



## 5.4.5 Invasive Species

This section provides a profile and vulnerability assessment for the invasive species hazard.

### 5.4.5.1 Hazard Profile

This section provides profile information including description, extent, location, previous occurrences and losses, and the probability of future occurrences. For this HMP, the invasive species hazard includes a discussion of invasive plants, invasive animals, and insect borne disease, which are further defined below.

#### Description

The U.S. Department of Agriculture defines *invasive species* as a species that is non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (USDA 2016). Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions (USDA 2016). Invasive species 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 (New York State Department of Environmental Control [NYSDEC] 2014). New York is home to nearly 500 invasive species of plants and animals that are tracked and managed by experts with universities and the Department of Environmental Conservation. According to NYSDEC (2018), invasive species in New York State cause or contribute to:

- Habitat degradation and loss.
- The loss of native fish, wildlife and tree species.
- The loss of recreational opportunities and income.
- Crop damage and diseases in humans and livestock.
- Risks to public safety.

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 Broome County. The Finger Lakes PRISM is housed in the Finger Lakes Institute at Hobart and William Smith Colleges and covers 17 central New York counties.

According to the Finger Lakes PRISM the priority agricultural invasive plant species of concern in the region include the following: 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 (Finger Lakes PRISM 2018).

Aquatic invasive species of concern include Hydrilla (*Hydrilla verticillata*), the water chestnut (*Trapa natans*), the macroalgae starry stonewort (*Nitellopsis obtuse*), the bloody red shrimp (*Hemimysis*), the round goby fish (*Neogobius melanostomus*), and the oriental weatherfish (*Misgurnus anguillicaudatus*) (Finger Lakes PRISM 2018).



Terrestrial invasive species of concern include the emerald ash borer (*Agrilus planipennis*), Giant hogweed (*Heracleum mantegazzianum*), Hemlock woolly adelgid (*Adelges tsugae*), Japanese knotweed (*Polygonum cuspidatum*), Oriental bittersweet (*Celastrus orbiculatus*), Swallow-wort (pale and black) (*Cynanchum spp.*), Japanese stiltgrass (*Microstegium vimineum*), Mile-a-minute vine (*Persicaria perfoliate*), and Slender falsebrome (*Brachypodium sylvaticum*) (Finger Lakes PRISM 2018).

New York State has been impacted by various past and present infestations of invasive insects, including high populations of invasive mosquitoes species and invasive tick species, which can cause Lyme disease, West Nile Virus (WNV), Eastern Equine Encephalitis (EEE), La Crosse Encephalitis, Powassan Virus, St. Louis Encephalitis, and Western Equine Encephalitis. Other insect species, such as emerald ash borer, Asian long horned beetles, Sirex woodwasp, and hemlock woolly adelgid, destroy trees and other vegetation. Not all of these invasive species and infestations have occurred in Broome County but were noted regionally and could spread into Broome County.

### Invasive Plants

An invasive plant is able to thrive and spread aggressively outside its native range. A naturally aggressive plant can be especially invasive when it is introduced to a new habitat (USDA 2017). Invasive plants include invasive aquatic plants. Invasive aquatic plants are introduced plants that have adapted to living in, on, or next to water, and can grow either submerged or partially submerged in water (USDA 2017a,). Invasive plants often are introduced to a new area for ornamental gardening.

#### Giant Hogweed

*Giant Hogweed* is a large invasive plant species that is classified as a noxious weed. Originally from Europe, Giant Hogweed is a clearly identified giant, towering height of 14 feet or more, large leaves of up to five feet wide, and large white flower heads that are up to two and a half feet in diameter. The sap of the Giant Hogweed, when combined with moisture and sunlight, can cause severe skin and eye irritation, painful blistering, permanent scarring, and blindness. The sap can come in contact with the skin through brushing against the bristles on the stem or the breaking of the stem and leaves (NYSDEC 2018).



Source: NYIS (2019)

#### Wild parsnip

*Wild parsnip* is similar to giant hogweed, as its sap contains chemicals that can cause a severe burn within 48 hours. It can cause skin discoloration that can lead to years of light sensitivity. *Purple loosestrife* can rapidly out-compete and displace native species. It creates a canopy that suppresses growth and regeneration and can pose a problem for nesting birds and waterfowl. The dense root system can trap sediments and raise the water table and reduce water flow resulting in flooding. *Kudzu* is a climbing vine that is known for its rapid rate of growth and length. It can reach over 100 feet in a single season. Originally planted to help prevent erosion, it is now invasive. (Syracuse Post Standard 2018).

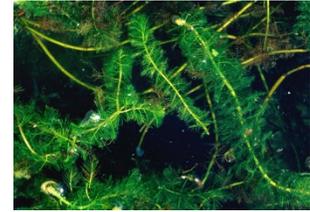


Source: NYIS (2019)



### Eurasian milfoil

*Eurasian milfoil* is an aquatic plant that grows in dense beds, choking out native aquatic vegetation and impeding recreational activities (NYSDEC 2017d). *Hydrilla* is another aquatic plant similar to milfoil that grows in dense beds, creating a thick canopy of surface mats that shades out vegetation below and can even reduce the ability of larger fish to thrive (Alberta Invasives Council 2016). *Water chestnut* is another aquatic plant species and resembles lily pads with large floating leaves. When large patches of water chestnut die out in the fall, it can result in reduction of dissolved oxygen and fish kills (NYISI 2018).



Source: NYIS (2019)

### Common reed or Phragmites

*Common reed or Phragmites* grows in dense thickets that makes habitats unsuitable for local animals. It outcompetes and replaces native plants, and produces mesoxalic acid, which is a toxin harmful to many plants. Although Common reed has been found in North America for thousands of years, it is spread when soil is disturbed in upland areas or when introduced into previously unimpacted wetlands. (Syracuse Post Standard 2018).



Source: NYIS (2019)

### Invasive Animals and Insects

#### Emerald ash borer

Emerald ash borer (EAB) is an Asian beetle that infests and kills North American ash species (*Fraxinus sp.*) including green, white, black, and blue ash. Thus, all native ash trees are susceptible. Adult beetles leave distinctive D-shaped exit holes in the outer bark of the branches and the trunk. Adults are roughly 3/8- to 5/8-inch long with metallic green wing covers and a coppery red or purple abdomen. They can 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 2014).



Source: NYIS (2019)

EAB affects black and white ash trees, which are valuable commercially and used for manufacture of flooring, furniture, and shipping pallets, as well as baseball bats. Approximately 114 million board-feet of ash lumber is grown annually in the eastern United States (approximately \$25 billion value). Hedgerows composed of ash trees help protect fields from drying and eroding from winds. These hedgerows also provide shelter to plants, animals, and humans (NYIS 2015).

The City of Binghamton’s Department of Planning, Housing & Community Development established an Emerald Ash Borer Preparedness Plan. (Binghamton, n.d.). The Preparedness Plan outlines sections from several ordinances that allow the city to combat the Emerald Ash Borer problem, establishes priorities for treatment and removal of impacted trees, determines replacement methods, identifies educational programs regarding the emerald ash borer, and provides a budget for the Plan.



### Hemlock woolly adelgid

Hemlock woolly adelgid (*Adelges tsugae*) is native to parts of Asia and was first discovered in New York State in 1985. It is in the family Adelgidae, which is related to aphids. The adelgid uses long mouth parts to extract sap and nutrients from hemlock foliage, preventing tree 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 2014).



Source: NYIS (2019)

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 microclimates that support terrestrial plant communities. Losses can result in warmer stream temperatures for fish and other aquatic species, thus harming them. Declines in hemlock can result in losses of unique plant and animal assemblages and in drastic changes to the ecosystem (NYIS 2015).

### True Armyworm

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. 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 1/2 inches long. The insect spends winters in the south and flies up to New York State in the spring (Cornell Cooperative Extension 2015).



Photo by Marlin E. Rice

### Black swallow-wort

Black swallow-wort 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 New York State.



### Brown marmorated stink bug

Brown marmorated stink bug (BMSB) is an invasive species that made its way from Asia to North America. The species was first documented in New York State in the Hudson Valley region in 2008 (Cornell Cooperative Extension 2015). These insects can impact numerous fruit and vegetable crops (peaches, apples, tomatoes, soy beans, sweet corn, berries, apricots, grapes, cherries, nectarines, lima beans, peppers, and ornamentals). Severe damage from these insects can render crops unusable for processed products.

Source: NYIS (2019)



### Ticks

Ticks are mostly native to Broome County, but several species are either invasive or have expanded their original range into Broome County. Asian Longhorn tick is invasive. Lone-Star Tick is not native to New York State but is expanding its range farther north from the south.

Source: NJAES (2019)

### Insect Borne Disease

#### Lyme Disease

Lyme Disease is caused by the Lyme Disease Bacterium, *Borrelia burgdorferi*, which normally lives in mice, squirrels, and other small animals. It is transmitted among these animals and to humans via bite of a certain





species of tick, particularly the deer tick. Lyme disease infections can cause symptoms affecting the skin, nervous system, heart, and joints of an individual (New York State Department of Health [NYSDOH] 2015).

### Eastern Equine Encephalitis

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Eastern Equine Encephalitis (EEE) spread via mosquitoes that have fed on infected bird species. About one third of humans that contract the disease die while most survivors suffer brain damage.

### West Nile Virus

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West Nile Virus (WNV) is a mosquito-borne virus that can cause encephalitis (inflammation of the brain) or meningitis (inflammation of the lining of the brain and spinal cord). WNV is spread to humans by the bite of an infected mosquito. A mosquito becomes infected by biting a bird that carries the virus (NYSDOH 2015).

### Regulations

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The New York State Invasive Species Council is a statutory body created in 2008 by Title 17, Section 9 of the Environmental Conservation Law (ECL). Its mission is 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 non-native to the ecosystem under consideration and whose introduction causes or is likely causing economic or environmental harm or harm to human health*. The council is co-led by the NYSDEC and the Department of Agriculture and Markets (NYSDAM) and consists of nine members: Commissioners of the NYSDEC, NYSDAM, Transportation, and Education; the Office of Parks, Recreation, and Historic Preservation; the Secretary of State; the Chairperson of the New York State Thruway Authority; the Director of the New York State Canal Corporation; and the Chairperson of the Adirondack Park Agency (NYSDEC, 2015).

The NYSDEC, in cooperation with NYSDAM, proposed new invasive species regulations (6 *New York Codes Rules and Regulations* [NYCRR] Part 575). The proposed regulations include a list of prohibited species possession, of which shall be unlawful with intent to sell, import, purchase, transport, or introduce; a list of regulated species that shall be legal to possess, sell, purchase, propagate, and transport but may not be knowingly introduced into a free-living state; and requirement of a permit for education, research, and other approved activities involving prohibited species and release of regulated species into a free-living state. The regulations specify the criteria for imposing these classifications and a means for future classification of species. The proposed regulation establishes grace periods for certain prohibited species to allow businesses to plan management of existing stock (NYSDEC 2015).

The New York State Invasive Species Program is made up of the following components:

- **Environmental Protection Fund:** The invasive species line item is the lifeline supporting the infrastructure of the statewide invasive species program, first described in the 2005 NYS Invasive Species Task Force Report and outlined below. Many of the components are administered as contracts through the NYS Department of Environmental Conservation.
- **New York Invasive Species Council:** Nine state agencies, co-chaired by NYS Department of Environmental Conservation and NYS Department of Agriculture and Markets.
- **New York State Invasive Species Advisory Committee:** Twenty-five representative stakeholders, including environmental, academic, industry groups.
- **Invasive Species Coordination Unit:** Two coordinating staff at the NYS Department of Environmental Conservation housed within the Division of Lands and Forests.
- **Partnerships for Regional Invasive Species Management (PRISMs):** Eight regional public-private partnerships established across New York to coordinate invasive species prevention and management and deliver on-the-ground programming. Broome County is part of the Finger Lakes PRISM.



- **iMapInvasives:** Web-based database and mapping system that stores and displays statewide invasive species occurrence, treatment, and assessment information for agencies and citizens alike.
- **New York Invasive Species Clearinghouse:** Web-based gateway to access timely, accurate, scientific, and policy information and information on upcoming invasive species events and invasive species news of interest.
- **New York Invasive Species Education Program:** Education program integrated within the Cornell Cooperative Extension Network that provides high quality science-based educational programs and cutting-edge research-based information regarding invasive species of major concern.
- **New York Invasive Species Research Institute:** Virtual institute that serves the scientific research community, natural resource and land managers, and state offices by promoting information-sharing and developing recommendations and implementation protocols for research, funding, and management to improve the scientific basis of invasive species management.
- **Additional Components:** The State of New York’s invasive species program leads special projects as needed and as resources and capacity allow, such as offering an Invasive Species Eradication Grant Program; preparing a NYS Invasive Species Management Strategy; coordinating and streamlining regulatory processes; implementing regulatory and encouraging non-regulatory approaches to prevention; supporting invasive species research; and responding to new species introductions to the state.

Specifically, the City of Binghamton established a list of acceptable shade trees for landscaping. The list includes prohibited trees and trees that are not recommended for planting. Among the trees not recommended for planting are ash trees and maples. The city notes that these two species are not recommended due to susceptibility to invasive insects which have caused significant damage in the United States (City of Binghamton, n.d.).

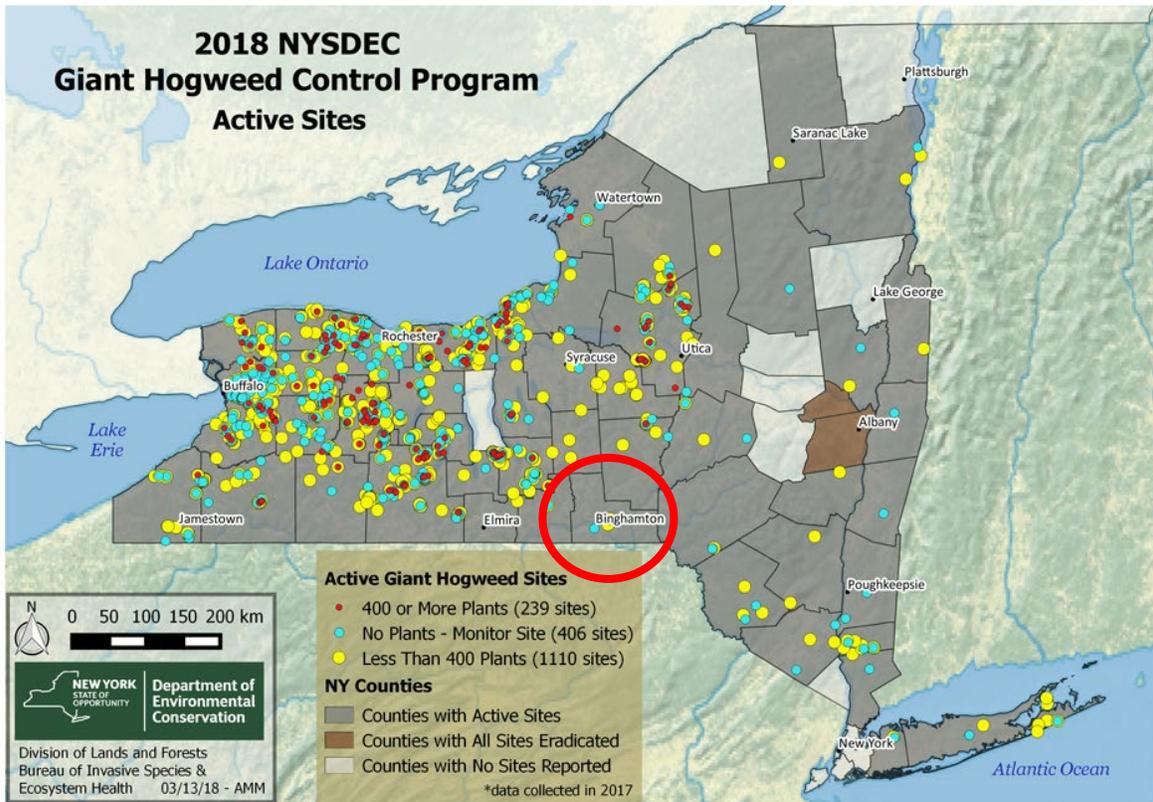
### Extent and Location

The extent and location of 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 Broome County. Levels of threat from 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. Some invasive species and infestations, such as mosquitoes and ticks, are found countywide. Others are limited to specific locations. Examples of known locations of invasive species within Broome County are described below.

The NYSDEC runs a Giant Hogweed Control Program. Figure 5.4.5-1 illustrates there are active giant hogweed locations (less than 400 plants) in central Broome County.



Figure 5.4.5-1. Giant Hogweed Control Program Active Sites for 2018



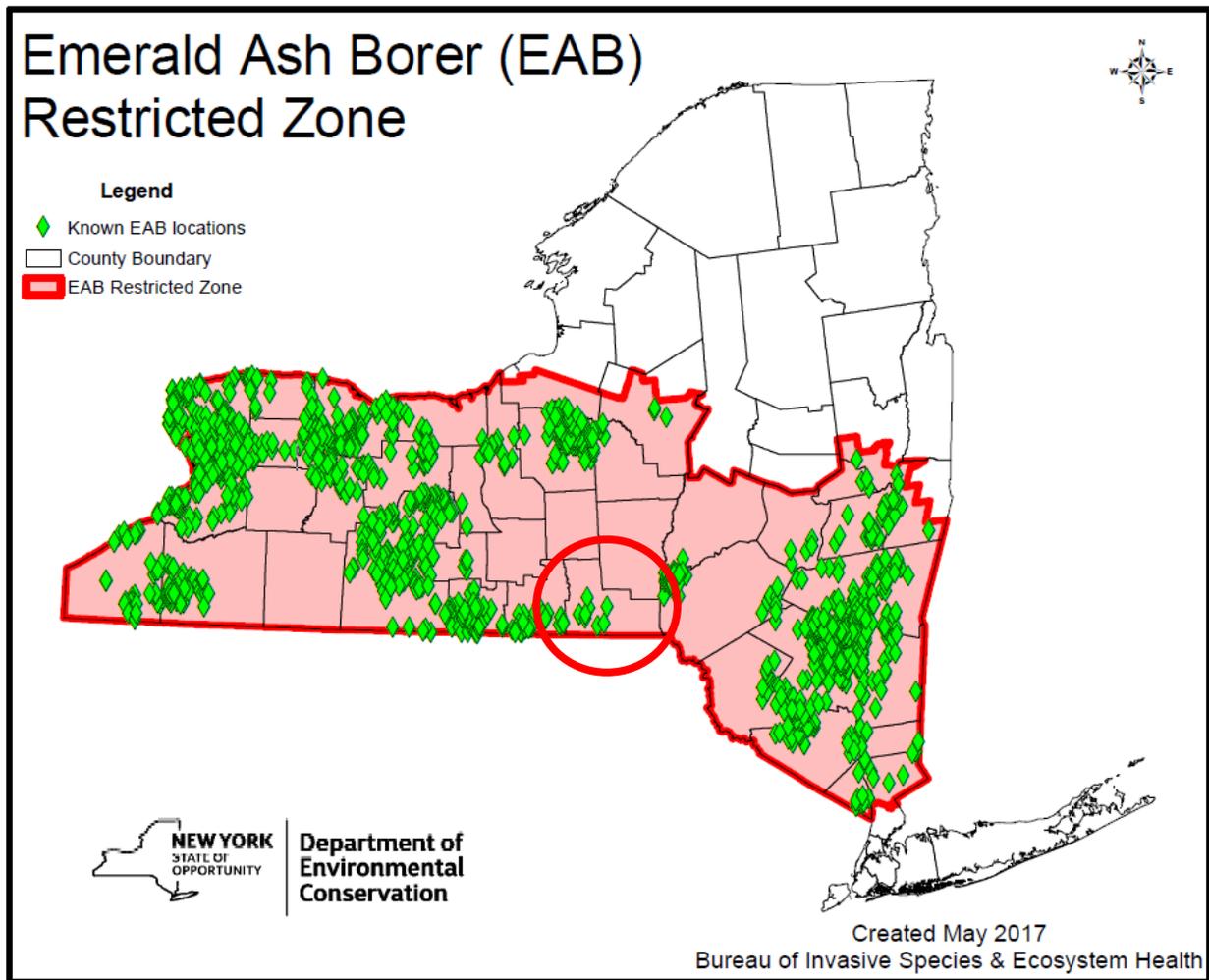
Source: Finger Lakes PRISM 2018

Notes: Broome County is circled in red.

EAB feeds on Ash trees. The NYSDEC has found that Ash trees of all species, comprise approximately 10 percent of Broome County’s forests. Figure 5.4.5-2 shows the known locations of EAB documented by NYSDEC. EAB is found in the center and southwestern portion of the county. Dead, infested ash trees were found in the Towns of Conklin, Kirkwood, Vestal, and Union and in the City of Binghamton (Cornell Cooperative Extension 2018 and EAB was detected in a County Park (Otsiningo).



Figure 5.4.5-2. Emerald Ash Borer Locations and the Restricted Zone



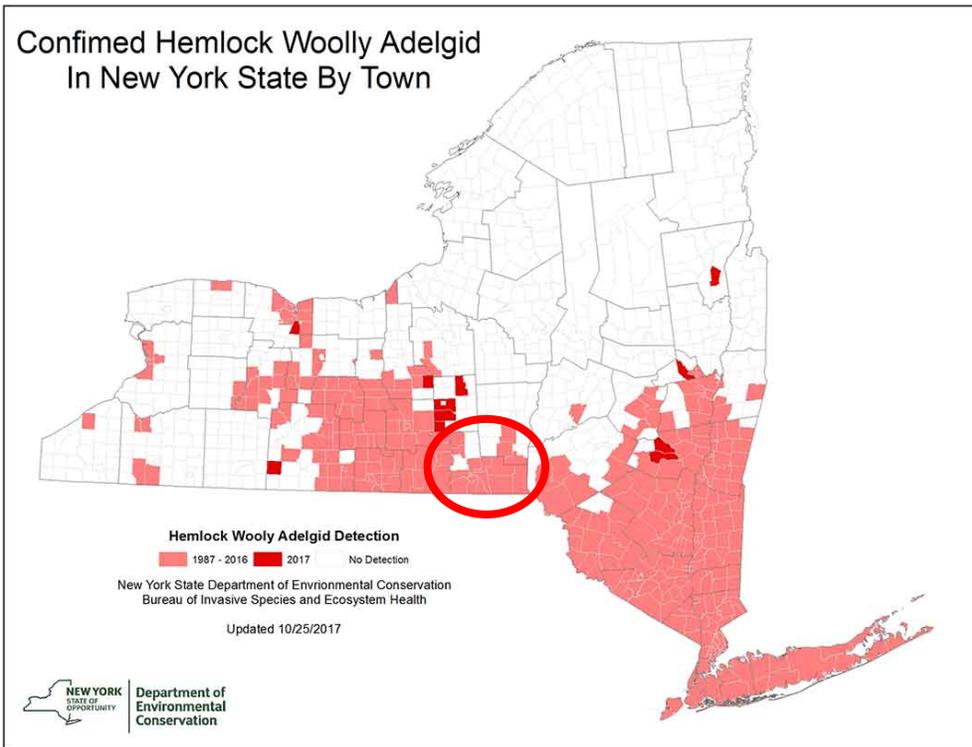
Source: NYSDEC 2017

Note: Broome County is circled in red.

Hemlock woolly adelgid infects hemlock trees. Figure 5.4.5-3 shows the known locations of hemlock woolly adelgid documented by NYSDEC. Hemlock woolly adelgid is found in the center and southwestern portion of the county. It has been found in numerous locations in Broome County from the Pennsylvania state line to the Town of Triangle (Cornell Cooperative Extension 2018).



Figure 5.4.5-3. Confirmed Hemlock Woolly Adelgid in New York State by Town.



Source: NYSDEC 2017

Note: Broome County is circled in red

Additional extent mapping for a wide range of invasive species in Broome County can be found at iMapInvasives, New York State's on-line, all-taxa invasive species database and mapping tool. iMapInvasives partners with many organizations to leverage collaboration in the fight against invasive species (PRISMs). According to iMapInvasives (2018), the comprehensive database can be used for the following:

- Documenting and sharing invasive species observation, survey, assessment and treatment data.
- The coordination of early detection and rapid response efforts through email alerts.
- Data analysis and summaries in the web interface and GIS.

### Previous Occurrences and Losses

For this HMP Update, known infestation and invasive species events impacting Broome County between 1999 and 2018 are listed in Table 5.4.5-1. Documentation of invasive species events within Broome County was not found prior to 1999. Detailed information regarding invasive species and losses resulting from these within the county is scarce. Therefore, Table 5.4.5-1 might not include all events that occurred within the county during the period between 1999 and 2018.

The Federal Emergency Management Agency (FEMA) has declared that New York State underwent one infestation-related emergency (EM) classified as a virus threat between 1954 and 2015. In 2000, Broome County was included in EM-3155 related to an outbreak of the West Nile virus (FEMA 2018).



Nearby counties have previously been included in a USDA agricultural disaster declaration (S3411) for invasive insects (armyworm); however, Broome County has not been included in any USDA disasters related to invasive species, and sources did not reveal impacts of armyworm in Broome County.

**Table 5.4.5-1. Infestation and Invasive Species Events in Broome County, 1999 to 2018**

Dates of Event	Event Type	FEMA Declaration Number	County Designated?	Event Details*
1999	Eurasian Milfoil	N/A	N/A	Eurasian Milfoil was first identified in Broome County.
2000	West Nile virus	EM-3155	Yes	An outbreak of West Nile virus throughout New York State resulted in an emergency declaration.
2008	Brown Marmorated Stink Bug	N/A	N/A	Brown marmorated stink bug was first identified in the Hudson Valley.
2012	Purple Loosestrife, European Water Chestnut	N/A	N/A	Purple Loosestrife and European Water Chestnut were first identified in Broome County.
2012-2016	Lyme Disease	N/A	N/A	Records from the CDC show that Lyme disease cases in the northeast and Broome County continued to grow during these years.
2014	Emerald Ash Borer	N/A	N/A	The EAB was first identified in Broome County.
2015	Wild Parsnip	N/A	N/A	Wild Parsnip was identified at several locations in Broome County.
2018	Giant Hogweed	N/A	N/A	NYSDEC reported giant hogweed at one site in the county.

Source: EDD MapS 2018; USDA 2018; NYSDOH 2015; CDC 2017

\* Many sources were consulted to provide an update of previous occurrences and losses; event details and loss/impact information may vary and has been summarized in the above table

CDC Centers for Disease Control

EAB Emerald Ash Borer

FEMA Federal Emergency Management Agency

N/A Not applicable

USDA U.S. Department of Agriculture

### Climate Change Projections

Climate change and the globalization of trade, travel, and transport are greatly increasing the number and type of species moved around the world, as well as the rate of movement. Changes in land use and climate are also rendering some habitats more susceptible to the establishment of nonnative species and may amplify the adverse impacts of biological invasion (NISC 2016).

Warmer temperatures and changing rainfall patterns provide an environment where mosquitos can remain active longer, greatly increasing the risk for animals and humans (e.g., West Nile Virus). Lyme disease could expand throughout the United States as temperatures warm, allowing ticks to move into new areas of the country. The changes in climate can also allow tropical and subtropical insects to move from regions where diseases thrive into new places (Natural Resources Defense Council 2015). Armyworms die in colder temperatures; however, warmer spring and winter temperatures allow them to continue to reproduce—a factor contributing to the outbreak in 2012. Mosquitoes capable of carrying and transmitting diseases now live in at least 28 states. Warmer temperatures, heavy rainfall, and high humidity have reportedly increased the rate of WNV infections in humans (Natural Resources Defense Council 2015). As temperatures increase and rainfall patterns change, these insects can remain active for longer seasons and within wider areas.



As climate change continues to take place, it is anticipated that the occurrence of invasive species is likely to increase in Broome County, particularly by species acclimated to warmer climates that expand their range to the north as temperatures warm.

### 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 invasive species. Broome County and all its jurisdictions will continue to be under threat of invasive species that may induce secondary hazards and health threats to the county population if infestations are not prevented, controlled, or eradicated.

Based on historical records and input from the Planning Partnership, probability of occurrence of invasive species in Broome County is considered *frequent* (100 percent annual probability; a hazard event may occur multiple times per year). Refer to Section 5.3 (Hazard Ranking) for additional information on the hazard ranking methodology and probability criteria.

### 5.4.5.2 VULNERABILITY ASSESSMENT

All of Broome County was identified as vulnerable to the invasive species hazard. Invasive species are of significant concern to Broome County, mainly due to their effects on public health, natural resources, and agriculture. Estimated losses are difficult to quantify; however, invasive species can impact Broome County's population and economy. Direct effects of infestation lead to cascading indirect impacts. As vegetation dies or becomes stressed and weakened by pests such as the emerald ash borer, available fuel and high-intensity wildfires increase. As species compositions change due to infestation outbreaks, whole fire regimes can shift. Physical stresses on trees can also affect how trees respond to other natural hazards such as hurricanes, drought, and ice storms (Kurtz 2007). The following text details the analysis of potential impacts of the invasive species hazard on Broome County.

#### Impact on Life, Health and Safety

The entire population of Broome County is vulnerable to insect-borne disease. According to the U.S. Census 2016 ACS 5-Year Population Estimate, Broome County had a population of 197,381. The elderly population and people with suppressed immune systems are most susceptible to effects of West Nile Virus and EEE. According to the 2016 ACS 5-Year Population Estimate, 17.6 percent of the population in Broome County is 65 and over. In Broome County, the following areas have the highest concentration of elderly population: City of Binghamton and Villages of Deposit, Endicott, Johnson City, Port Dickinson, Whitney Point, and Windsor; locations of higher concentrations also can be present in areas throughout each of the county's towns. Refer to Figure 4-9 in Section 4 (County Profile), which displays the densities of populations over 65 in Broome County.

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. This can lead to increased harmful algal blooms and negative impact on drinking water supplies. Soil destabilization can increase the likelihood of mudslides in areas with steep slope.

#### Impact on General Building Stock and Critical Facilities

No structures are anticipated to be affected directly by invasive species; however, the EAB could cause a catastrophic loss of the ash tree throughout state forests, which could result in stream bank instability, erosion, and increased sedimentation. In addition, a preponderance of dead tree limbs could increase the occurrence of downed trees on roadways and power lines in storms with heavy winds. Dead trees and limbs can increase the risk of wildfire in the county.



Some invasive plants have been shown to destabilize soil due to high densities and shallow root systems, negatively impacting nearby buildings. Other invasive plant species, such as common reed and purple loosestrife, have been known to clog culverts, increasing flood risk.

### **Impact on the Economy**

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Impacts of 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 invasive species have not been quantified in available documentation. Spreading of disease will impact worker productivity as individuals miss work to recover. Crop losses from invasive species could be significant; during 2012, the county's crop was severely impacted by the armyworm. Economic losses are not available currently.

The EAB can infect nursery stock and mature trees, which could reduce the timber value of hardwood exports (CFIA 2014). In 2010, the USDA Northern Research Station conducted computer simulations of EAB spread to estimate the cost of ash tree treatment, removal, and replacement (re-planting of new trees) between 2009 and 2019. The simulations predicted an EAB infestation covering 25 states, and assumed treatment, removal, and replacement of more than 17 million ash trees on developed land within established communities. The total costs were estimated at \$10.7 billion. This figure doubled when the model was reset to include developed land outside and inside human communities (USDA 2013).

### **Future Changes that May Impact Vulnerability**

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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 can 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 and Change in Population**

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As discussed in Sections 4 (County Profile) and 9 (Jurisdictional Annexes), areas targeted for future growth and development were identified across Broome County. Any areas of growth could be impacted by invasive species because the entire planning area is exposed and vulnerable. Changes in land use have the potential to render some habitats more susceptible to invasive species, such as clearing the land and providing opportunities for invasive species to inhabit the area. Clearing the land also can reduce the habitat for predator species that could manage the spread of invasive species naturally. The specific areas of development are indicated in tabular form and on the hazard maps included in the annexes in Section 9 (Jurisdictional Annexes).

According to population projections from the Cornell Program on Applied Demographics, Broome County will experience a continual population decrease through 2040 (an estimated 17,400 people by 2040). This decrease will reduce the overall vulnerability of the county's population over time; however, a closer examination of the demographics (e.g., age) and movement of population within the county could lead to an increase in vulnerability to the elderly and rural versus urban/suburban areas. Refer to Section 4.4.2 (Population Trends) in the County Profile for a discussion on population trends in the county.

### **Climate Change**

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Broome County is projected to see increases in the average annual temperature by 4.4–6.3 °F by the 2050s and 5.7–9.9 °F by the 2080s. As the climate warms, the habitat range will increase for insects, including mosquitoes,



ticks, and armyworms. As discussed earlier, increases in the rate West Nile Virus infections have been correlated to increasing temperatures and precipitation amounts. In addition, the increased average temperatures allow insects to survive for longer periods throughout the year and extend the time that populations are susceptible to infection of an insect borne disease. As climate changes, Broome County is likely to experience an increase in invasive species.

### **Change of Vulnerability Since 2013 HMP**

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Invasive species is a new hazard of concern to the Broome County HMP.

### **Issues Identified**

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The potential impacts insect-borne diseases to the elderly population can be substantial. The elderly population are the most susceptible to the effects of West Nile Virus and EEE and make up over 17 percent of the county's total population. Invasive species can cause devastating impacts to the agricultural industry in Broome County, leading to crop losses. EAB is very common in the county and are killing the ash trees throughout. The dead trees pose a threat to the utility lines and infrastructure. Many of the surrounding counties have been included in USDA declarations related to the armyworm. With their proximity to Broome County, the impacts of the armyworm can be felt by Broome County.

Climate change as well as environmental factors could increase the potential for harmful algal blooms. The first incident of harmful algal bloom at the beach at Dorchester Park (Whitney Point Lake) resulted in a brief closure during the 2018 summer season.