Taghkanic Creek or its tributaries. Some agricultural practices may be detrimental to water quality and streamside habitats, by causing runoff or erosion. Polluted Farms that implement best management practices for soil and water conservation can support water quality.

Vegetated stream buffers are key to reducing the impacts of development and agriculture on streams and wetlands. A lack of vegetated buffers allows more potential pollutants to enter a stream and increases the potential for erosion.

Road salt is a growing potential threat

Road salt deposited on roads, driveways, parking lots and sidewalks may wash into streams and ponds. This influx produces a spike in salinity and may also deplete the oxygen available to stream life.[24] Water quality reports from the City of Hudson show sodium has been detected at levels that should not be consumed by people on severely restrictive sodium diets though still within the acceptable range.[25] The Taghkanic Creek may be affected by road salt. Chloride is toxic to aquatic life, causing harm even at low levels.[26] Road salt accumulates in sediments in drainage ditches, ponds, lakes, and wetlands, as well as groundwater. There is no easy way to remove road salt from the environment, making it challenging to restore affected water bodies.[27]

[21] Capital Region Indicators, Vacancy Status, https://www.capitalregionindicators.org/profile/3635969, accessed November 4, 2021.
[22] Morse, et al. 2018
[23] New York State DEC: Stormwater. https://www.dec.ny.gov/chemical/8468.html; accessed August 3, 2021.
[24] Hinsdale, Jeremy. 2018 "How Road Salt Harms the Environment" State of the Planet, Columbia Climate School.
[25] City of Hudson Annual Drinking Water Quality Report, 2020. Retrieved on December 3, 2021.
[26] Hinsdale 2018; Kelly, et al, 2019. Road Salt: The Problem, the Solution, and How to Get There, the Cary Institute of Ecosystem Studies.
[27] Hinsdale 2018

Invasive plants

Invasive plants are another threat to streamside areas. Among the materials that streams carry are seeds and materials from invasive plants, such as Japanese knotweed. Invasive plants mt form extensive monocultures, replacing native plant communities and destabilizing streambanks. Other species that can cause problems for streamsides include purple loosestrife and multiflora rose. The best way to avoid invasive species problems along streams is to leave trees and shrubs in place.

Culverts and dams

Culverts, dams, and other related infrastructure present threats to stream habitats. These structures influence the movement of water, sediment, animals, and materials in ways that affect the health of the stream and the in-stream habitats for organisms. These structures often slow water flow, leading to warmer temperatures in the stream. Water impounded by a dam often has less tree cover, which leads to warmer water.

Many of the organisms that live in streams need to move up- and downstream to access the different kinds of habitats they need to feed, breed, and grow. Culverts and dams may be barriers to the movement of animals, and effectively reduce available habitat. In the Taghkanic Headwaters, and other parts of the Hudson Valley, teams of volunteers and professionals have been assessing the culverts and dams along streams to identify those that pose barriers, especially those that impede wildlife movement.[28] Approximately twelve culverts that are considered moderate to severe barriers are present along the creeks in the Taghkanic Headwaters, as shown in Figure 13. Dams present in the watershed may create lakes that support community needs, such reservoirs for drinking water or recreation. Other dams are remnants from past mill sites or other activities. While dams are shown on the map, they are not ranked for their potential to impede the movement of wildlife.

Threats to both forests and streams

Development is increasing even as population is declining

In Columbia County, as in much of rural New York, development pressure does not come from population growth, but a change in the way we live on the landscape. Of the four towns in the watershed, only Claverack's population grew from 2010-2020 and only by 37 people. Yet from 2001-2019, the developed area for Columbia County increased 3.73% and the impervious area increased 11.72%.[29] Although the increases in developed area are relatively small, these small impacts contribute to the loss of forest and increase in fragmentation.

There is a perception that low-density development has less of an impact on wildlife and water than higher density development but, all development has impacts, even one house in the woods. While the footprint of a new house and yard is obvious, these sites and the activities around them exert an "ecological influence goes well beyond the footprint of the house and beyond backyard."[30]

Some animals rely on a special combination of forest and wetlands, and roads often lie in their path between the two.

