4.3.9 Invasive Species

This is a new section and hazard to the Pike County HMP and provides a profile and vulnerability assessment for the invasive species hazard.

Location and Extent

An invasive species is a species 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. The Commonwealth of Pennsylvania plays host to a number of 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 threats include unintentional release of species, the movement of goods and equipment that may unknowingly harbor species, smuggling, ship ballast, hull fouling, and escape from cultivation (PISC, 2010). Invasive species threats are generally divided into two main subsets:

- *Aquatic Invasive Species* are nonnative 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 nonnative arthropods, vascular plants, higher vertebrates, or pathogens that complete their lifecycle on land instead of in an aquatic environment and whose introduction does or is likely to cause economic or environmental harm or harm to human health.

The Commonwealth of Pennsylvania HMP discusses a number of identified invasive species impacting the Commonwealth. For the purpose of this HMP update and as identified by the Pike County Steering Committee, the following will be discussed further:

- Eurasian Watermilfoil
- Emerald Ash Borer
- Purple Loosestrife
- Hemlock Woolly Adelgid
- Japanese Knotweed
- Gypsy moth
- Phragmites
- Rock Snot
- Zebra Mussel

Additionally, Pike County identified ticks and mosquitos as a concern due to the diseases they can carry and spread. Please refer to Section 4.3.13 (Pandemic) for details regarding diseases spread by ticks and mosquitos. The location and extent of invasive threats depends on the preferred habitat of the species as well as the species' ease of movement and establishment. The presence of invasive species has been reported throughout Pike County.

Eurasian Watermilfoil

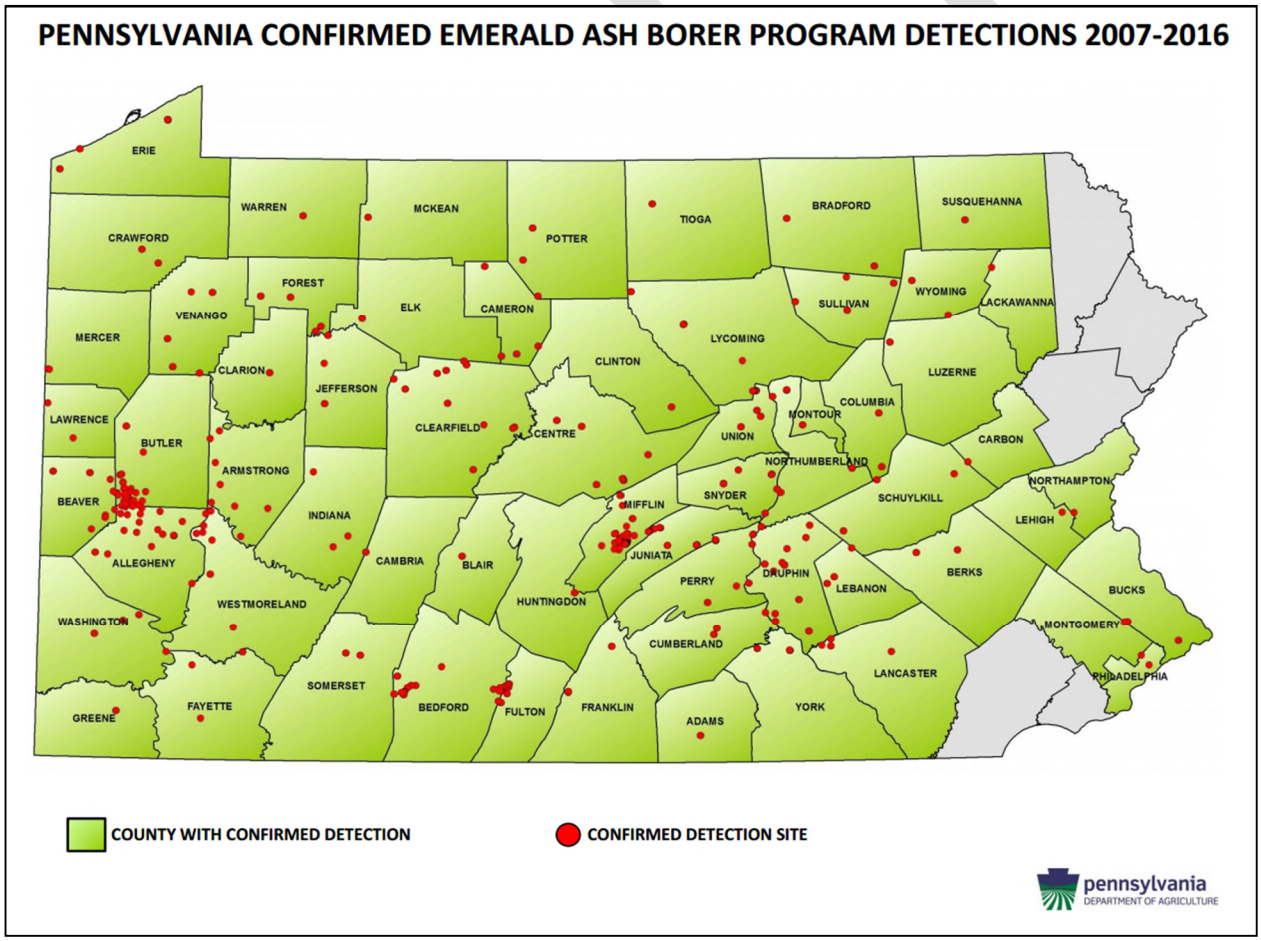
Eurasian watermilfoil is native to Europe, Asia and northern Africa. It was accidentally introduced into the U.S. sometime between the late 1800s and 1940s, either from the aquarium trade or attached to boats. It is a submerged aquatic invasive plant that has stems that grow up to the water's surface, usually 10 feet in length but can grow as much as 30 feet. Watermilfoil is found in lakes, ponds and other aquatic environments where

