



4.3.9 Invasive Species

This section provides a profile and vulnerability assessment for the invasive species hazard. An invasive species is a group of living organisms that is not indigenous to a given ecosystem and that, when introduced to a non-native environment, is likely to cause economic or environmental harm or pose a hazard to human health.

4.3.9.1 Location and Extent

The Commonwealth of Pennsylvania is host to several invasive pathogens, insects, plants, invertebrates, fish, and higher mammals. These species have largely been introduced by the actions of humans. Common pathways for invasive species include unintentional release, the movement of goods and equipment that may unknowingly harbor species, smuggling, emptying ship ballast water, hull fouling, and escape from cultivation (Pennsylvania Invasive Species Council [PISC] 2010). Invasive species threats are generally divided into two main subsets, as described below.

- Aquatic invasive species are non-native viruses, invertebrates, fish, and aquatic plants that threaten the diversity or abundance of native species; the ecological stability of the infested waters; human health and safety; or commercial, agriculture, aquaculture, or recreational activities dependent on such waters.
- Terrestrial invasive species are non-native arthropods, vascular plants, higher vertebrates, or pathogens that complete their life cycle on land instead of water and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

The PISC, the lead organization for invasive species threats, has identified over 100 species threats that are or could potentially become significant in Pennsylvania. Of these threats, Chester County officials and municipal leaders have identified plants, insects, and diseases that have caused, or have potential to cause, significant damage to the county’s natural landscape and agricultural economy through defoliation and mortality, or out-competition for vital resources. Sections of Chester County’s Comprehensive Plan Landscape recognizes the importance of preserving and restoring natural resources, promoting and protecting native species, and maintaining agricultural productivity for the county’s cultural heritage and economic stability (Chester County 2018). The potential impact of invasive species on agriculture is significant, as Chester County has a vibrant agricultural community that is a significant driver of Chester County’s economy.

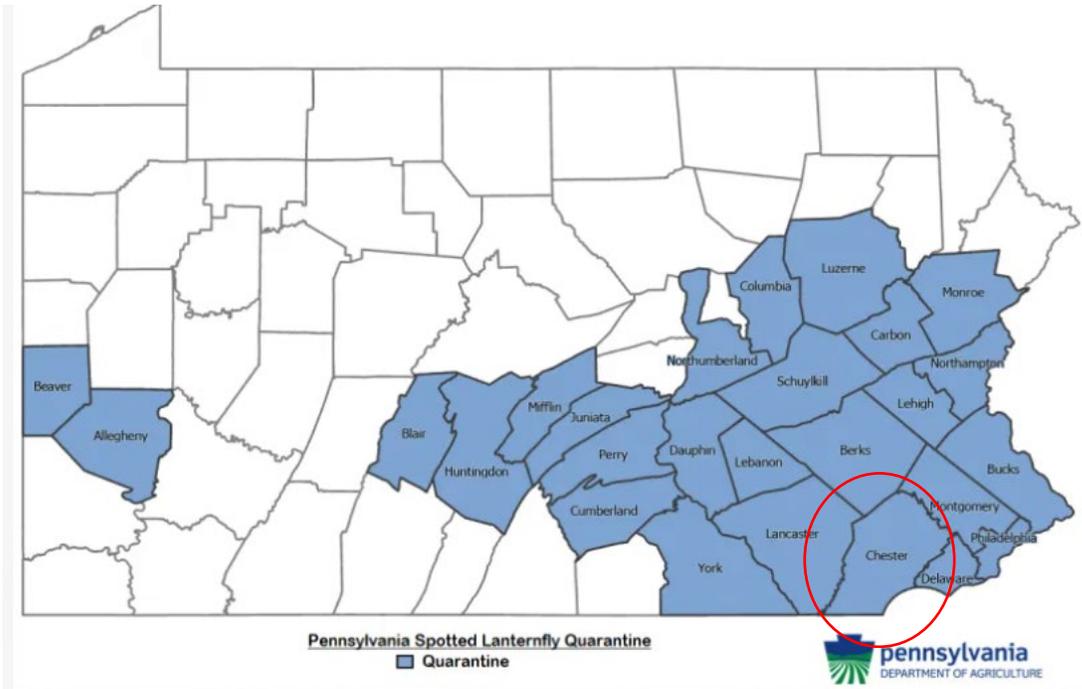
In Pennsylvania, the insects and diseases that have caused the most damage in terms of defoliation and mortality during recent years include the emerald ash borer, gypsy moth, hemlock woolly adelgid, beech bark disease, and oak wilt. These species also pose a threat to Chester County. Additionally, Chester County officials and municipal leaders identified a number of invasive insects, diseases, and plants that are of particular concern.

