



5.4.7 Infestation and Invasive Species

This section provides a profile and vulnerability assessment of the infestation and invasive species hazard for Monroe County.

5.4.7.1 Hazard Profile

This section provides information regarding the description, extent, location, previous occurrences and losses, climate change projections and the probability of future occurrences for the infestation and invasive species hazard. Lyme disease and West Nile Virus caused by ticks and mosquitos are discussed in Section 5.4.1 – Disease Outbreak.

Hazard Description

An infestation is defined as an invasion or overrun by parasites that attack plants, animals, and humans. Insect, fungi, and parasitic infestations can result in destruction of various natural habitats and cropland, impact human health, and cause disease and death among native plants, wildlife, and livestock. An infestation is the presence of pest organisms within an area or field, on the surface of a host, or in soil at numbers or quantities large enough to harm, threaten, or otherwise negatively affect native plants, animals, and humans. Pests are any organisms (insects, mammals, birds, parasite/pathogen, fungi, non-native species) that threaten other living species within an environment. Pests compete for natural resources and can transmit diseases to humans, crops, and livestock. Human populations are generally affected by insect or animal infestations that can lead to epidemics or endemics.

Invasive species are non-native species that can harm the environment, the economy, or human health. They may come from anywhere in the world, and as international trade increases, so does the rate of invasive species introductions. Invasive species threaten nearly every aspect of the world and are one of the greatest threats to New York State’s biodiversity (NYSDEC n.d.). They can cause or contribute to the following:

- Habitat degradation and loss
- Loss of native fish, wildlife, and tree species
- Loss of recreational opportunities and income
- Crop damage, and diseases in humans and livestock (NYSDEC n.d.)

Thousands of species have been introduced into the United States, posing serious threats to agriculture, human health, and the integrity of land and water. New York State and Monroe County are vulnerable to damage from these invasive species. The following are names of invasive species found in New York State; however, this list does not include all plant species that are invasive or potentially invasive within the state.

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|-----------------------------|-----------------------------|------------------------------|
| • Amur Cork Tree | • Broadleaf Water – milfoil | • Common Frogbit |
| • Amur Honeysuckle | • Canada Thistle | • Cup-plant |
| • Autumn Olive | • Carolina Fanwort | • Curly Pondweed |
| • Beach Vitex | • Chinese Lespedeza | • Cut-leaf Teasel |
| • Black Locust | • Chinese Sliver Grass | • Cypress Spurge |
| • Black Swallow-wort | • Chinese Lespedeza | • Eurasian Water – milfoil |
| • Border Privet | • Chinese Sliver Grass | • European Common Reed Grass |
| • Brazilian Waterweed | • Chinese Yam | • Floating Primrose – Willow |
| • Broad-leaf Pepper - grass | • Cogon Grass | |
| | • Common Buckthorn | |

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- Garden Loosestrife
- Garlic Mustard
- Giant Hogweed
- Japanese Angelica
- Tree
- Japanese Barberry
- Japanese Honeysuckle
- Japanese Hops
- Japanese Knotweed
- Japanese Stilt Grass
- Japanese Virgin's - bower
- Kudzu
- Leafy Spurge
- Lesser Celandine
- Marsh Dewflower
- Mile-a-minute Weed
- Morrow's
- Honeysuckle
- Mugwort
- Multiflora Rose
- Narrowleaf Bittercress
- Norway Maple
- Oriental Bittersweet
- Pale Swallow-wort
- Parrot-feather
- Porcelain Berry
- Purple Loosestrife
- Reed Canary-grass
- Rock Snot (diatom)
- Rusty Willow
- Slender False Brome
- Small Carpgrass
- Smooth Buckthorn
- Spotted Knapweed
- Sycamore Maple
- Tall Glyceria
- Uruguayan Primrosewillow
- Water Chestnut
- Water thyme
- Wavyleaf Basketgrass
- Wild Chervil
- Wineberry
- Winged Euonymus
- Winter Creeper
- Yellow Floating Heart
- Yellow Iris