stagnant to slow moving water is found. Once watermilfoil becomes established, the dense mats of leaves block light, leading to a decline in the abundance of native plants. It can also reduce habitat for fish pawning and breeding and impact recreational uses (DCNR No Date). In Pike County, milfoil has been observed in Pecks Pond (DCNR 2001).

Emerald Ash Borer

The emerald ash borer (EAB) is a half-inch long metallic green beetle. Larvae of this beetle feed under the bark of ash trees. Their feeding eventually girdles and kills branches and entire trees. It was detected for the first time in Pennsylvania in late June 2007. EAB adults were identified in Cranberry Township in Butler County (DCNR 2016). EAB is currently quarantined throughout Pennsylvania and has been confirmed in at least 22 counties. Pike County has been included in the quarantine. The quarantine was established to slow the spread of EAB by the Pennsylvania Department of Agriculture. It makes it illegal to move out of the Commonwealth all hardwood firewood, ash trees of any size, ash saw logs, limbs, branches, stumps or roots (DCNR 2011). Between 2007 and 2016, EAB has been confirmed in nearly all counties of Pennsylvania; however, EAB has not been confirmed in Pike County (PA Department of Agriculture 2016).

Figure 4.3.9-1. Pennsylvania Confirmed Emerald Ash Borer Program Detections, 2007 to 2016



Source: PA Department of Agriculture 2016

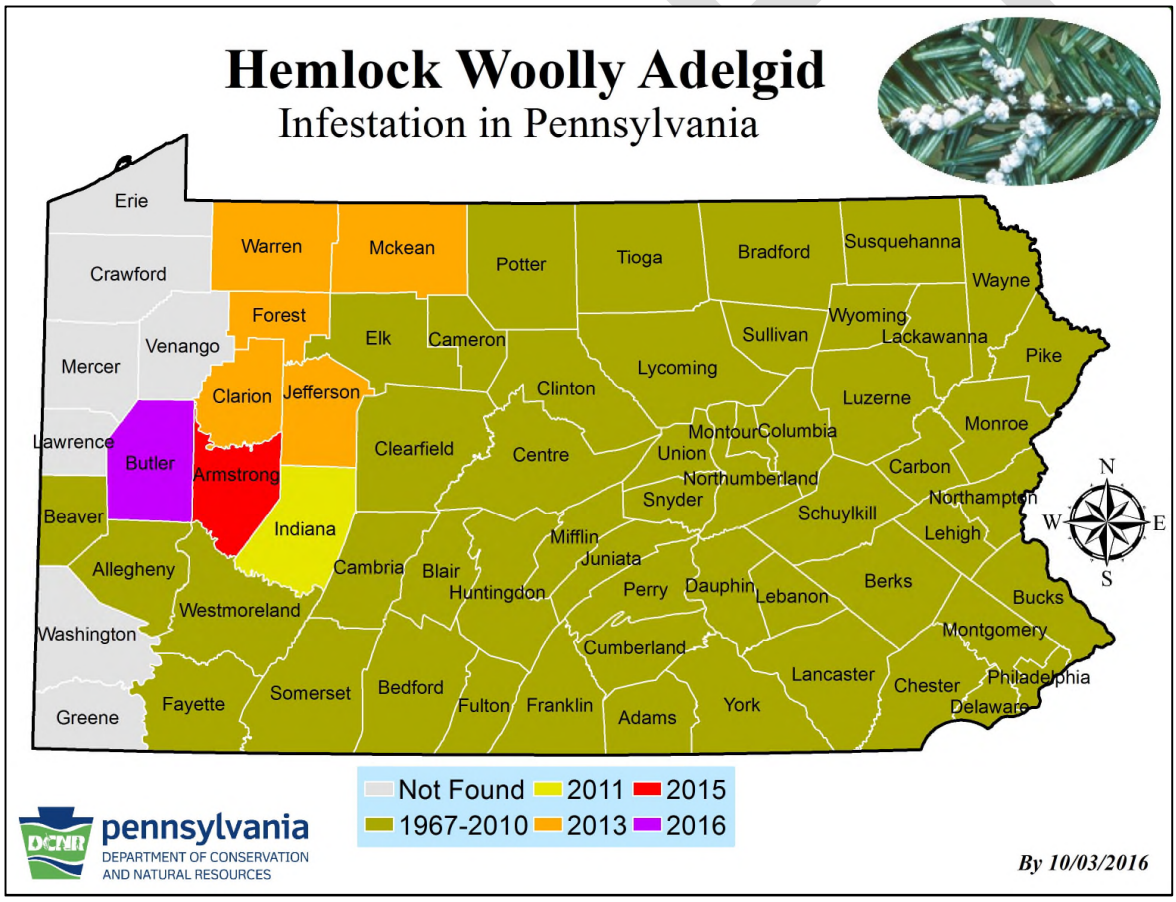
Purple Loosestrife

Purple loosestrife is a perennial herb with square, woody stems, which grow anywhere from four to 10 feet high. Magenta-colored flower spikes are present throughout much of the summer. It prefers open wetlands and is capable of invading freshwater wet meadows, tidal and non-tidal marshes, river and stream banks, pond edges, reservoirs and ditches. Purple loosestrife was first introduced to North America in the early 1800s as an ornamental. It outcompetes native plants including some federally endangered species. This species reduces habitat for waterfowl, clog waterways, disrupt nutrient cycling and collect debris, eventually displacing an entire wetland (DCNR No Date).

Hemlock Woolly Adelgid

The hemlock woolly adelgid, is a serious pest of Eastern hemlock in the northeastern states. This insect was first reported in southeastern Pennsylvania in the late 1960s and has spread to both ornamental and forest hemlocks. Adelgids are small, soft-bodied insects that are closely related to aphids. The hemlock woolly adelgid sucks sap from the young branches which results in premature needle drop and branch dieback. Some trees die within four years while others persist in a weakened state for many years. As of October 2016, Pike County is infested by hemlock woolly adelgid (DCNR 2016).

Figure 4.3.9-2. Hemlock Woolly Adelgid Infestation in Pennsylvania



Source: DCNR 2016

Japanese Knotweed

Japanese Knotweed is an herbaceous perennial with straight, hollow stems and grows three to 12 feet tall. The plant's greenish white flowers bloom from August to October. It was introduced to North America for ornamental use and for forage and erosion control in the late 1800s. Japanese Knotweed is capable of quickly forming dense stands and crowd out natural vegetation. Thickets of knotweed can clog small waterways and displace streamside vegetation, increasing bank erosion and lowering the quality of riparian habitat for fish and wildlife (DCNR No Date).

Gypsy Moth

The gypsy moth (*Lymantria dispar*) is a non-native insect from France that was introduced to Massachusetts in 1869. It is now established in 19 states, including Pennsylvania. Its caterpillar (larva) stage eats the leaves of a large variety of trees. A sample of some of the many species it eats includes oak, maple, apple, crabapple, aspen, willow, birch, mountain ash, pine and spruce. The populations of gypsy moths rise and fall in cycles. When populations are high, thousands of acres of trees can be damaged. In Pennsylvania, it was first discovered in Luzerne and Lackawanna Counties in 1932. A total of 4.3 million acres were defoliated in the Commonwealth during the historical peak year in 1990. Suppression programs have been carried out by the Pennsylvania Bureau of Forestry since 1968 to minimize the impacts of the gypsy moth. In 2016, Pike County was included in the gypsy moth suppression program (DCNR 2016). The County worked with the DCNR in a joint effort to spray for gypsy moth caterpillars in certain residential areas within Pike County. The insecticide was applied by aircraft, flying approximately 50 feet above the treetops (Pike County Conservation District 2016).

The USDA has a gypsy moth program that regulates the movement of gypsy moth host material from infested areas to other areas of the country. This program is a federal-state partnership that prevents the establishment of gypsy moths in areas of the United States that are not contiguous to current regulated states and counties. Figure 4.3.9-2 illustrates the quarantine areas of the United States. Pike County is located within a gypsy moth quarantine area.

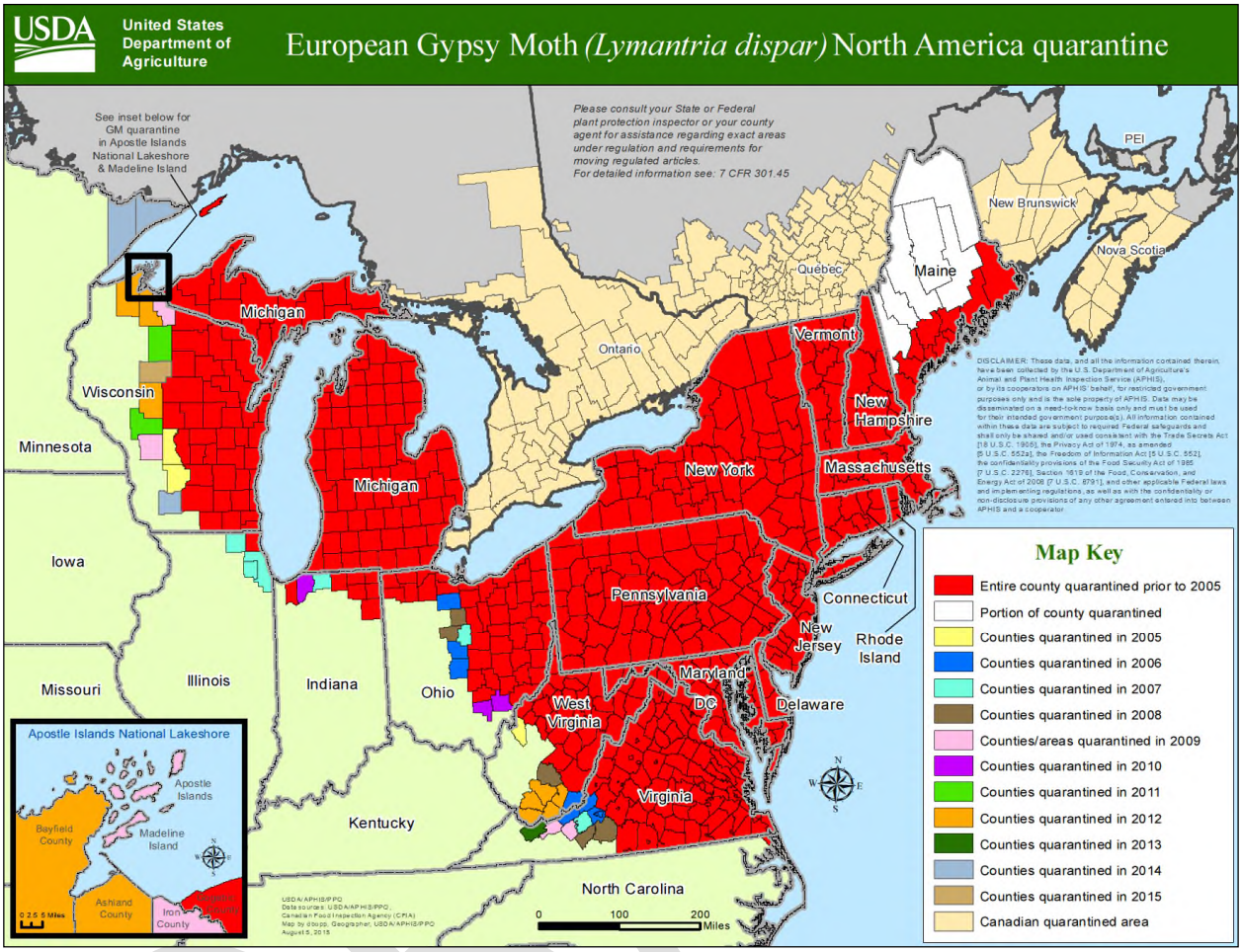
Phragmites

A major threat to the natural habitat of many swamps, lakes and wetlands throughout Pike County is the presence of a common reed (*Phragmites austrailis*); known as phragmites. Runoff from roads inputs nutrients into these areas that allows this species, among others, to colonize and thrive. This invasive species can alter the hydrology of the wetland and degrade and alter habitats (PHNP 2011).

Rock Snot

Large blooms of an invasive aquatic alga *Didymosphenia geminata* (also known as Didymo or "Rock Snot") have been seen throughout the 200-mile non-tidal portion of the Delaware River and several tributaries. Rock Snot is not a public health hazard, however, this invasive crowds or smothers more biologically valuable algae growing on the riverbed, and altering the physical and biological conditions within a stream (Sanchez, 2013).

Figure 4.3.9-3. Gypsy Moth Quarantine Areas in the United States



Source: USDA 2015

Zebra Mussel

The zebra mussel (*Dreissena polymorpha*) was accidentally introduced to the Great Lakes in the 1980's and has been spreading in Pennsylvania's waters. Zebra mussels grow on hard surfaces including the shells of native mussels, and in high densities can starve and suffocate native mussels by covering their shells completely. Zebra mussels are not as abundant in flowing waters as in lakes, but in rivers, such as the Hudson River (NY), they are persisting many years after their initial invasion (PHNP 2011).

According to the Pike County Natural Heritage Inventory, this species has been spotted in the Delaware River Watershed is not yet known in Pike County, but must be watched for its disastrous effects on ecosystems and economies (PHNP 2011).

Pennsylvania has a Noxious Weed law that prevents the propagation, sale, or transport of thirteen weed species within the Commonwealth. This includes purple loosestrife identified as a concern for Pike County. The Pennsylvania Fish and Boat Commission maintains a list of Aquatic Invasive Species that are prohibited from possession, sale, barter, or distribution within the Commonwealth (PA Code 58.71.6). This list includes the zebra mussel.

Range of Magnitude

The magnitude of invasive species threats ranges from nuisance to widespread killer and 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. Some invasive species are not considered an agricultural pest and do not harm humans. However, other species can cause significant changes in the composition of an ecosystem. For example, EAB has 99% mortality rate for any ash tree it infects. Other species can clog waterways, smother native plants, and impact animals (PA HMP 2013).

There is a wide range of environmental impacts caused by invasive species. 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 that go beyond harm to host species and ecosystems, particular in the case of invasive species that attack forests. Pennsylvania's 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. There is also an impact on agricultural harvests like honey. As a state with strong agricultural population, invasive species remain a hazard for the economic livelihood of the state (PA HMP 2013).

An example of a possible worst-case scenario for invasive species is the increase in population of hemlock woolly adelgid and their destruction to the Eastern hemlock population. Without this tree species, streams may increase in temperature, impacting the native brook trout; destroy wildlife cover; and impact forest aesthetics and recreational opportunities.

Past Occurrence

Based on all sources researched, Pike County has been impacted by Hemlock wWolly Adelgid, Purple Loosestrife, Japanese Knotweed, Watermilfoil, Gypsy Moth, Phragmites and Rock Snot with growing concern over Zebra Mussels. However, specific occurrences and quantified losses were not identified for these invasive species in Pike County.

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 establish themselves, 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. This may shift the dominance of ecosystems in the favor of nonnative species (Pennsylvania State Hazard Mitigation Plan 2013).

Based on historical documentation, increased incidences of infestation throughout Pennsylvania and the overall impact of changing climate trends, it is estimated that Pike County and all its jurisdictions will continue to experience the impacts of invasive species that may induce secondary hazards and health threats to the County population if they are not prevented, controlled or eradicated effectively.

Future occurrences of invasive species can be considered *highly likely* as defined by the Risk Factor Methodology probability criteria (further discussed in Section 4.4).

Vulnerability Assessment

To understand risk, a community must evaluate what assets are exposed or vulnerable in the identified hazard area. For invasive species, Pike County has been identified as the hazard area. Therefore, all assets in Pike County, as described in the County Profile section, are vulnerable to invasive species. The following text evaluates and estimates the potential impact of infestation on the County including:

- Overview of vulnerability
- Data and methodology used for the evaluation
- Impact on: (1) life, health and safety of residents, (2) general building stock, (3) critical facilities, (4) economy, and (5) future growth and development
- Effect of climate change on vulnerability
- Further data collections that will assist understanding this hazard over time

Overview of Vulnerability

Invasive species is a significant concern to Pike County, mainly due to its impact on natural resources. Estimated losses are difficult to quantify; however invasive species can impact Pike County's population and economy. Direct impacts of invasive species have cascading indirect impacts. As vegetation dies or becomes stressed/weakened by pests such as hemlock woolly adelgid, EAB or gypsy moth, there is an increase in available fuel and increase in high intensity wildfires. As species composition changes due to invasive species, whole fire regimes can shift. Physical stresses on trees may also affect how street trees respond to physical stresses caused by other natural hazards such as hurricanes, drought and ice storms.

Data and Methodology

Due to a lack of quantifiable loss information, a qualitative assessment was conducted to evaluate the assets exposed to this hazard and the potential impacts associated with this hazard.

Impact on Life, Health and Safety

The entire population of Pike County is vulnerable to infestation.

Impact on General Building Stock and Critical Facilities

No structures are anticipated to be directly affected by infestation. However, structures can be indirectly affected by the collapse of infested Ash or Hemlock trees. Falling trees can cause damage to nearby structures and powerlines.

Impact on Economy and Environment

The impact invasive species has on the economy and estimated dollar losses are difficult to measure and quantify. Costs associated with the activities and programs implemented to conduct surveillance and address invasive species have not been quantified in available documentation. Not only do invasive species have a negative impact on the natural native environment but may impact the fishing, boating, and tourism economies in Pike County as well.

Impact of Future Growth and Development

Areas targeted for potential future growth and development within the next 5 years have been identified across the County (further discussed in Section 2.4 of this HMP). Any areas of growth could be potentially impacted by the invasive species hazard because the entire planning area is exposed and potentially vulnerable.

Effect of Climate Change on Vulnerability

Climate change is contributing to the introduction of new invasive species. As maximum and minimum seasonal temperatures change, invasive species are able to establish themselves in previously inhospitable climates. Evidence suggests that a changing climate will further increase the likelihood of invasive species impacting natural areas and that the consequences of those invasive species may be magnified. Warming temperatures also gives invasive species an earlier start and increases the magnitude of their growth (PA HMP 2013; U.S. Forest Service 2016).

Additional Data and Next Steps

For the HMP update, any additional information regarding localized concerns and past impacts will be collected and analyzed. This data will be developed to support future revisions to the plan. Mitigation efforts could include building on existing Pennsylvania, Pike County, and local efforts.