[28] per New York State Water Resources Institute https://wri.cals.cornell.edu/hudson-river-estuary/watershed-management/aquatic-connectivity-and-barrier-removal-culvert-dams/.
[29] Land use change data from www.mrlc.gov/eva/
[30] Vispo 2014

Climate change exacerbates risks to forests and water

The Hudson Valley is already experiencing the unpredictable weather expected to occur more frequently as the climate changes. Healthy forest and stream ecosystems will be more resilient to changes in the climate. Climate change is expected to bring myriad changes to:

- The amount and timing of precipitation. Columbia County is seeing an increase in rainfall amount and intensity, especially during winter to spring. Prolonged summer dry periods will result in more low-flow conditions in streams, stressing fish and other aquatic life.
  Winter processes. This region will experience a longer frost-free season and a reduction in snowpack. Frozen ground plus heavy winter rains increase susceptibility to runoff and erosion, especially on unvegetated lands.
- Temperatures. Annual average air temperature is already 1-3°C higher in the eastern US.[31] More heat waves are expected, and plant and animal species will need to shift northward, higher in elevation, or find cooler microclimates (such as north-facing slopes).

These changes foretell risks to forests and water. Soil moisture will likely decrease with warmer, less snowy winters, fewer steady rainfalls, and higher evaporation from increased temperatures. This could lead to more frequent and intense periods of short-term drought, stressing local drinking water supplies, agricultural production, forest, and stream systems.[32]

Existing protections are limited

There are some state-level rules that provide some limited protection for Taghkanic Creek and other surface water resources in the watershed. New York State has no protection for forests, outside of those in the Adirondack or Catskill Forest Preserves. This points to the need for local conservation action. It is important to understand the gaps in protection, to identify what local actions will mitigate the threats.

- Watershed Rules and Regulations for the City of Hudson prevent some uses within 300 feet of the Taghkanic Creek and its tributaries. The 1972 regulations are outdated and enforcement is challenging given the different jurisdictions.[33]
- A state stream permit is required for alterations to the bed and bank of "protected streams" which includes the Taghkanic itself, as well its tributary streams.
- A state wetland permit is required for alterations to state-mapped wetlands 12.4 acres and larger plus a 100' buffer. For context, 12.4 acres is the size of nine football fields. Not all wetlands this large are mapped, and smaller wetlands have less protection. Direct impacts of activities such as filling and/or alteration of water flow to non-regulated wetlands will degrade water quality in the headwaters. Some towns require setbacks from streams and waterbodies, which prohibit development within a certain distance (often 50 or 100 feet) of a stream. These may or may not encompass all the lands that directly affect the stream, such as the entire floodplain.

[31] USGCRP, 2018: Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 1515 pp. doi: 10.7930/NCA4.2018.

[32] See also Rosenzweig, C., 2011. Responding to climate change in New York State: Synthesis report. New York State Energy Research and Development Authority.

[33] See factsheet on New York State's Watershed Rules and Regulations.

AREAS OF EXCEPTIONAL CONSERVATION VALUE

Stakeholders identified two primary conservation values to guide this plan:

- *clean water for people and wildlife, and*
- *connected forests for plants and animals.*

These conservation values can help identify areas of high importance. CLC and stakeholders reviewed available data related to plants and animals, forests, streams, and several analyses of connectivity for wildlife. Five places emerge, each with its own mix of features, but all intricately connected to forest connectivity and clean water. These areas are places where additional conservation efforts might be prioritized, including land protection and land management.

Forested ridges and valleys, Hillsdale

Large forests along the ridges to the west and north of Knapp Hollow in Hillsdale are important parts of the linkage between large forests regionally. The Taghkanic Headwaters includes just the southern part of Kijt Uit Mountain; the large forests there extend outside the watershed, and are an opportunity to protect a forest pinch point for wildlife shifting their ranges in response to climate change. These lands also drain to sensitive coldwater streams which provide habitat for trout. From the small streams in this area, water flows through Knapp Hollow before joining the Taghkanic Creek.