Invasive insects of concern in Chester County include the spotted lanternfly, thousand cankers disease, cankerworms, emerald ash borer, and Asian long-horned beetle (Penn State Agricultural Extension). Other invasive insects of concern for Chester County include the Chestnut blight, hemlock woolly adelgid, gypsy moth (Chester County Natural Heritage Inventory Update 2015). If defoliation occurs 2 years in a row, tree mortality is likely (Hoover and Haydt 2010).

The spotted lanternfly was first observed in neighboring Berks County in 2014. Since then, the pests have been found in 13 southeastern Pennsylvania counties, including Chester County (Yanisko 2017). As a result, the movement of firewood in Chester County and the other impacted counties is restricted and in 2020, a total of 26 counties are on Pennsylvania’s spotted lanternfly quarantine list, as shown in Figure 4.3.9-1. Spotted lanternflies threaten agricultural crops, including apples, grapes, and hardwoods (Pennsylvania Department of Agriculture [PDA] 2017), and would impact farms, orchards, and wineries. An infestation has the potential to cause \$18 billion worth of crop loss (Bresswein 2017).



Figure 4.3.9-1. Pennsylvania’s Spotted Lanternfly Quarantine, 2020



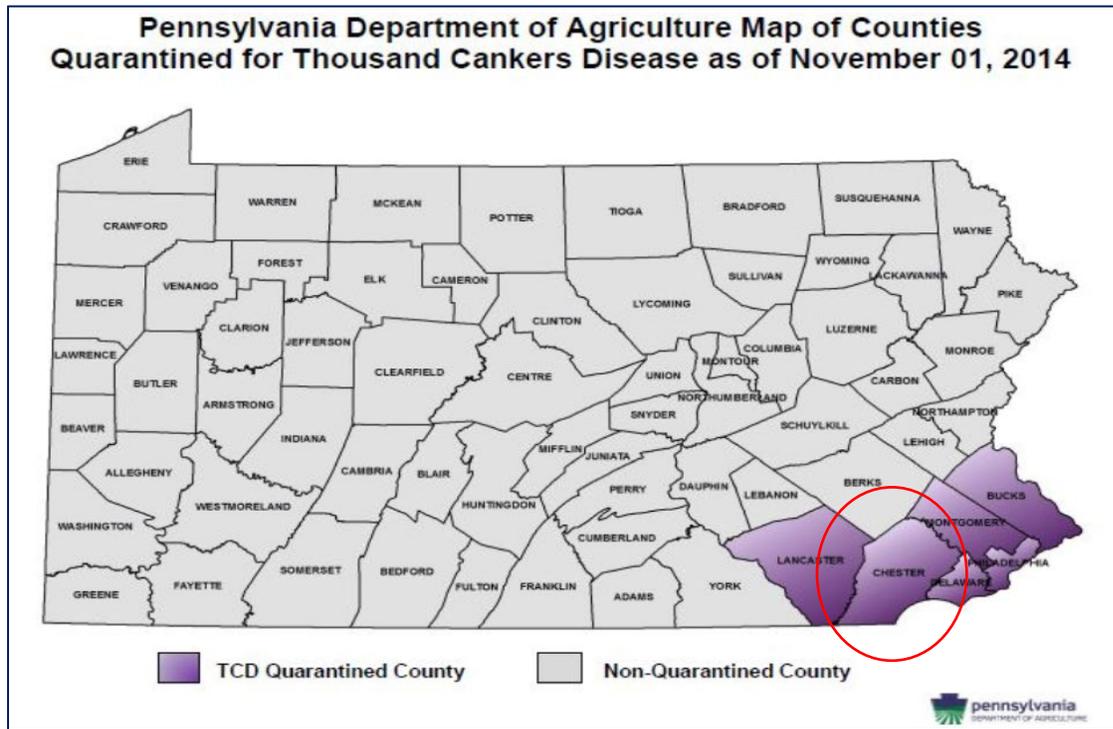
Source: PDA 2020

Note: Chester County is indicated by the red oval.

Thousand cankers disease was first identified in Bucks County in August 2011 and spread to Chester County in 2014. On July 22, 2014, a quarantine order was imposed to restrict the movement of walnut material from Bucks, Chester, Delaware, Montgomery, and Philadelphia counties. Figure 4.3.9-2 shows the few counties in Pennsylvania that were in quarantine as of 2014. This disease is transmitted to black walnut trees when walnut twig beetles carrying the fungus *Geosmithia morbida* tunnel beneath the bark, causing cankers to form. After repeated attacks, the cankers impede water and nutrient movement through the tree, resulting in tree death. Black walnut lumber is highly valued for woodworking and furniture-making, and the tree nuts are consumed by humans (PDA 2017b).



Figure 4.3.9-2. Pennsylvania’s Thousand Cankers Disease Quarantine, 2014



Source: PDA 2014

Note: Chester County is indicated by the red oval.

Asian long-horned beetles have been confirmed within Chester County and pose a threat to hardwood trees, including maples, birch, elm, willow, ash, and poplar trees. As they feed, larval beetles bore holes into the hardwood trees, eventually killing the tree (U.S. Department of Agriculture [USDA] 2017b).

Chestnut blight is a fungus that was first detected in New York City in 1904 and later discovered in Pennsylvania. The Chestnut blight wiped out most of the country’s American chestnut that once compromised one-fourth to one-half of eastern U.S. forests, and was prized as a food for humans, livestock, and wildlife and for its durable wood (Chester County Natural Heritage Inventory Update 2015).

A number of invasive plants also pose a significant threat to ecosystem biodiversity and agricultural productivity because of their ability to out-compete native species. Pennsylvania has identified 10 Class A noxious weeds as part of the Controlled Plant and Noxious Weed Act. These plants include Palmer amaranth, waterhemp, animated oat, dodder, goatsrue, giant hogweed, hydrilla, wavyleaf basketgrass, broomrape, and kudzu (PA Agricultural Code Title 7, 2016). Some species (e.g., Palmer amaranth and waterhemp) are prolific seed producers and have developed a potential resistance to traditional herbicides, making them challenging and expensive to manage. Others, like kudzu, grow rapidly and prevent slower-growing, native plants from establishing.

The Brandywine Conservancy identified a list of other invasive plants that pose a threat to the county. These plants include bamboo, bush honeysuckles, common reed, garlic mustard, Japanese barberry, Japanese honeysuckle, Japanese hop, Japanese knotweed, Japanese stiltgrass, lesser celandine, mile-a-minute, multiflora rose, Norway maple, oriental bittersweet, pachysandra, porcelain berry, privet, Russian and autumn olive, thistle, tree of heaven, wineberry, and winged euonymus (Brandywine Conservancy n.d.).

The location and extent of these invasive threats depends on the preferred habitat of the species as well as the species’ ease of movement and establishment.



4.3.9.2 Range of Magnitude

The magnitude of invasive species threats ranges from nuisance to widespread killer. Some invasive species are not considered agricultural pests and do not harm humans. Other invasive species can cause significant changes in the composition of Pennsylvania’s ecosystems. Forest or crop-impacting invasive species could have a significant economic impact in Chester County because the county hosts both forest-based recreation and a large, diverse agricultural sector. Still more invasive species can cause widespread illness or death in humans.

Invasive species contribute to a broad range of environmental impacts. The aggressive nature of many invasive species can cause significant reductions in biodiversity by crowding out native species. This can affect the health of individual host organisms as well as the overall well-being of the affected ecosystem.

Beyond causing human, animal, and plant harm, there are secondary impacts of invasive species in that they also cause harm to host species and ecosystems, particularly in the case of invasive species that attack forests or agricultural crops. Forests prevent soil degradation and erosion, protect watersheds, stabilize slopes, and absorb carbon dioxide emissions. The key role of forests in the hydrologic system means that if forest land is wiped out, the effects of erosion and flooding will be amplified. Invasive species would also negatively impact the county’s agricultural economy by increasing the cost of pest control measures and decreasing harvest yields. Overall, invasive species reduce the productivity and profitability of agricultural land. Invasive species that affect the health of hardwood trees can have particularly damaging secondary impacts in urban and suburban areas. As the damage progresses, branches become less stable and are more susceptible to winds. Significant building and auto damage can result from falling trees.

The magnitude of an invasive species threat is generally amplified when the ecosystem or host species is already stressed, such as in times of drought. The already-weakened state of the native ecosystem causes it to more easily succumb to an infestation. An example of a possible worst-case invasive species scenario is if the spotted lanternfly would continue to spread across Chester County and significantly destroy the county’s crops. With the high mortality rate associated with the spotted lanternfly, crops including grapes and apples would be devastated. Farms, orchards, and wineries could experience an \$18 billion loss (Bresswein 2017). Such significant crop loss could cause farms to collapse, resulting in the loss of jobs and valuable income to the county. If the land is no longer agriculturally profitable, arable land could be developed for residential or business use.

4.3.9.3 Past Occurrence

Invasive species have been entering Pennsylvania since the arrival of early European settlers. The presence of the emerald ash borer in Chester County was first confirmed in 2013. Chester County is part of the emerald ash borer infestation zone, along with 61 other Pennsylvania counties (USDA 2020). Additionally, the hemlock woolly adelgid has been present in Pennsylvania since the 1960s and was first detected in Chester County in the mid-1960s. DCNR continues to monitor the westerly progression of the invasive species, and since 2010, has detected a general movement west. Within the past 5 years, cankerworms and spotted lanternflies have been observed in Chester County and have the potential to cause significant crop and forest damage. Chester County is also part of the quarantine zone for the emerald ash borer and spotted lanternfly. As of April 29, 2011, the entire state of Pennsylvania was under quarantine for the emerald ash borer (USDA 2020). This means it is legal to move firewood, ash, and the insect between counties, but it is not legal to move non-compliant items out of the state or move non-compliant firewood into the state.

4.3.9.4 Future Occurrence

According to the PISC, the probability of future occurrence for invasive species threats is on the rise because of the growing volume of transported goods; increasing technology, efficiency, and speed of transportation; and expanding international trade agreements. Expanded global trade has created opportunities for many organisms to be transported to and established in new countries and regions. Furthermore, climate change is contributing to the introduction of new invasive species. As maximum and minimum seasonal temperatures change, pests are able to establish themselves in previously inhospitable climates. This also gives introduced species an earlier



start and increases the magnitude of their growth, which may shift the dominance of ecosystems in the favor of non-native species.

In order to combat the increase in future occurrences, the National Invasive Species Management Council—which is a collaboration of state agencies, public organizations, and federal agencies—released the Invasive Species Management Plan in May 2009 (Pennsylvania Invasive Species Management Council [PISC] 2018). This plan outlines the Commonwealth’s goals for the management of the spread of non-native invasive species and creates a framework for responding to threats through research, action, and public outreach and communication. More information on the Species Management Plan can be found online at www.invasivespeciescouncil.com. It is reasonable to assume that current threats, including the emerald ash borer, hemlock woolly adelgid, Asian long-horned beetle, spotted lanternfly, cankerworms, and thousand cankers disease, will continue to directly impact or threaten Chester County. Plants currently identified as part of the Noxious Weed Act including Palmer amaranth, waterhemp, animated oat, dodder, goatsrue, giant hogweed, hydrilla, wavyleaf basketgrass, broomrape, and kudzu are also likely to threaten Chester County.

The future occurrence of invasive species is considered *highly likely* as defined by the Risk Factor Methodology probability criteria (further discussed in Section 4.4).

4.3.9.5 Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the area identified. The following sections discuss the potential impact of the invasive species hazard on Chester County, including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on (1) life, health, and safety; (2) general building stock and critical facilities; (3) economy; and (4) future growth and development
- Effect of climate change on vulnerability
- Additional data and next steps

Overview of Vulnerability

Chester County’s exact vulnerability will depend on the invasive species in question. However, in general, the University of Arizona and the National Invasive Species Information Center have identified the following characteristics of areas that are more likely to be invaded:

- Lack of natural predators or diseases to keep the species under control in its native environment
- Present vacant ecological niches that can be exploited by non-native species
- Lack of species diversity
- Lack of a multi-tiered canopy (in the case of invasive plants)
- Disturbed by fire, construction, or agriculture prior to invasion (University of Arizona 2006)

Estimated losses are difficult to quantify; however, infestation can impact Chester 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 may also affect the way trees respond to other natural hazards such as hurricanes, drought, and ice storms (Kurtz 2007).

Because of the current presence of invasive species in Chester County, the county is vulnerable to invasive species. Despite quarantine and control efforts, invasive species movement occurs across county lines through anthropogenic and natural modes, including freight shipping, transplantation, and animal movement. Considering the extent of the current infestations and neighboring county infestations, it is reasonable to project that the county’s vulnerability will increase.



Data and Methodology

Because of lack of quantifiable loss information, a qualitative assessment has been used to evaluate assets exposed to this hazard and potential impacts associated with this hazard.

Impact on Life, Health, and Safety

The entire population of Chester County is vulnerable to invasive species to some extent, but direct impacts to life, health, and safety are minor.

Impact on General Building Stock and Critical Facilities

No structures are anticipated to be affected directly by infestation or invasive species; however, the emerald ash borer may 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 utility lines during storms with heavy winds.

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 a variety of infestations within Chester County have not been quantified in available documentation. Losses from spotted lanternflies have been estimated for the state of Pennsylvania, and an infestation has the potential to cause \$324 million worth of crop loss to farms, orchards, and wineries including a loss of 2,800 jobs (Pennsylvania State University [PSU] 2020).

Although the economic impact has not been quantified for Chester County, state-wide agricultural losses due to invasive species were estimated at \$5,808,803,000 (Pennsylvania Emergency Management Agency [PEMA] 2013). The potential impact of invasive species on agriculture is significant because Chester County is one of the top-performing counties in the agricultural production of state total sales. Based on these figures, the potential agricultural loss from invasive species impacts could be billions of dollars.

Invasive species not only have an economic impact on agriculture but forests as well. Certain species such as the southern pine beetle can damage and kill trees leading to potential fires. First responders must focus on controlling the forest fires and their resources and personnel are limited.

Impact of Future Growth and Development

As discussed in Section 2, areas targeted for future growth and development have been identified across Chester County. Any areas of growth could be impacted by the infestation hazard because the entire planning area is exposed and vulnerable.

Change of Vulnerability

Invasive species were not profiled in the 2015 Chester County Hazard Mitigation Plan; therefore, the change in vulnerability to this hazard cannot be determined.

Additional Data and Next Steps

Any additional information regarding localized concerns and past impacts will be collected and analyzed. These data will be developed to support future revisions to the plan. Future mitigation efforts could include partnering and collaborating with existing Commonwealth of Pennsylvania and local efforts.