The Finger Lakes Partnership for Regional Invasive Species Management (PRISM) is a cooperative partnership of diverse stakeholders from throughout the central region of New York State, including Monroe County. According to the Finger Lakes PRISM agricultural working group, the priority invasive plant species of concern in the region include Autumn and Russian olive, Canada thistle, Field bindweed, Japanese knotweed, Johnson grass, Ragweed, Spotted knapweed, Swallow-wort, Velvet leaf, and Wild parsnip for plants; Basil downy mildew (*Peronospora belbahrii*), Grape crown gall (*Agrobacterium tumefaciens*), Late blight (*Phytophthora infestans*), Phytophthora blight (*Phytophthora capsici*), and Plum pox virus (Potyvirus) for diseases; and BMSB (*Halyomorpha halys*), Garlic bloat nematode (*Ditylenchus dipsaci*), Golden nematode (*Globodera rostochiensis* - not an insect but should be included), Spotted wing drosophila (*Drosophila suzukii*), and Swede Midge (*Contarinia nasturtii*) for insects. Aquatic species of concern include the macrophytes Hydrilla and *Trapa natans* (water chestnut); macroalgae *Nitellopsis obtusa* (starry stonewort); invertebrates *Corbicula fluminea* (Asian clam) and *hemimysis* (bloody red shrimp); and the fish *Neogobius melanostomus* (round goby) (New York Invasive Species (IS) Information 2022).

New York State has been impacted by various past and present infestations, including high populations of mosquitoes, which can cause West Nile Virus (WNV); deer ticks, which can cause Lyme disease; and Asian longhorned beetles and hemlock woolly adelgid, which destroy trees. Other infestations that have affected the state include Eastern Equine Encephalitis, La Crosse Encephalitis, Powassan Virus, St. Louis Encephalitis, Western Equine Encephalitis, Emerald Ash Borer, and Sirex Woodwasp. Not all of these infestations have occurred in Monroe County. The infestations listed below merit attention.

Black Swallow-Wort, also known as *Cynanchum louiseae*, is a weed in the shape of a V and resembles a swallow's tail. The invasive plant has been found in gardens and parks throughout Monroe County.

Brown Marmorated Stink Bug (BMSB) is an invasive species that is native to Eastern Asia and was first detected in Pennsylvania in October 2001. The insect has spread across a number of eastern U.S. states, and its presence has now been documented in Oregon and California as well. These insects can be an agricultural pest, threatening apples, pears, peaches, figs, mulberries, citrus, persimmons, and soybeans (Cornell Cooperative Experience 2019). Severe damage from these insects can render crops unusable for processed products.



Emerald Ash Borer (EAB) is an invasive beetle from Asia and kills North American ash species (*Fraxinus* sp.), all of New York’s ash trees are susceptible to EAB. The first EAB infestation in New York State was discovered in Cattaraugus County 2009. As of the summer of 2022, the presence of EAB has been confirmed in all New York counties except; Essex, Hamilton, and Lewis (NYSDEC 2021). The EAB is a small and very destructive beetle. It has four stages: adult, egg, larva, and pupa. The adult beetle are roughly 3/8 to 5/8 inch long with metallic green wing covers and a coppery red or purple abdomen. They may be present from late May through early September but are most common in June and July. Signs of infection include tree canopy dieback, yellowing, and browning of leaves (NYSDEC 2021).

Hemlock Woolly Adelgid (HWA) came to the U.S. from southern Japan and has been present in New York State since the 1980s, where it most likely arrived on infested nursery stock that was sold and distributed near New York City and the Lower Hudson region, and in 2008 the HWA was first found in the Finger Lakes Region (Cornell Cooperative Experience 2019). The adelgid uses long mouth parts to extract sap and nutrients from hemlock foliage, preventing free growth and causing needles to discolor from deep green to grayish green and to drop prematurely. Loss of new shoots and needles seriously impairs tree health. Infestation is usually fatal to the tree after several years. Wind, birds, other wildlife, and movement of infested host material (wood) by humans are all factors in dispersion of the adelgid (NYSDEC 2018). Hemlock wood is commonly used in barns and on farm building projects. Groves of hemlock trees provide habitat and cover for deer, ruffed grouse, turkey, rabbit, and snowshoe hare. Loss of hemlock groves can result in loss of cool, damp, and shaded microclimate that supports terrestrial plant communities. Losses can also result in warmer stream temperatures for fish and other aquatic species, thus harming them.

Spotted Lanternfly is a planthopper native to China and Southeastern Asia. Spotted lanternfly is a significant economic and lifestyle pest for residents, businesses, tourism, forestry, and agriculture. The greatest agricultural concern falls on grapes, hops, apples, blueberries, and stone fruits. Its presence has led to crop loss, exporting issues, and increased management costs (New York State Integrated Pest Management 2022a).

True Armyworm, also known as the common armyworm, is primarily a pest of plants in the grass family: forage/pasture/ grasses and lawns, small grains, and corn. However, under distress, armyworms will also attack legumes and other plants. Young larvae appear smooth, cylindrical, pale green to brownish, while mature larvae are smooth and marked with two orange, white-bordered strips on each side. Larvae range in size from 1/8 inch to 1 ½ inches long. The insect spends winters in the south and flies up to New York State in the spring (Cornell Cooperative Extension 2021).

Regulations

The Invasive Species Council (Council) is a statutory body that was created in 2008 by Title 17, Section 9 of the Environmental Conservation Law (ECL). The Council was created to coordinate among multiple State entities and partners in addressing the environmental and economic threats of invasive species. The legislation defines invasive species as “a species that is (a) non-native to the ecosystem under consideration; and (b) whose introduction causes or is likely to cause economic or environmental harm or harm to human health” (NYSDEC 2022).

The Council is co-led by the Department of Agriculture and Markets (AGM) and consist of nine members: the Commissioners of DEC, AGM, Transportation, Education, and Office of Parks Recreation and Historic Preservation (OPRHP), Secretary of State, the Chairperson of New York State Thruway Authority, the Director of the New York State Canal Corporation, and the Chairperson of the Adirondack Park Agency (APA) (NYSDEC 2022).



As of 2014, New York State has adopted regulations (6 New York Codes Rules and Regulations [NYCRR] Part 575) which identifies the regulations standards for selling and offering regulated species. Any persons who purchase a regulated invasive species is required to maintain all labels, signs and notices pertaining to invasive species in the given areas (New York Codes, Rules, and Regulations 2022).

Extent and Location

The extent and location of an infestation or invasive species depend on the preferred habitat of the species, as well as the species’ ease of movement and establishment. Each threat can impact most areas of New York State, including Monroe County. Levels of threat from infestations and invasive species range from nuisance to widespread. The threat typically intensifies when the ecosystem or host species is already stressed, such as during periods of drought and increased periods of rainfall.

Black Swallow Wart

Black Swallow-Wort, also known as *Cynanchum louiseae*, is a weed in the shape of a V and resembles a swallow’s tail. The invasive plant has been found in gardens and parks throughout Monroe County. In 2014, reports of black swallow-wart were found in all the parks located within the County (Democrat & Chronicle 2014).

Brown Marmorated Stink Bug

Figure 5.4.7-1 below shows the distribution of brown marmorated stink bugs in New York State as of 2022. The red circle identifies Monroe County, where over 500 cases have been reported.

Emerald Ash Borer

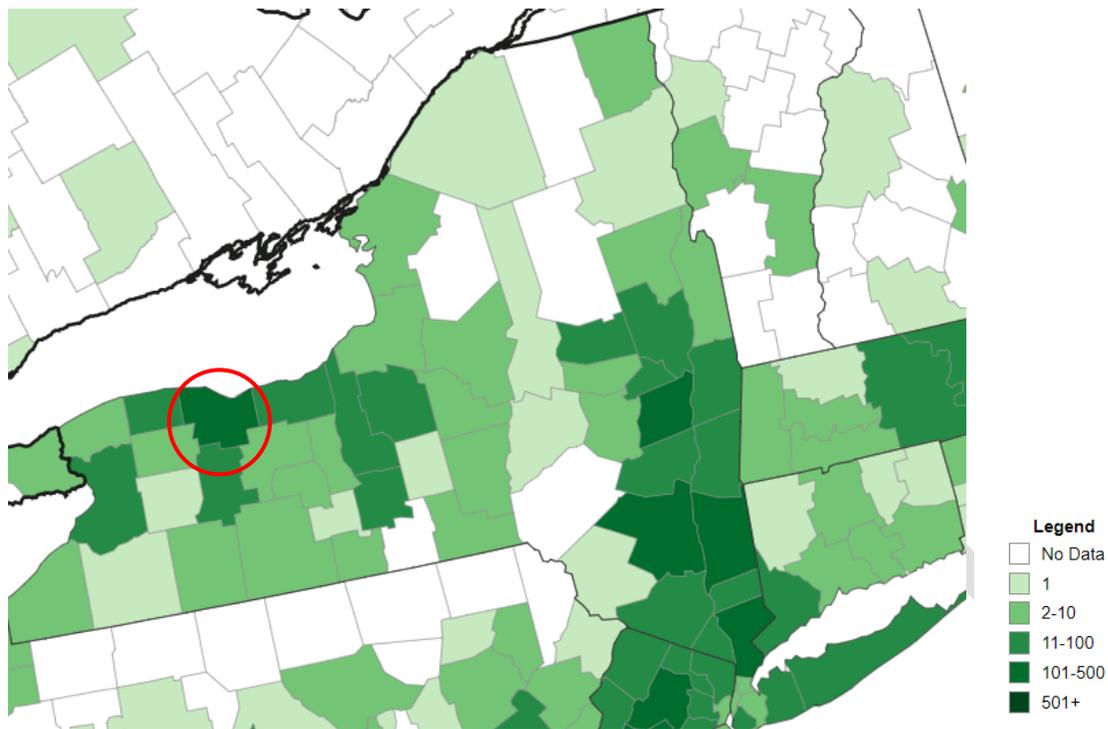
The Emerald Ash Borer (EAB) is a very small but very destructive beetle, that has decimated North America’s native ash tree population, and is responsible for putting all three of New York’s ash species into serious decline (Monroe County Soil & Water Conservation District 2020). Signs of infestation in the tree canopy include dieback, yellowing, and browning of leaves. Monroe County is home to the highest density of ash trees in New York State, leaving a disproportionate impact on the County’s parks, forests, and waterways (Monroe County Soil & Water Conservation District 2020). Ash frequently grows along streams, swamps, and lakes, and is key to reducing nutrient runoff and sediment erosion, the Monroe County Soil & Water Conservation District along with Monroe County and New York State Parks planted 21,240 new trees of different species along the waterways in the County where ash typically grew, in hopes to provide the same benefits to water quality, secure the economic and ecological health of water and waterways (Monroe County Soil & Water Conservation District 2020). This initiative was funded through the Great Lakes Restoration Initiative and was completed in 2020.

Hemlock Woolly Adelgid (HWA)

The Hemlock Woolly Adelgid (HWA) is an aphid like insect that threatens hemlock trees in eastern North America. HWA has been in North America for twenty years and has been spreading across New York State and to higher elevations at an alarming rate (Cornell Cooperative Extension 2018). Early detection is the key to successful management, HWA are recognized by white woolly masses produced on twigs in late winter. Figure 5.4.7-2 shows the distribution of HWA in New York State and Monroe County as of January 2020. The dark blue circle indicates Monroe County.



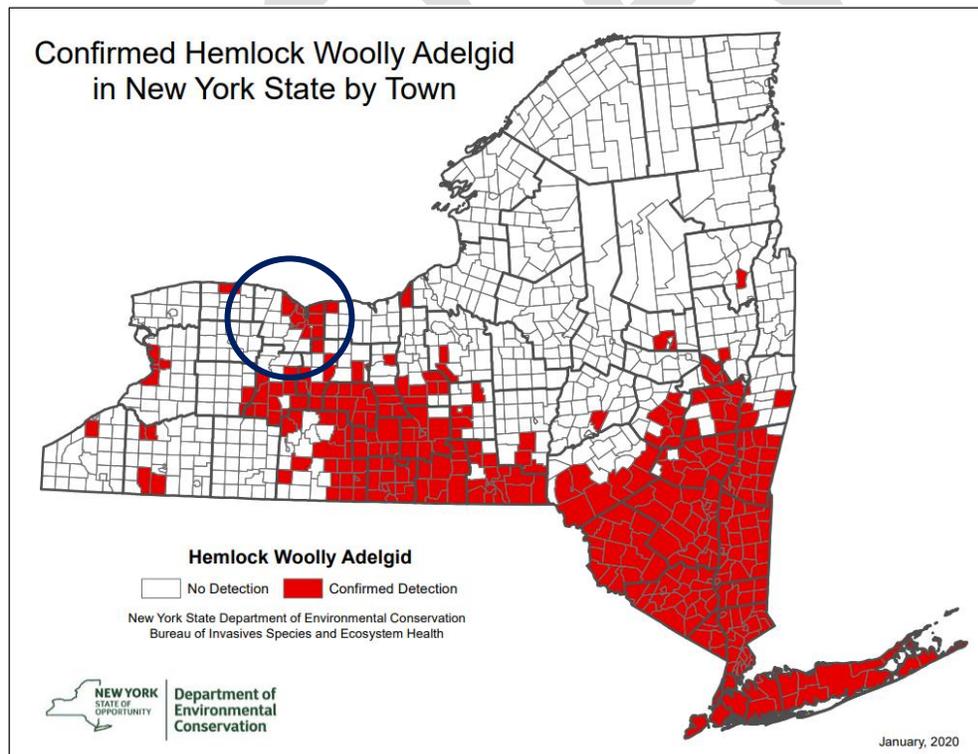
Figure 5.4.7-1 Brown Marmorated Stink Bug Distribution in New York State and Monroe County



Source: EDDMaps 2022

Note: The red circle indicates the position of Monroe County

Figure 5.4.7-2. Confirmed Hemlock Woolly Adelgid in New York State by Town



Source: NYSDEC 2020



Note: The black circle indicates the approximate position of Monroe County

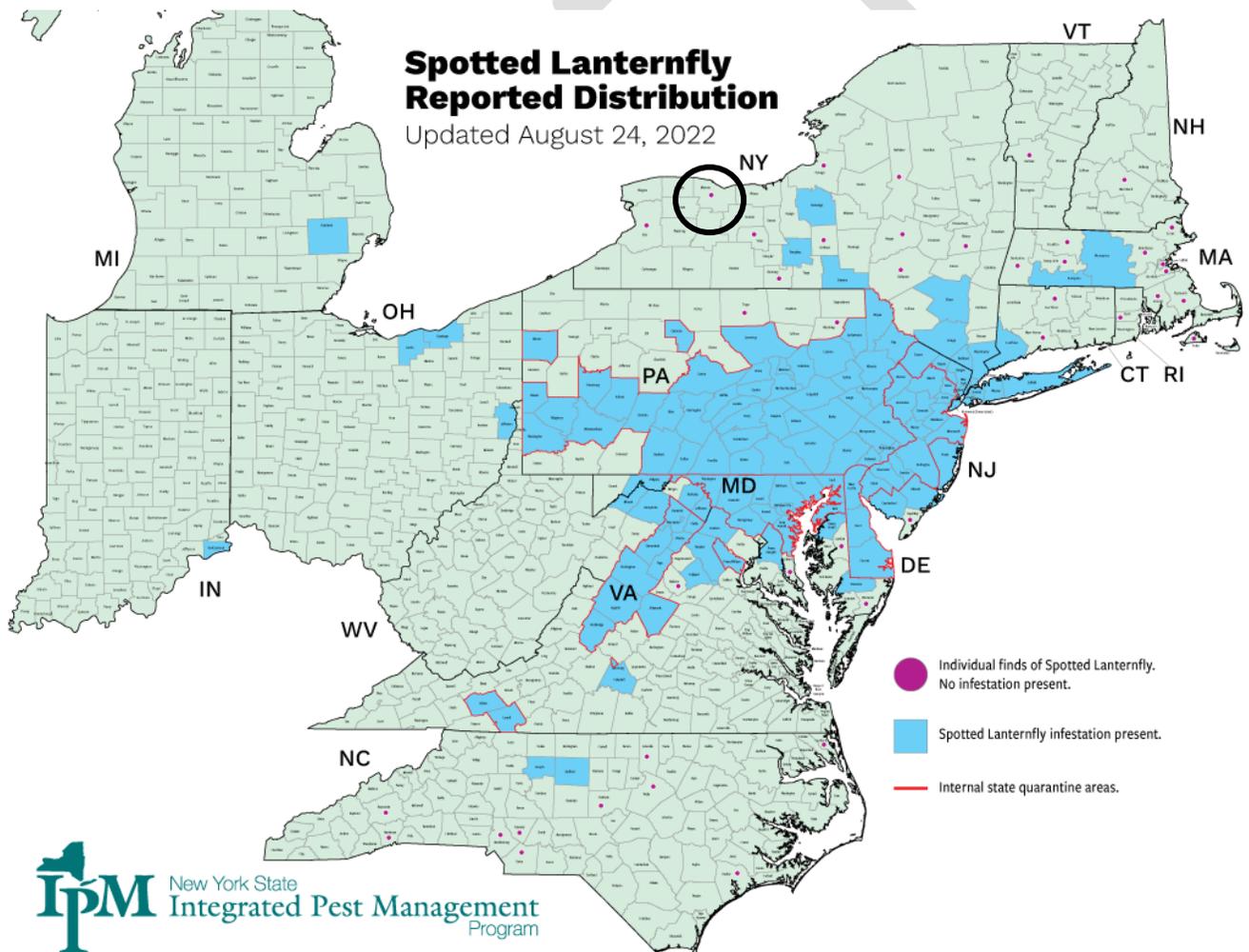
Based on the information presented in the above image, the northeast and southeast portions of Monroe County have the largest detection of HWA.

Spotted Lanternfly

The spotted lanternfly (*Lycorma deliculata*) is an Asian plant hopper. In the USA, spotted lanternfly is an invasive species that could be very devastating to some crops and hardwood trees. This insect was accidentally introduced into Pennsylvania and was confirmed in September 2014. Since this time, the insect has spread throughout the mid-Atlantic (New York State Integrated Pest Management 2022a)

The spotted lanternfly can feed on more than 70 plant species including cultivated grapes, fruit trees, and hardwood trees. Key tree hosts include black walnut; red maple; and agricultural crops such as grapes, hops, apples, and peaches. As of August 2022, spotted lanternfly has been found in Monroe County but has not reached infestation levels yet (New York State Integrated Pest Management 2022a).

Figure 5.4.7-3 Spotted Lanternfly Reported Distribution



Source: New York State Integrated Pest Management 2022a
Note: The black circle indicates the position of Monroe County



True Armyworm

The True Armyworms are primarily a pest of plants in the grass family: forage, pasture, grasses and lawns, small grain, and corn. This native species does not overwinter in New York but fly north from southern states in the spring. Under hunger stress armyworms will attack legumes, and other plants. Commercial field crops at risk for armyworms; grass or mostly grass hay fields, pastures, corn fields that were late planted into grass fields, no-till or reduced tillage fields, fields with crop residue, planted into small grain (especially rye grass) cover crop, corn fields with grassy weeds, quackgrass, crabgrass and bluegrass and other perennials, small grain fields (Cornell Cooperative Extension 2021).

Previous Occurrences and Losses

Many sources provided historical information regarding previous occurrences and losses associated with infestations and invasive species throughout New York State and Monroe County; therefore, the loss and impact information for many events varies depending on the source. The accuracy of monetary figures discussed is based on the available information in cited sources.

FEMA Major Disaster and Emergency Declarations

Between 1954 and 2022, New York State and Monroe County were not included in any FEMA declared infestation and invasive species disasters (DR) or emergency declarations (EM). However, Monroe County was included in a West Nile Virus outbreak in 2000. Section 5.4.1 (Disease Outbreak) includes more information on this declaration.

USDA Declarations

The Secretary of Agriculture from the U.S. Department of Agriculture (USDA) is authorized to designate counties as disaster areas to make emergency loans to producers suffering losses in those counties and in counties that are contiguous to a designated county. Between 2015 and 2022, Monroe County was included in the following USDA-designated agricultural disasters that included or may have included losses due to infestation and invasive species:

- S4023 - 2016 Insects
- S4031 - 2016 Insects
- S4037 - 2016 Insects

The USDA crop loss data provide another indicator of the severity of previous events. Additionally, crop losses can have a significant impact on the economy by reducing produce sales and purchases. Such impacts may have long-term consequences, particularly if crop yields are low the following years as well. USDA records indicate that Monroe County has experienced crop losses from infestation and invasive species events. Table 5.4.7-1 provides details regarding crop losses in Monroe County according to USDA records.

Table 5.4.7-1. USDA Crop Losses from Infestation and Invasive Species in Monroe County (2015-2022)

| Year | Crop Type | Cause of Loss | Losses |
|------|----------------|---------------------------------------|---------------|
| 2015 | Soybeans | Wildlife/Invasive Species/Infestation | \$12 thousand |
| 2016 | Corn, Soybeans | Wildlife/Invasive Species/Infestation | \$11 thousand |
| 2017 | Corn | Wildlife/Invasive Species/Infestation | \$14 thousand |
| 2018 | Corn, Soybeans | Wildlife/Invasive Species/Infestation | \$22 thousand |
| 2019 | Corn, Soybeans | Wildlife/Invasive Species/Infestation | \$4 thousand |



| Year | Crop Type | Cause of Loss | Losses |
|------|----------------|---------------------------------------|--------------|
| 2020 | Corn, Soybeans | Wildlife/Invasive Species/Infestation | \$6 thousand |
| 2021 | Soybeans | Wildlife/Invasive Species/Infestation | \$2 thousand |
| 2022 | Soybeans | Wildlife/Invasive Species/Infestation | \$1 thousand |

Source: USDA 2022

Previous Events

No new invasive species have impacted Monroe County since 2015. No infestation events have been identified since 2015. For events prior to 2015, refer to Appendix H (Supplementary Data). For detailed information on damages and impacts to each municipality, refer to Section 9 (Jurisdictional Annexes).

Climate Change Impacts

Climate change is beginning to affect both people and resources in New York State, and these impacts are projected to increase. The impacts related to increasing temperatures and sea level rise are already causing complications in the state. *ClimAID: The Integrated Assessment for Effective Climate Change in New York State (ClimAID)* was undertaken to provide decision-makers with information on the state’s vulnerability to climate change and to facilitate the development of adaptation strategies informed by both local experience and scientific knowledge (NYSERDA 2011/2014).

Temperatures in New York State are warming, with an average rate of warming over the past century of 0.25° F per decade. Average annual temperatures are projected to increase across New York State by 2–3.4 °F by the 2020s, 4.1–6.8 °F by the 2050s, and 5.3–10.1 °F by the 2080s. By the end of the century, the greatest warming is projected to be in the northern section of the state (NYSERDA 2011/2014).

Each region in New York State, as defined by ClimAID, has attributes that will be affected by climate change. Monroe County is part of Region 1 (Western New York and the Great Lake Plains), where temperatures are estimated to increase by 4.3 to 6.3°F by the 2050s and 5.7 to 9.6°F by the 2080s (baseline of 47.7°F, middle range projection). Precipitation totals are estimated to increase between four to ten percent by the 2050s and four to thirteen percent by the 2080s (baseline of 34.0 inches, middle range projection). Table 5.4.7-2 displays the projected seasonal precipitation change for the region (NYSERDA 2011/2014).

Table 5.4.7-2. Projected Seasonal Precipitation Change in Region 1, 2050s (% change)

| Winter | Spring | Summer | Fall |
|-----------|----------|------------|-----------|
| +5 to +15 | 0 to +15 | -10 to +10 | -5 to +10 |

Source: NYSERDA 2014

Temperature and rainfall increases due to climate change are anticipated, and evidence exists that climate change may be a factor in expansion of infestation and infectious diseases in the United States. Warmer temperatures and changing rainfall patterns provide an environment where insects can remain active longer, greatly increasing the risk for animals and humans. The changes in climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resource Defense Council 2015). Armyworms die in colder temperatures. Warmer spring and winter temperatures allow them to continue to reproduce—a factor contributing to the outbreak in 2012.

As temperatures increase and rainfall patterns change, these insects can remain active for longer seasons and within wider areas. The ability to predict the future distribution of invasive species in response to climate change is a difficult task due to the factors that influence local and short-term invasion patterns, and because invasive species and concurrent climate and land-use changes are dynamically linked (Finch, et al. 2021).





Probability of Future Occurrences

Based on historical documentation and given the overall impact of changing climate, New York State is expected to undergo increased incidences of infestation. Monroe County and all its jurisdictions will continue under threat of infestations that may induce secondary hazards and health threats to the County population if infestations are not prevented, controlled, or eradicated.

In Section 5.3, the identified hazards of concern within Monroe County were ranked. Probability of occurrence, or likelihood of an event, is one parameter used for hazard rankings. Based on historical records and input from the Steering Committee, probability of occurrence of infestation and invasive species within the County is considered “occasional” (Between 10 and 100 percent annual probability of a hazard event occurring., as presented in Table 5.3-1).

5.4.7.2 Vulnerability Assessment

A qualitative assessment was conducted for infestations and invasive species in Monroe County. The following discusses the County’s vulnerability to this hazard. Refer to Section 5.1 (Methodology and Tools) for additional details on the methodology used to assess the infestation and invasive species risk.

Impact on Life, Health and Safety

The entire population of Monroe County is vulnerable to infestation. According to the 2020 U.S. Census, Monroe County had a population of 759,443. As discussed earlier, infestations can have an impact on agricultural commodities. This destruction of crop may include consumable resources that are sold to persons in the County. Section 5.4.2 (Drought) discusses the number of farms that are operating in the County (i.e., 527 farms) (USDA 2017). It is reasonable to assume that the farms in Monroe County also experience losses in crops. This not only impacts the livelihood of the farmers; it also affects the community that relies on these crops for food or other commodities.

Impact on General Building Stock

Structures are not anticipated to be directly affected by infestation or invasive species; however, EAB may cause a catastrophic loss of ash trees throughout the County, which could result in stream bank instability, erosion, and increased sedimentation, impacting ground stabilization and possibly cause foundation issues for nearby structures. Additionally, with an increased number of dead trees, there is an increased risk of trees falling on roadways, power lines, and buildings.

Some invasive plants have been shown to destabilize soil due to high densities and shallow root systems, negatively impacting nearby buildings and septic systems. Other invasive plant species have been known to clog culverts and streams, increasing flooding risk.

Impact on Critical Facilities

Water treatment plants could be impacted by infestation and invasive species because of similar issues that the general building stock may experience. Water that becomes polluted due to increased sedimentation and erosion will require additional treatment. If the system becomes clogged with these pollutants, the ability of water treatment plants to operate may become impaired. Additionally, soil that becomes unstable due to decaying vegetation can impact critical facilities that are built on or around these soils.



Impact on Economy

Impacts of infestation and invasive species on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with activities and programs implemented to conduct surveillance and address infestation have not been quantified in available documentation. Crop losses from invasive species may be significant; during 2012, the County’s crop was severely impacted by the armyworm. In 2017, there were 85,422 acres of cropland in Monroe County with \$66,638,000 in crops sold (USDA 2017). Therefore, it is reasonable to believe that Monroe County farmers have experienced monetary losses from infestations.

EAB is the responsible for placing all three of New York’s ash species in serious decline. Ash wood is the primary wood for baseball bats, the most common tree planted in parks and city streets, and has a long history of positive impact to several wildlife species (Monroe County Soil & Water Conservation District 2020). The cost of removal for ash trees can be upwards of \$1 million depending on the number of trees for removal and their location.

Impact on the Environment

As previously discussed, Monroe County’s parks, forests, landscaping, and agricultural areas are vulnerable to spotted lanternfly, HWA, and EAB. Species that cause eventual destabilization of soil, such as invasive insects that destroy plants or invasive plants that outcompete native vegetation but have less effective root systems, can increase runoff into waterbodies. Soil destabilization can also increase the likelihood of mudslides in areas with a steep slope.

Cascading Impacts On Other Hazards

Species that result in damage and death to trees can increase the risk of wildfire. For more information on wildfire, refer to Section 5.4.11. Soil destabilization can also increase the likelihood of mudslides in areas with a steep slope. For more information on landslides, refer to Section 5.4.8.

Future Changes That May Impact Vulnerability

Understanding future changes that impact vulnerability in the County can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The County considered the following factors to examine potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate, including the impacts of climate change

Projected Development

Section 4 identifies areas targeted for future growth and development across the County. Any areas of growth located within Monroe County could be potentially impacted by invasive species and infestation. Specific areas of recent and new development are indicated in tabular form and/or on the hazard maps included in Volume II, Section 9 (Jurisdictional Annexes) of this plan.

Projected Changes in Population

According to the 2020 Census, the population of the County has increased by approximately 1.2 percent since 2010. The County’s population is anticipated to slightly increase over the next decade (0.7 percent increase by 2030). Changes in the density of population and the increased construction throughout the County could lead to increased infestation of homes and other structures. When building developments locate near wetlands, forested



areas, or agricultural lands, it increases the possibility of infestation. Refer to Section 4 (County Profile), which includes a discussion on population trends for the County.

Climate Change

Climate change and invasive species are two of the top four drivers of global biodiversity loss, affecting production landscapes, reducing crop yields, and the provision of ecosystem services (Masters and Norgrove 2010). Land use changes because of climate change creates an empty niche for invasive species to occur so together these drivers have a greater impact. Climate change can facilitate invasive species and infestation such as new species that become invasive entering regions due to climate change, species hierarchy in ecosystems will begin to shift, leading to new dominants that may portrahit invasive behaviors, and climate induced stress in the ecosystem will facilitate invasive ecosystems (Masters and Norgrove 2010). Alternatively, invasive species and infestations can facilitate climate stress by increasing the ecosystems susceptibility to climatic disturbance, through reducing the number of species and their functional types within an ecosystem.

Change of Vulnerability Since 2017 HMP

Overall, the County’s vulnerability has not changed since the 2017 HMP, and exposure and vulnerability to infestation and invasive species will continue throughout Monroe County.

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