Forests, Eastern Claverack

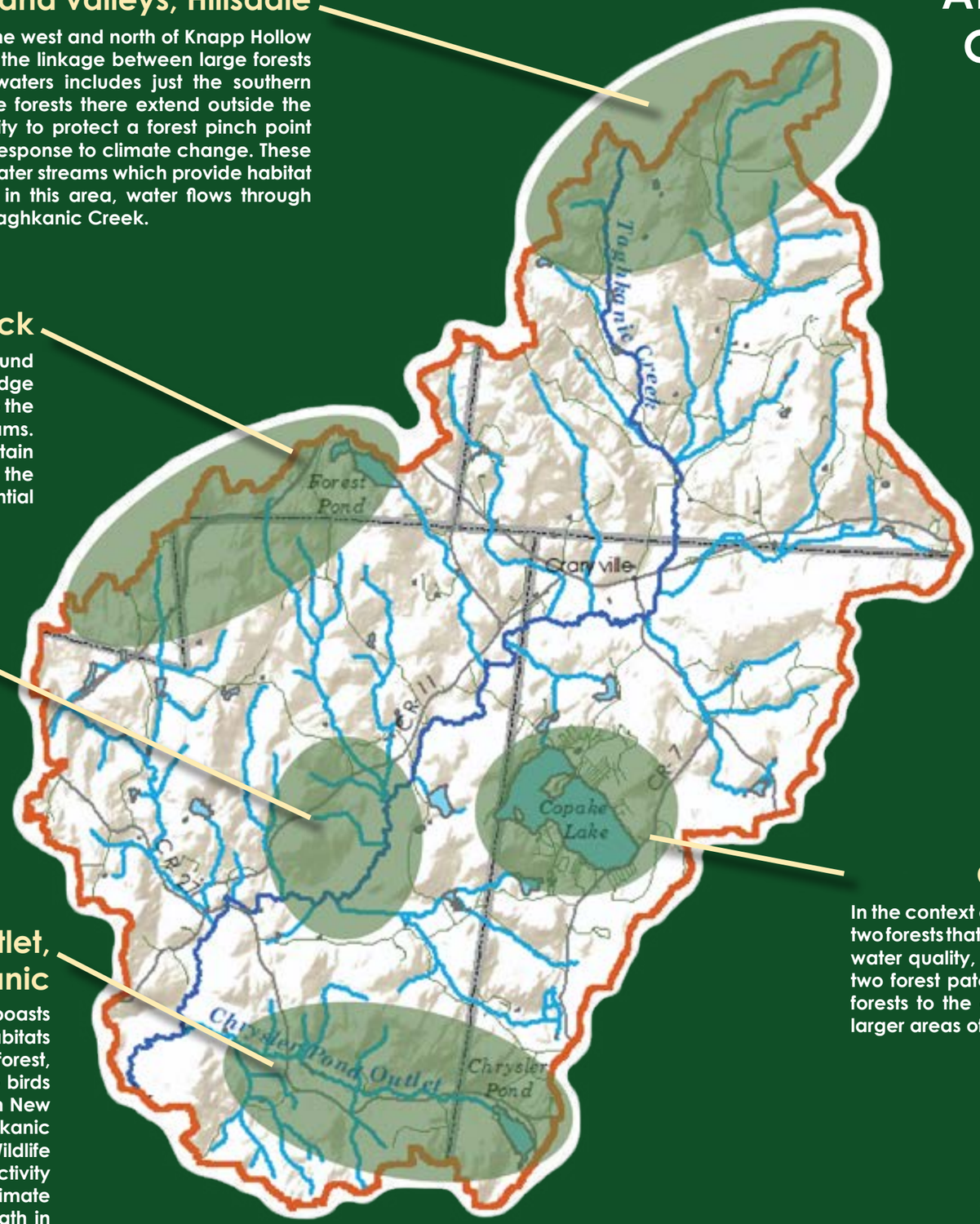
The largest forests in the Town of Claverack are found along the ridges and hills that make up the western edge of the watershed. The streams in this area, which flow to the Taghkanic Creek, are classified as trout spawning streams. Analysis by scientists highlights the opportunity to maintain forest connectivity in this area, with consideration for the size of the forests, road crossings, and other potential barriers for wildlife.

Pumpkin Hollow Swamp, Taghkanic

In Pumpkin Hollow swamp the Taghkanic Creek flows through the largest extent of forested wetlands and streamside habitat in the watershed. There is likely "ancient" floodplain forest here that supports a diversity of native plant species and has additional ecological importance. These extensive wooded wetlands help keep the stream cool, supporting brook trout spawning.

Chrysler Pond and Outlet, Copake and Taghkanic

The area around Chrysler Pond and along the outlet stream boasts an extensive complex of woods and wetlands. Important habitats include an exemplary red maple hardwood swamp, floodplain forest, vernal pools, "ancient" floodplain forest, and habitat for rare birds (including the Least Bittern, which is considered threatened in New York). Chrysler Pond outlet is a trout stream that joins the Taghkanic Creek at New Forge State Forest. Part of the Doodletown Wildlife Management Area is nearby. From the perspective of connectivity to support wildlife that are shifting their ranges in response to climate change, this area is of particular importance, providing a path in what is considered a pinch point in the surrounding landscape*.



Copake Lake forests, Copake

In the context of a densely developed lakeside community, the two forests that drain to Copake Lake are important for supporting water quality, which is somewhat degraded in the lake. These two forest patches are part of a linkage zone between larger forests to the east and west, providing connections between larger areas of forest (to the east and west).

*Anderson, M.G., Barnett, A., Clark, M., Prince, J., Olivero Sheldon, A. and Vickery B. 2016. Resilient and Connected Landscapes for Terrestrial Conservation. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA