Keystone Wild! Notes

Winter 2015 Edition

Check out this Issue:

What's Ice Got to do With It?

By Rebecca Bowen
Ecological Services Section Chief
Bureau of Forestry

Ice: it's what keeps a drink cold. It's what forms on top of puddles and ponds. It's what falls from the sky in fluffy white snowflakes. It's what… *influenced landscapes?* Yes—in the form of glaciers.

It may be hard to believe but a long time ago, hundreds of feet of ice were present in parts of Pennsylvania. Beginning in the Pleistocene Epoch, about one and a half million years ago, glaciers periodically covered parts of North America. During this period, the North American climate varied from slightly warmer to much colder than present day. The last cycle of North American glaciation ended only about 18,000 years. At that time, glaciers covered about a quarter of Pennsylvania—in the northeast and northwest.

Glaciers

But what is a glacier, exactly? A glacier is a huge sheet of ice that moves. It begins as simple snowfall that gradually builds up over years, maybe hundreds of feet of snow and ice freezing, thawing and compacting. The weight of the snow and ice builds up and causes pressure, until it begins to shift and slide under its own weight—probably starting down a slope. The huge mass of ice picks up momentum and continues to move across the land mass (although they move slowly, about a half-mile a year). Freezing and thawing can create movement too. The ice mass grows as more snow and ice is accumulated, and shrinks as the ice melts and forms water.

If you have ever pushed a heavy object on dirt, sand or gravel, you know how it can scrape the ground, pushing aside what's underneath or grinding it down into the dirt. Glaciers did the same thing; they eroded the land surface and created valleys, channels and plains. Material such as sand, gravel and rocks were picked up in the ice and deposited elsewhere. There are many names for the types of deposits from glaciers, which we'll look at more closely later. The ice also melted and released water onto the landscape (called "meltwater"). The meltwater and solid deposits from glaciers influenced the habitat types present today in northern Pennsylvania.

(Continued on page 3)

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In cooperation with the PA Game Commission and
PA Fish & Boat Commission

From the Editor's Desk

By Rebecca Bowen, Editor of *Keystone Wild!Notes*

Ah, winter. Cold weather, snow, heavy coats, mittens and scarves. The time for cozy fires and hot chocolate…and for ice! This edition of *Keystone Wild!Notes* we dedicate to the wonders of ice. We humans beat the icy elements by staying warm in our houses. But how do animals do it? The natural world is filled with amazing adaptations that animals use to make it through the winter and avoid turning into an icicle (although we'll see one species of frog that does turn into a frog-cicle!).

We'll also look at how ice has sculpted Pennsylvania through glaciation--it is interesting to think that some habitats are now present because of a giant ice pack. We'll also see what effect ice scour has on river habitats.

We visit a recipient of a WRCP grant and see how his research on the hemlock woolly adelgid (an invasive insect affecting eastern hemlock trees) is going. We are also proud to announce the winners of the 2014 WRCP grants.

So while you're watching snow pile up on a cold wintry day, be glad you have a warm place to live. And think about all the great ways nature has adapted to survive extremes. Also think about the unsung hero of winter: ice!

Rebecca Bowen
is the Ecological Services Section Chief in DCNR Bureau of Forestry.

Do Something Wild!
Pennsylvania Wild Resource Conservation Program

WRCP Videos Available Online

The two most recent WRCP documentaries, **"Fungi: Pennsylvania's Hidden Treasures"** and **"Dangerous Invasions,"** can be viewed online at **www.pacast.com**.

Just click on the Productions tab to see these and other Commonwealth Media Services videos.

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Frost column in soil
Photo: Jason Ruck, Wikimedia.com

Frozen-over Susquehanna River, north of Harrisburg, looking north
Photo: Greg Podniesinski

Cover Story: What's Ice Got to do With It? (continued)

Glaciation in Pennsylvania

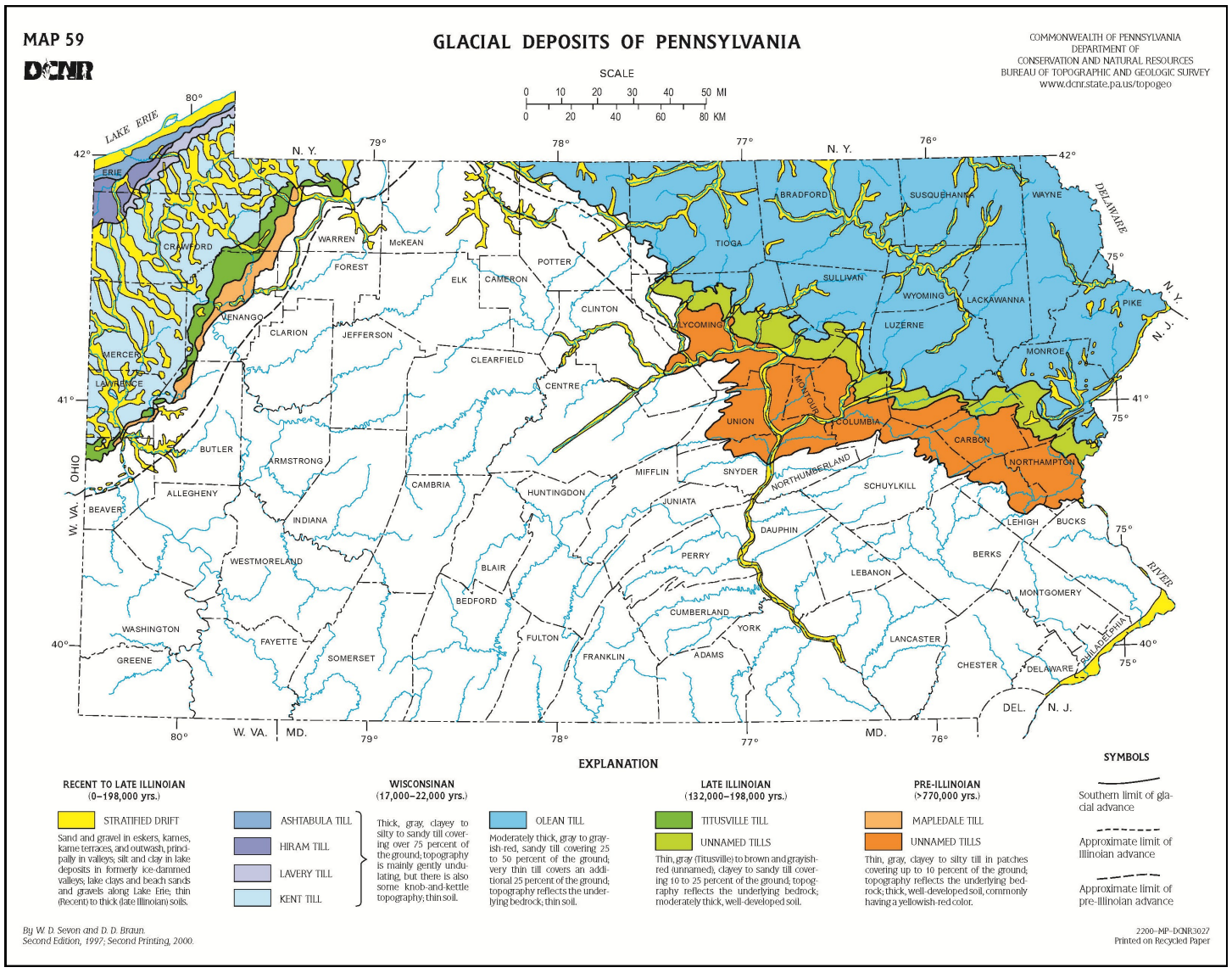
Pennsylvania was repeatedly visited by the icy giants. Scientists believe that there were four glaciations called the Pre-Illinoian, Late Illinoian, Wisconsinan and the Recent to Late Illinoian. Geologists use the soils, rocks and geological formations to determine whether or not glaciers affected an area. In Pennsylvania, evidence of glaciation can be found in the northeastern corner of Pennsylvania, as far south as parts of Northampton, Lehigh, Schuylkill, Columbia, Northumberland, Snyder, Union, Lycoming, and Potter counties. In the northwest, glaciers from Lake Erie covered a swath of parts of Warren, Venango, Butler and Beaver counties. These glaciers influenced the habitat differently in the west versus the east.

Types of Formations

Glaciers left their marks on the surface of North America. They compressed, gouged, carved, eroded, and left behind valleys, rivers, lakes, sand, gravel and boulder deposits. Some of the types of deposits and formations are listed below.

Till: a general term for the unsorted solid material left behind by a glacier (sand, gravel, soil, boulders, etc).

Eskers: are long, linear formations left behind by rivers under the ice like large snakes of gravel and sand. The meltwater filtered through cracks in the ice and flowed along the surface of the land, cutting channels under the glacier and pushing along till as they flowed. When the glaciers melted or receded, the rivers dried up but the till was left behind.



Source: DCNR Bureau of Topographic and Geologic Survey

What's Ice Got to do With It? (continued)

End moraine: this is a linear pile of till marking the furthest extent of the glacier's limit, similar to an esker but usually in a straighter line. The glacier pushed till in front of it as it advanced, but once the glacier receded or melted, the material was left behind.

Kettle: these are depressions in the ground, usually filled with water, that were caused by giant blocks of ice that broke off of the glacier when it receded. These big blocks melted and left behind depressions filled with meltwater. Many of these kettles have developed into bogs today.

Glacial outwash: sand and gravel deposited by running water from the melting ice of a glacier. When rivers of melt water wash away at glacial till deposits, they carry the finer clay-sized materials away and leave behind thick outwash deposits of sand and gravel that concentrate in valleys. The glacial outwash then forms an outwash plain, known as a sandur, formed from the meltwater of glaciers.

Lodgment till: this is a generally flattened area resulting from a glacier smoothing out the high and low places. Glaciers dropped till, filled in valleys and also rounded out hilltops through erosion.

Kame: a hill or hummock composed of stratified sand and gravel laid down by glacial meltwater. The mounds formed in holes in the ice, along the front of a glacier, or where a glacier met an obstruction like a hill or mountain.

Pothole: a hole worn into the bedrock due to meltwater plunging down a crevasse (crack) in the ice. The water and till eroded a hole in the rock below.

Evidence of Glaciers you can see Today

Eastern Pennsylvania:

Parts of Columbia, Luzerne, Lackawanna, Wayne and Susquehanna counties were repeatedly glaciated and as a result talus slopes are present at the base of Moosic Mountains in Lackawanna County and large boulders are present in soils. "Talus" refers to a pile of rocks that accumulate at the base of a mountain or cliff. Although talus slopes were likely not glaciation features, but peri-glacial, or on the edge of glaciation.

Talus slope, Photo: DCNR

When glaciers were at their full extent, most of unglaciated Pennsylvania was similar to tundra. Talus formations were a result of intense freeze-thaw cycles. This area is characterized by higher elevations (around 1200-2300 feet), waterfalls, rounded or flat uplands with deep valleys and lakes.

Bogs are a common feature in the east due to glacial deposits filling and blocking the original drainage patterns. As a result, glaciated areas have poorly developed drainage

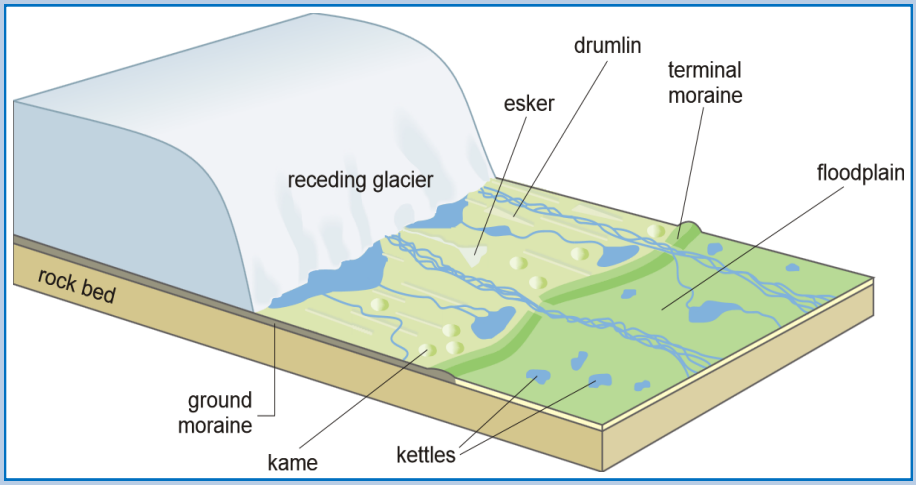


Illustration of a receding glacier and its effects on the surrounding landscape.

(Illustration: Hans Hillewaert (vectorisation), Wikimedia.com)

What's Ice Got to do With It? (continued)

systems, within slow moving rivers and streams, isolated kettle lakes and bogs, as well as forested swamps. The bedrock in the east is dominated by acidic sandstone so the glacial till and outwash deposits that formed in this region also tend to be acidic, favoring the formation of bogs.

As the water passed through these features, it slowed down and dropped out the silt and clay it was carrying. Over time the basins became lined with silty deposits and became productive lakes. Plants and sphagnum mosses grew in the lakes. As the plants and sphagnum die they form peat, a mass of dead plant and moss matter, which is acidic and low in nutrients.

These northern bogs tend to have evergreen tree cover and are specialized habitat for a number of rare plants and communities such as creeping snow-berry (*Gaultheria hispidula*) and bog rosemary (*Andromeda polifolia*). As a result, many of these sites are often protected areas now.

Promised Land State Park, Pike County

This state park features glacial till, both evergreen and deciduous forests and many bogs that are poor in nutrients. The forests provide habitat for many woodland animals such as the blackburnian warbler and salamanders.

Pike Creek Gorge, Tioga State Forest, Tioga and Lycoming counties

Pine Creek Gorge, or the "Pennsylvania Grand Canyon" in Tioga State Forest near Waterville is a good example of a gorge or valley carved by meltwater from a glacier.

Tannersville Cranberry Bog Preserve, Monroe County

This sphagnum bog is a product of a glacial kettle lake that developed into a bog over time. Bogs are characterized by conifers such as black spruce and tamarack, acidic condition, low nutrients and sphagnum moss.

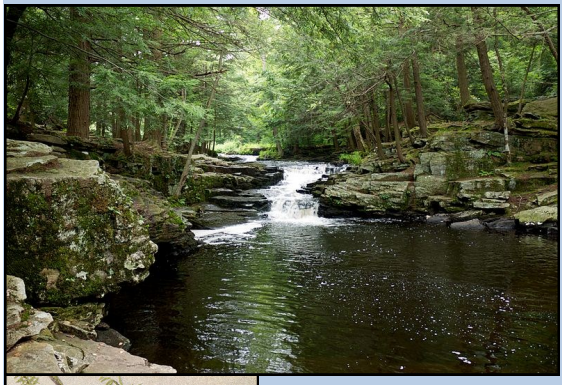
Many interesting or rare plant species such as pitcher plant, sundews, Labrador tea, leather-leaf, swamp azalea and cranberry use this site, which is owned and protected by The Nature Conservancy, and field trips are offered.

Western Pennsylvania:

Some western sections of Pennsylvania were affected by glaciers as well. You can see broad, flat uplands cut by sharp and shallow river valleys. There are also landforms such as eskers, kames, kettles, valleys and moraines.

The region closest to Lake Erie, saw the brunt of the glacier coming from the lake into the state. This formed an escarpment (long, steep slope at the edge of a plateau separating areas of different heights) and the sandy dunes of Presque Isle.

While bogs are more common in the east, fens tend to be more common in the west. Fens (like bogs) are peat forming wetlands. But the parent material in the western part of Pennsylvania tends to be less acidic and more alkaline (limestone, dolomite and calcareous shales) and receive their water from drainage and groundwater, not rainfall. Since they are less acidic they allow for a greater diversity of life to flourish. These are some very productive communities.



***Above*, Promised Land State Park waterfall**

Photo: Sixlocal, Wikimedia.com

***Left*, Blackburnian warbler (*Setophaga fusca*)**

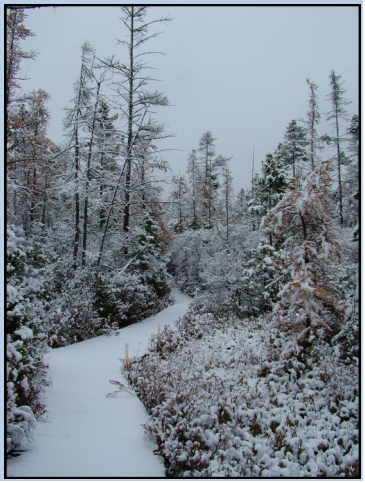
Photo: Louis Agassiz Fuertes, Wikimedia.com

Pine Creek Gorge

Photo: Snottywong, Wikimedia.com

Tannersville Cranberry Bog

Photo: Greg Podniesinski, DCNR



What's Ice Got to do With It? (continued)

West Liberty Fen, Butler County

This is a seepage wetland that provides habitat for wetland birds, dragonflies and several plant species of concern.

Jacksville Esker (also called West Liberty Hogback and West Liberty Esker), Butler County

This geologic feature is an esker (or linear deposit of sand and gravel till) found near Moraine State Park. The six-mile long mound was formed during the last glaciation. The site is owned by the Western Pennsylvania Conservancy and is open to the public.

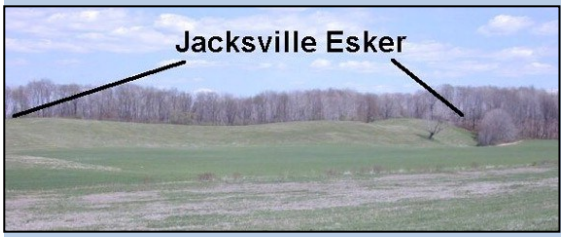
Presque Isle State Park, Erie County

Presque Isle was formed during the Wisconsinan glacial period. The sandy peninsula that is Presque Isle is actually the end moraine of the glacier that advanced into Lake Erie, then retreated and left behind debris. Presque Isle is habitat to many unique plants and animals including the Cerulean warbler.

For more information, please visit the DCNR's Bureau of Topographic and Geologic Survey's website which has publications and digital information available.

An alder-leaved buckthorn-sedge-golden ragwort fen like West Liberty Fen.

Photo: PNHP

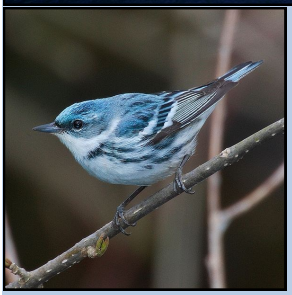


Jacksville Esker (West Liberty Esker).

Photo: Gary Fleeger, DCNR

Remember the Wild Resource Conservation Program at Tax Time

For the past 32 years your support of the Wild Resource Conservation Program has helped return otters to our rivers and eagles to our skies. Because of you every county has information on its wild resources and where they live, and every student in every classroom can learn about the special plants and animals that live in their neighborhood. We need your help now more than ever. Please remember us when you file your PA-40 state income tax by donating all or part of your tax refund on line 32. If you aren't receiving a state tax refund, consider making a direct donation or buying a Wild Resource Conservation license plate for your car. Our wild things, wild places, and future generations will thank you.



***Top*, Aerial view of Presque Isle peninsula**

Photo: Robert K. Grubbs, Wikimedia.com;

***Left*, Cerulean warbler**

Photo: MDF, Wikimedia.com

Amazing Ice

by Rebecca Bowen,

Ecological Services Section Chief for Bureau of Forestry

Ice is the solid form of water and is made up of two elements held together by chemical bonds: hydrogen and oxygen. The chemical formula is H-O-H, or H_2O. In liquid form, the bonds that hold the Hs (hydrogen) and Os (oxygen) together slide around haphazardly and can squeeze together more tightly. When water freezes and forms solid ice, the bonds lock into a regular lattice pattern that takes up more space than the liquid form.

Frost, Lajoux, Jura, France

Photo: Annick Monnier, Wikimedia.com

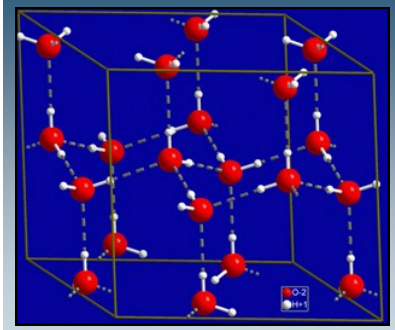
This regular lattice pattern is what makes unique patterns in snowflakes and frost. This is why pipes burst when they freeze in the winter and what causes "frost heave," which is the upward swelling of soil during freezing caused by the ice. This pattern also makes the solid less dense than the liquid, which is different from most solids. Things that are less dense float, which is why ice floats on top of water. Another reason that ice floats is because lattice pattern traps small air bubbles in the water when it freezes.

We may overlook it, but it is very important to aquatic life that the ice forms on top of a body of water, not sinks to the bottom. The ice forms an insulating layer between the water and the cold air. This keeps the water from losing heat and allows fish and other animals to survive.

See Pages 11 and 12 to find out how animals cope with surviving the cold and ice.

Pennsylvania Academic Standards that apply to this article:

3.2.A: Chemistry, Properties, Structure and Matter and Energy



Chemical structure of ice crystal, showing Oxygen (O, red balls), and Hydrogen (H, white balls). The dotted line shows how the molecules are attracted to each other.

Photo: Material scientist, Wikimedia.com

Here are two easy ways you can explore the properties of ice.

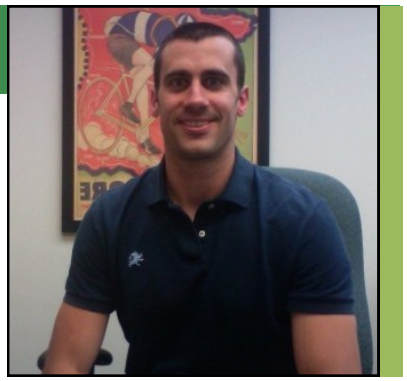
Try it!

Fill a cup with one cup of water. Mark the water level (with tape or a grease pencil), or use a liquid measuring cup that is marked. Pour ½ of the cup into an ice cube tray and freeze it. When the water is frozen, put the cubes back in the cup with the water. Does the water level match the previous level? Is it higher or lower? Do the cubes sink or float? Why or why not?

Try it!

Pour water into a clear plastic picnic cup, mark the level with a permanent marker. Put the cup with the water in the freezer overnight. Take the cup out the next day. Does the water level still match your mark? Why or why not?

The Cold Truth: Overwintering of the Invasive Hemlock Woolly Adelgid in Pennsylvania



Article and photos by Michael A. Elintsky, Ph. D.
Chair, Department of Biology at Mercyhurst University

Some 15 years ago, I had the opportunity to hike and explore the mountains and valleys of the Great Smoky Mountain National Park in eastern Tennessee and western North Carolina while conducting research with one of my university professors. As an avid outdoorsman and nature enthusiast, I vividly recall being awestruck by the beauty of the natural environment - babbling brooks laden with trout descending through dense thickets of laurel and rhododendron, hawks and vultures riding thermals high in the sky, butterflies flitting through the canopy.

***Top*, Hemlock "skeletons" on a hillside. *Right*: hemlock branch with wooly adelgid.**

However, I also began to notice large numbers of gray "skeletons" – dead trees – towering upward through the forest canopy; this was especially evident while standing on a summit or ridge peering down on the forest below. Upon closer inspection, these "skeletons" were once majestic eastern hemlocks.

I began to look more closely and noticed that nearly all remaining hemlocks were covered in large numbers of white, silky clusters on the underside of the needles. Only upon returning home did I learn that what I had observed was the impacts of an infestation of the invasive hemlock woolly adelgid (HWA), *Adelges tsugae.* At that very moment I did not give this much further thought. But, as it turns out, these observations had a lasting impact on my career as a biologist.

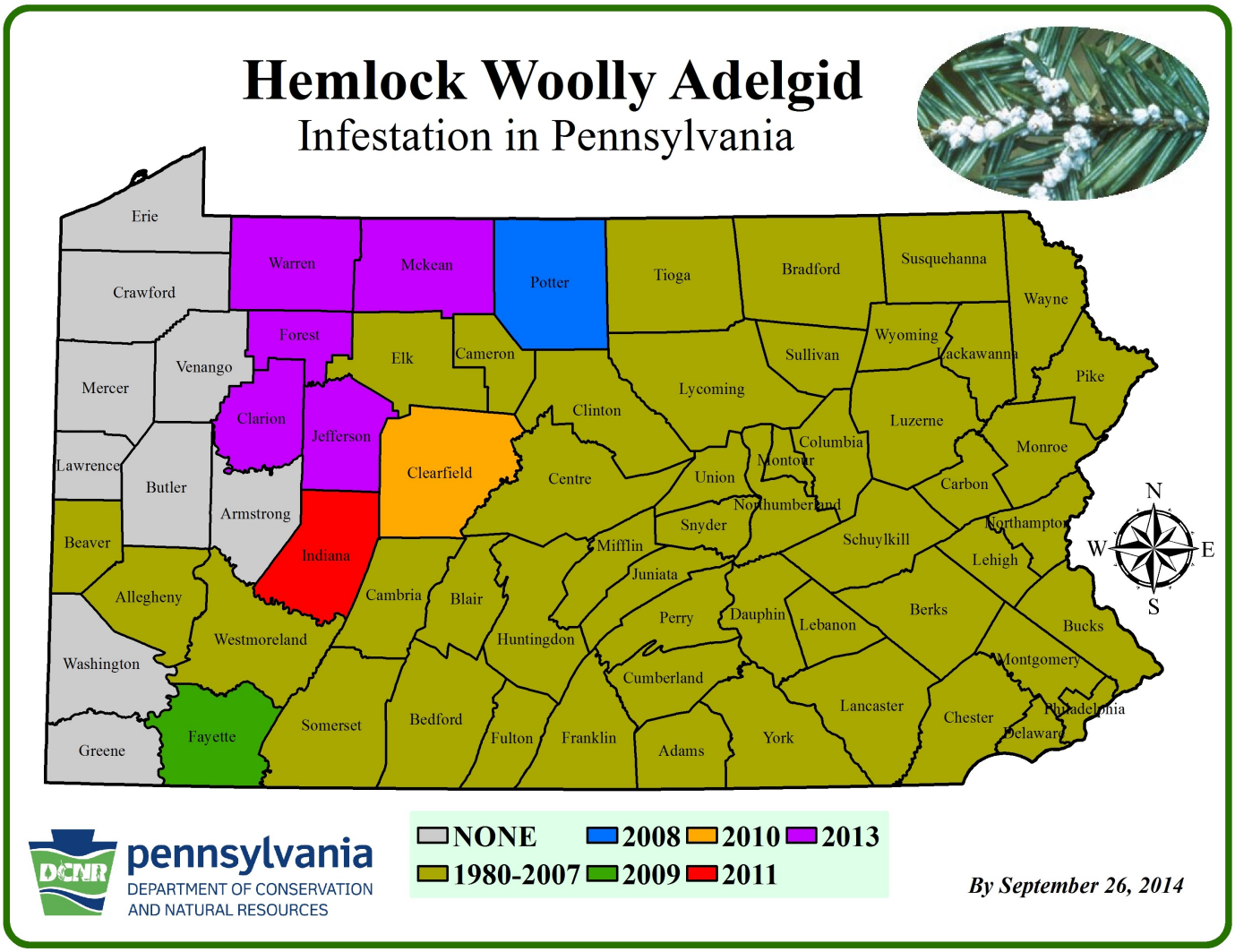
Fast forward 15 years and it is now well recognized that invasive species, such as HWA, pose one of the greatest threats to natural ecosystems, and present significant ecological and financial costs. Invasive insect pests that damage foliage, reduce tree vitality, and result in tree mortality and widespread forest decline have increasingly affected forests within the northeastern United States. Managing these invasive species requires understanding the species' life history and the processes that govern their arrival, establishment, and spread. Regional climate is one such factor that determines the distribution of invasive pest species.

Additionally, climate affects pathogens and insect pests through its influence on their host species, such as changes in host nutritional status or the production of defense compounds. Much research focus has now shifted to the response of plant and animal communities, including the impact of invasive species, to climate change.

Since approximately 1970, temperatures across the northeastern United States have warmed ~0.25°C per decade. While there will certainly be both "winners" and "losers" from climate change, the general view for invasive insect pests is that warmer is better. This may be especially true for those species whose distribution is currently constrained by low temperature and winter survival.

For insects and other invertebrates, environmental conditions, and especially low temperatures, are recognized as one of the most important factors limiting a species' distribution. During autumn and winter within the northern United States, these animals may be regularly challenged by extended periods of often-extreme subfreezing temperatures.

Historically, these animals have been classified into one of two groups based upon their strategy for survival of such conditions. Freeze-intolerant animals must remain unfrozen (i.e., supercooled) at subzero temperatures, as freezing of the body fluids is ultimately lethal. Conversely, freeze-tolerant animals readily survive the freezing of their body fluids, often promoting ice formation at high subzero

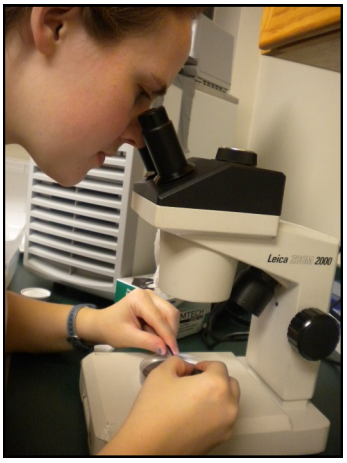


temperatures. Both strategies rely upon a variety of ecological and physiological adaptations for winter survival, including the selection of overwintering hibernacula, the seasonal accumulation of antifreeze compounds (i.e., cryoprotectants), the synthesis of antifreeze and/or ice nucleating proteins, and the use of metabolic suppression for energy conservation. Because of their importance in range determination, cold winter temperatures and the strategies used to survive such conditions are important factors in evaluating the ability of invasive species to establish and spread. Based upon HWA infestation records in the eastern United States, the range expansion of southern adelgid populations have progressed almost twice as fast as northern populations. At the northern range of the adelgid, cold winters are thought to explain the observed slow rate of spread of HWA and the longer survival of infested hemlocks.

The HWA is an aphid-like insect that feeds on hemlock trees by inserting its stylet into twigs at the base of needles on the underside of branches. It is hypothesized that the insect injects toxic saliva, which weakens the tree, causing needle loss, reduced growth, and eventual death typically within four to six years of initial infestation. The adelgid is parthenogenic (i.e., develops from an unfertilized egg) and completes two generations per year; its high rate of reproduction likely contributes substantially to its overall impact. Native to Asia, the adelgid was accidentally introduced to Virginia from Japan in the early 1950s. Once introduced, the HWA spread slowly along the east coast of the United States. Its current distribution now includes 18 states and extends from northern Georgia to southern coastal Maine, with inland populations found as far north as the southern border of Vermont and New Hampshire.

Pennsylvania is very much at the center of the ongoing range expansion of the HWA. This invasive insect has been found in PA for more than 40 years and, as of 2014, approximately two-thirds of the state has been

Grants in Action (continued)



infested by the HWA, with range expansion of the adelgid into new hemlock stands proceeding to the north and west. However, the role of winter environmental conditions within the adelgid microhabitat in either facilitating or slowing the current range expansion within Pennsylvania has not been well-studied. Therefore, with the dedicated assistance of several Mercyhurst University undergraduate students, we have begun a long-term, state-wide monitoring project to assess the cold tolerance of HWA to gain a better understanding of the role of winter survival in the spread of this invasive pest within the commonwealth.

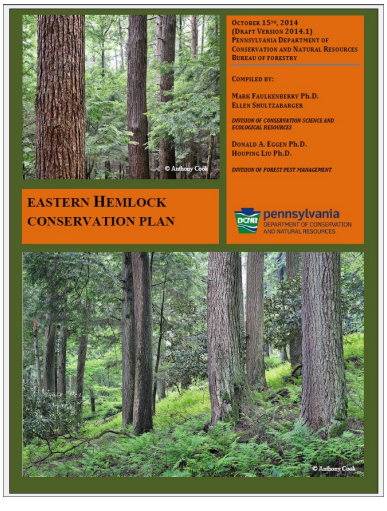
Based on our studies of field-collected adelgids, HWA is a freeze-intolerant insect that experiences increased mortality at temperature below -10°C (14°F); in lab trials no adelgids survived temperatures below -28°C (-18°F). Additionally, the survival of adelgids declined with multiple exposures and more time spent at low temperature, and HWA appears to become more sensitive to cold later in the winter (e.g., March). We have now used these initial laboratory studies as the foundation on which to develop and test a model to predict the survival of overwintering adelgids based upon the temperatures experienced across the state.

Using data from NOAA weather stations across the state and the deployment of numerous temperature data loggers within hemlock stands, model predictions have closely matched field surveys of overwintering survival of adelgids over the last three winters. We have observed dramatic variability in overwintering survival of HWA from year-to-year and across the distributional range of the adelgid within the state. For example, during the winter of 2011-12 nearly 90 percent of adelgids survived winter in the southeast portion of the state (e.g., Chester and Adams counties). During that same winter, less than 10 percent of adelgids in Tioga County survived the winter. Similar variation was observed during the winter of 2012-13 with HWA survival across the state ranging from less than five percent to nearly 80 percent. But what about the, by all accounts, brutally cold winter of 2013-14? There was a positive side to the long, harsh cold, as adelgid populations definitely felt the effects of the low temperatures last winter. Across the state most infestations experienced less than 15 percent and some nearly zero percent survival. It certainly appears that at least along the northern and western extent of the adelgid range within the state, the low temperatures experienced during winter are a significant source of adelgid mortality and likely have served to slow the spread of the invasive pest. It is, however, also important to note that one extreme winter is unlikely to stop the spread of this invasive pest, as previous research has suggested that as little as two percent winter survival may be enough to maintain an infestation.

So what does the future hold for our state tree and HWA? I am optimistic that the management of viable hemlock stands on a landscape-scale and the effective control of this highly invasive pest may be achieved through a multi-faceted, collaborative effort among all stakeholders. While it is unlikely that low temperatures alone will prevent future infestations of HWA, cold winters can serve as a significant source of adelgid mortality, slow range expansion, and aid efforts to control this pest species. So the next time that you have to brave the cold and shiver on the way to work or school, keep in mind that Mother Nature is simply trying to do her part to assist in the control of HWA. Hopefully this thought makes the cold a bit more tolerable this winter!

Answers to Color Me Wild! page 27.

3 **Bullfrog** (*Rana catesbeiana*)
1 **Small-mouth bass** (*Micropterus dolomieu*)
6 **Banded Sunfish** (*Enneacanthus obesus*)
5 **Eelgrass** (*Zostera marina*)
4 **Milfoil** (*Myriophyllum*)
7 **Pussy-willow** (*Salix discolor*)
2 **Highbush blueberry** (*Vaccinium corymbosum*)



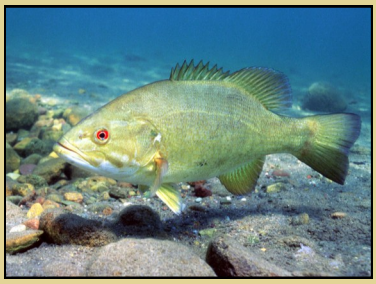
DCNR Bureau of Forestry has developed a conservation plan for eastern hemlock. This plan will help guide public and private land managers facing hemlock wooly adelgid damage.

Wintertime Animal Adaptations

by Rebecca Bowen, Ecological Services Section Chief for Bureau of Forestry

Pennsylvania Academic Standards that apply to this article:

3.1.A: Biological Science, Organisms and Cells and 3.1.C: Biological Sciences, Evolution



Small-mouth bass (*Micropterus dolomieu*)
Photo: Eric Engbretson, USFWS

Fish, like this small-mouth bass, spend the winter closer to the lake bottom, where the water is warmer.

Bullfrog tadpole (*Rana catesbeiana*)
Photo: Pierre Fidenci, Wikimedia.com

Bullfrogs can overwinter in lakes and ponds as tadpoles, swimming in the warmer water closer to the bottom. Adult bullfrogs dig into the mud in a pond or lake, their skin absorbs dissolved oxygen from the water.

Timber rattlesnake (*Crotalus horridus*)
Photo: Aura Stauffer, DCNR

Timber rattlesnakes hibernate in dens below the frost line, and may emerge on warmer days.

Wildlife have different types of ways to make it through the winter, called adaptions. Adaptations are changes that nature had made through many generations to better cope with an environment. Here are some adaptations of common wildlife. First, we look at cold-blooded animals, like reptiles, fish and amphibians. These animals cannot regulate their body temperatures, so they have developed ways to keep from freezing to death.

Box turtle (*Terrapene carolina*)
Photo: Tony Ballioni, United States Fish & Wildlife Service

Reptiles respire through their lungs not their scaly skin. This box turtle will burrow into the earth or mud to hibernate. If they are underwater, they can get dissolved oxygen from the linings of their mouths and throats.

Wood frog (*Rana sylvatica*)
Photo: Aura Stauffer, DCNR

Amphibians such as terrestrial frogs, toads and salamanders survive winter on land but start their life in the water, often in vernal ponds. The wood frog hides in crevices or under leaves. Ice crystals form in their bodies, but they produce natural antifreeze to keep from freezing solid.

Wintertime Animal Adaptations (continued)

Mallard ducks (*Anas platyrhynchos*)
Photo: Greg Czarnecki

Birds are warm-blooded, meaning their bodies have mechanisms to regulate their own body temperatures. Birds, like these mallard ducks, have a layer of fat on their bodies, especially their legs, to keep them from freezing. Standing on one leg is an adaptation too—it keeps both legs from getting too cold at once.

Eastern bluebird with fluffed feathers (*Baeolophus bicolor*)
Photo: Greg Czarnecki

Many birds fly south for the winter, but the birds that stick around in winter have ways to keep warm too. They fluff their feathers out to trap body heat and shiver to keep warm.

These are some examples of warm-blooded animals, like birds and mammals. These animals are able to regulate their own body temperatures and they have developed some clever adaptations to survive icy conditions.

So, when you are chilly on a winter day, think about all the amazing ways nature has developed to beat the cold!

White-tailed deer (*Odocoileus virginianus*)
Photo: Ken Thomas, Wikimedia.com

This mammal has a unique adaptation—their winter coat is made of hollow hairs that trap air and insulate them. The hairs are not like drinking straws, but made up of hollow cells like Styrofoam.

Indiana Bat (right, *Myotis sodalis*)
Photo: Aura Staffer, DCNR

Many species of bats hibernate deep in caves where the temperature is constant, though some species hibernate under bark. Bats and other mammals like flying squirrels may huddle together in the same den or cave to conserve

American beaver (*Castor canadensis*)
Photo: D. Gordon E. Robertson, Wikimedia.com

Aquatic mammals like beavers and otters have a thick layer of fat to keep them warm.

Pennsylvania Natural Heritage Program Spotlight

Ice on the River

by Greg Podniesinski,
Director of the
Pennsylvania Natural
Heritage Program

On a warm summer day, kayaking down the Susquehanna, Allegheny or Delaware rivers, you drift by islands and shoreline covered by grasses, trees and shrubs; maybe you see some trees and shrubs strangely absent or clumps of trees bent and damaged. It might be hard to imagine the cause, but if you were on that same stretch of river six months earlier, the river might look like a like a barren arctic landscape: nothing but ice and snow from shore to shore. The cause of battered shrubs and trees and stretches of barren shoreline becomes more evident: river ice. Even more amazing, is some species actually thrive in this harsh ecosystem.

River ice formation begins as floating patches of ice crystals called frazil that grow to form larger patches (circular "pancakes") and eventually the river fills with these pancakes of frazil. If conditions are cold enough and the river is not flowing too fast, the slushy frazil pancakes will freeze to form a continuous cover of ice. Ice can also grow from the river's edge to form shelves out into the river (border ice). In Pennsylvania's rivers, ice typically forms in the channel as frazil and as border ice at the same time. Once the river is frozen over, ice formation continues below the surface as more frazil forms and solidifies on the underside of the ice, causing it to thicken. If the water is shallow enough, ice may also form along the river bottom (anchor ice).

Ice Impacts

Once ice has formed it can affect the river bed and plants and animals along the river. The effects of river ice depend on a number of factors, including the stage of river (i.e., normal flow versus low flow or flooding), the amount and thickness of ice, the topography of the river channel and human influences (including obstructions like bridges and dams as well as thermal pollution from power plants).

Pennsylvania Academic Standards that apply to this article:

4.1.D: Adaptations can help organisms survive in their environment

4.1.E: Changes in an environment over time

It is also important to consider the properties of ice. While ice is less dense than water (about 10 percent less dense), it still weighs 57.4 lbs/ cubic foot. To put that in perspective, a large piece of river ice 10 feet in diameter and one foot thick would weigh over 4500 lbs (or the same as a full-size car). Ice is also a solid, and while not a hard as stone, it can still erode and move material along the river channel and shorelines.

River ice can affect rivers by altering the flow of water underneath the ice, especially as ice thickens in shallow water. Water flow may become constricted, increasing the pressure and velocity of the flowing water and causing erosion where it might not occur in the absence of ice. In some instances, the faster flow in shallower areas causes finer material like sand, silt and clay to be washed away, leaving behind only the larger stones. These areas are called cobble pavements and may extend for significant stretches of river where heavy ice cover is common.

River ice can also directly impact woody plants and animals living

Young river birch (*Betula nigra*) pushed over by ice, note active sprouting from base.
Photo: Greg Podniesinski

Susquehanna River just below the Shamokin power plant on February 12, 2013 showing open water with frazil ice. Power plant smokestacks in background.
Photo: Greg Podniesinski

on the river bottom if the ice forms around them and freezes them in place, either as border ice or as anchor ice. If the river rises and the ice breaks up, plants, animals and even rocks, sand and gravel frozen into the ice can be plucked out of the river bed and shoreline and moved downstream.

When a mid-winter thaw or the spring melt causes flooding, river ice can become a real threat to people as well as plants and animals. If the ice cover is thick and flooding occurs suddenly (i.e., sudden warm-up accompanied by heavy rain on a deep snow pack), then river ice is a threat on multiple fronts. Thick river ice scraping along the shoreline or along the heads of river islands can act as bulldozers, gouging the river bottom and removing anything growing in it. Ice can also pile up along the shore to form large accumulations of ice weighing several tons or more.

Ice-Adapted Communities

The effects of these two actions create a distinct appearance for several river plant communities. The Hairy-fruited Sedge (*Carex trichocarpa*) Floodplain Wetland is a plant community that is common along the shore of the Upper Delaware River, where it forms extensive "lawns" along stretches of the river that have few, if any shrubs and no trees. These areas experience severe scour during the winter that removes any vegetation that rises above the substrate, but the plants in this community are adapted to the ice scour conditions. They have deep perennial roots that penetrate the hard cobble and gravel pavement and the buds for next year's growth lie at or just below the substrate surface, protecting them from most of the effects of ice scour.

There are some shrubs that seem to tolerate the ice scour. One is the sand cherry (*Prunus pumila* var. *depressa*), a cousin of our native black cherry, but distinctly unlike in size and habitat. The sand cherry grows in another floodplain community subject to scour that is dominated by prairie grasses, especially big bluestem (*Andropogon gerardii*), Indian-grass (*Sorghastrum nutans*) and cordgrass (*Spartina pectinata*). Like its name implies, the sand cherry grows in sandy and gravelly bars and low shorelines, but instead of an upright growth form, the sand cherry tends to grow prostrate (flat against the ground) and has tough flexible branches so that during winter floods, they present a small target for scouring ice blocks.

Like the sand cherry, a number of shrubby willow species (*Salix sp.*) also grow along the shore and are subject to ice scour, but their strategy seems to be tolerance. Shrub willows have thin flexible branches that will bend, rather than break, as scouring ice moves by. If willow branches do break, the branch fragments have the ability to root and start a new shrub wherever they wash ashore come spring time.

The Pennsylvania endangered plant species, aster-like boltonia (*Boltonia asteroids*) is a species that needs ice scour to survive. The scouring effect of the ice makes the habitat less suitable for many other species, allowing the aster-like boltonia to fill this niche. It is well-adapted perennial to the seasonal fluctuations of the river. Invasive plant species that tolerate the disturbances of the scour can be a threat to the boltonia.

Island Life

While the shoreline can be a rough place to live, islands can be even rougher. Here river ice can accumulate in piles over 10 feet thick, weighing 550 lbs per square foot, or more. When the river rises and ice on island heads begin to shift, they move down stream and across the island. Most islands show a predictable pattern from the upriver end to the down river end that reflects the effects of ice. Beginning just upriver from an island in shallow water, there is often a zone of hard-packed gravel, usually colonized by a single plant species, American water-willow (*Justicia*

Slabs of river ice stacked on the shoreline near Fort Hunter on the Susquehanna River. Ice accumulations are five to ten feet deep.
Photo: Greg Podniesinski

Three to four-inch diameter silver maple and river birch trees pushed over by accumulated ice floes.
Photo: Greg Podniesinski

Aster-like boltonia (*Boltonia asteroids*) growing in a shallow crevice in rock along the Susquehanna River.
Photo: Emilee Boyer Euker, DCNR

americana). This perennial plant has very tough roots that form a nearly impenetrable matrix of gravel and roots that is very difficult to remove, even with a shovel.

Downstream from the water willow, the first zone on the island is where the ice first accumulates and is often characterized by coarse gravel or a cobble pavement and little or no vegetation. Next comes a zone of battered shrubs and tree saplings growing in gravel and sand, whose size belies their age. Close examination shows that many of these shrubs and saplings have been damaged, bent or broken repeatedly over many years, only to recover and grow again each spring and summer.

Downriver from this zone is typically a zone of young trees several inches in diameter. This is where the impacts of river ice can be dramatic, where trees up to 20-30 feet tall have been permanently bent over by ice and their bark gouged and scarred. Trees typical in this zone are river birch (*Betula nigra*), sycamore (*Platanus occidentalis*) and silver maple (*Acer saccharinum*). It is not unusual to see an odd row of straight trees in this zone, which upon closer examination, are the branches of a sycamore bent at 45 degrees, with its upright branches taking on the growth form of individual trees.

Finally, at the end of most medium to large islands is a mature stand of trees, typically dominated by silver maples with the occasional sycamore and river birch. Here the signs of ice damaged are limited to the scars of their youth or the occasional recent scars from ice that made it through the protective buffer of the vegetation upstream on the island.

So we can see that ice can be important to river habitats—both in destructive forces as well as providing specialized niche habitat for certain species. The ice-scour zones of rivers are truly unique habitats in Pennsylvania.

River ice accumulated along the shoreline near Fort Hunter, Susquehanna River.
Photo: Greg Podniesinski

Sand cherry (*Prunus pumila var. depressa*)
Photo: Greg Podniesinski

Island just north of the Harvey Taylor Bridge on February 12, 2013 showing ice accumulations over ten feet high on the island head.
Photo: Greg Podniesinski

"Snowflakes are one of nature's most fragile things, but just look at what they can do when they stick together."

—Vista M. Kelley

Frost and Forests — Timing is Everything

Article by Greg Czarnecki, WRCP Director

Photos by Don Eggen

Chief of the Forest Pest Management Division, Bureau of Forestry, DCNR

According to Norse mythology, frost is caused by an invisible spirit who is the son of the winds. While generally a friendly spirit, he has a short temper and can kill by freezing if provoked. His name is Jokul Frosti, or Jack Frost, and if you have a vegetable or flower garden, you know all about his temper.

Unlike ice, which forms when liquid water freezes, frost is formed when water vapor in the air freezes without passing through the liquid phase, hence the delicate crystals that form on objects such as window panes and leaves. The first killing frost of the fall and the final one of the spring are the bookends that define the growing season. While many of our non-native ornamental flowers, vegetables, and crops are susceptible to frost damage, our native plants are much more resilient - most of the time. It all depends on timing, especially in the spring.

Early spring frosts can be especially bad for forests, because the young buds and flowers are very vulnerable to frost. Frostbitten buds mean fewer leaves and frostbitten flowers mean less fruit, nuts, or seeds are produced. Usually the last frost of the season occurs well before the buds burst or the flowers emerge, but climate change is upending the normal timing of things.

A good example was the spring of 2013 when a killing frost occurred in the northern part of the state soon after many of the trees had begun to emerge from their winter dormancy. The extent of the frost damage was widespread, but varied considerably, influenced by factors such as altitude, the density of the trees, and microclimate. More than 131,000 acres of forest in Cameron, McKean, and Tioga counties were affected.

Localized frost damage along Route 6 in Tioga County, spring 2013

Frostbitten tree, Leonard Harrison State Park, spring 2013

Did you know?

Frostbite usually doesn't kill conifers (evergreen trees like white pine and spruce). The cold may slow them down by damaging new evergreen growth but not long-term damage.

Frost and Forests — Timing is Everything (continued)

When a forest gets frostbite, the implications go far beyond the trees themselves, because the amount of leaf cover and the trees' health have significant impacts on the ecosystem and the way it functions. Frost damage can result in:

- **Changes on the forest floor.** Beneath the canopy of temperate deciduous forests you usually find deep shade. As a result of frost damage, however, there can be a lot more sunlight reaching the forest floor, significantly altering the understory growth.
- **Reduced carbon uptake.** Trees remove massive amounts of carbon from the atmosphere and convert it into wood and other tissues through photosynthesis. This process occurs in the leaves, so a reduction in leaf cover leads to less carbon uptake.
- **Nutrient loss.** Leaves are the energy factories of the forest, cranking out nutrients throughout the growing season and depositing them in the soil when they fall to the forest floor in the fall.
- **Less food for wildlife.** Seeds and fruits of forest trees are important food sources for many different animals, from deer and bear to turkeys and woodrats. A major reduction in these has a ripple effect throughout the ecosystem.
- **Water imbalance.** Trees are like giant straws, removing water from the soil and passing it out of their leaves through a process called transpiration. Fewer leaves can significantly alter this process, increasing the amount of water stored in the soil as well as altering the relative humidity of the air. This can lead to an increase in flooding, landslides, and even changes in precipitation patterns.
- **Reduced resistance**. Trees that are damaged by frost are more susceptible to pests, diseases, and other environmental stressors that would normally have only a minor impact on a healthy tree.

While the frequency of frost is predicted to decline due to climate change, that doesn't mean that frost damage will as well. Freeze-thaw fluctuations are likely to increase, resulting in more frequent early leaf-out and a subsequent increase in frost damage.

It's all a matter of timing.

Patchy frost damage in Leonard Harrison State Park, spring 2013

The Language of Ice

The languages of Native American cultures from polar regions, Inuit and Yupik (often called "Eskimo"), have unique ways to describe ice and snow. But contrary to popular belief, they don't have hundreds or thousands of distinct words, but rather about the same number as in the English language—a dozen or so. But they can combine root words and suffixes in almost unlimited ways, and one word can have as much description as a whole sentence!

Here are some examples:

***Qani*—snowflake (or falling snow)**

***Qanittag*—freshly fallen snow**

***Siku*—ice, in general**

***Sikuliaq*—new ice appearing on surfaces**

Sources: Washington Post; Wikipedia.com; Canadian Encyclopedia.com

2014 WRCP Grants

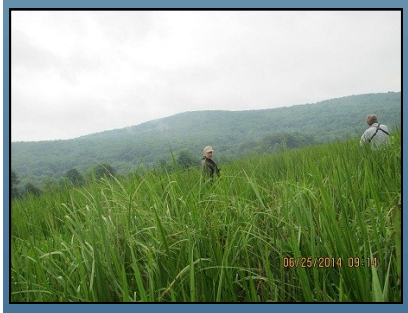
For the 31st year in a row the Wild Resource Conservation Program is awarding grants for worthy education, conservation, and research projects that will help conserve the Commonwealth's native plants and non-game animals. The following 11 projects, totaling $383,442, were selected during the latest grant funding cycle.

Marc Bechard and David Barber attach a satellite transmitter to a young broad-winged hawk. (Photo: Mary Linkevich, Hawk Mountain)

The Raptor Project: Tracking Broadwings and Black Vultures from Space. This project of Hawk Mountain Sanctuary will connect educators and citizens with migratory raptors through educational curricula, posters, web pages, and activities that track and compare two Pennsylvania species: the broad-winged hawk and black vulture using real-time satellite telemetry data.

Cosmo returns for a last installment

Cosmo's World, the video series produced by Lehigh Valley Telecommunications Corporation, will get the third and final installment. Two videos and associated lesson plans looking at the function and importance of trees, the effects of the seasons, and what a tree requires from, and in turn provides, to the environment. The videos and accompanying teacher resources, which will be designed for a pre-K through seven-year-old audience, will be in accordance to the Pennsylvania academic standards.



Botanists search for rare plants in Tioga County. (Photo: Chris Firestone)

Field Surveys and Assessments for Plant Species of Special Concern in the Northern Tier. This project will involve field assessments conducted by the Western Pennsylvania Conservancy, and other botanists, of plant species of special concern, which have been identified as priorities by the Bureau of Forestry, in the northern tier of the state.

Northern riffleshell mussels Photo: Mary Walsh

Assessment of Mussel Habitat, Communities and Rare Species in the Ohio River. The Western Pennsylvania Conservancy will evaluate the mussel community in the least-disturbed sections of the Ohio River, mudpuppy habitat, and assess potential relocation areas for the northern riffleshell and clubshell mussels.

2014 Grants Awarded (continued)

The hairy-tailed mole is a cryptic mammal. Photo: Charlie Eichelberger

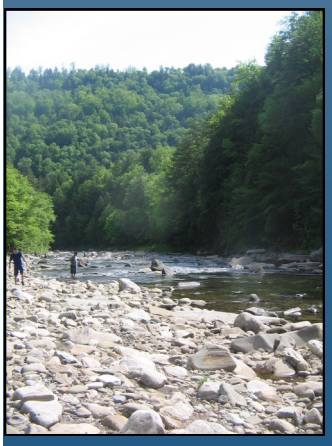
Surveys for Cryptic Small Mammal Species in the Central Mountains Important Mammal Area. The Western Pennsylvania Conservancy will support the Pennsylvania Game Commission's Pennsylvania Mammal Atlas. It will address the distribution and abundance of several species, including northern water shrew, rock shrew, southern bog lemming, least weasel, long-tailed weasel, ermine, eastern small-footed myotis, and several species of moles.

Forest interior birds like the Canada warbler will be studied by the National Audubon Society. Photo: David Yeany

Forest Interior Bird Habitat Relationships in the Pennsylvania Wilds. Interior forest bird communities in the Pennsylvania Wilds have significance to the commonwealth and beyond since many birds breeding here migrate between North and South America. Audubon Pennsylvania and the Western Pennsylvania Conservancy will conduct extensive off-road surveys throughout the 12-county region to document current bird densities and determine relationships with forest stand types and landscape features.

Bog turtle Photo: US Fish and Wildlife Service

Bog Turtle Assessment, Restoration and Monitoring on Public Lands. This project, by the Mid-Atlantic Center for Herpetology and Conservation, will develop bog turtle management plans, restore bog turtle habitats in southeastern Pennsylvania, and will include population monitoring before and after habitat modification.



World's End State Park Photo: Ruhrfisch, Wikimedia.com

Legacy Sediment in the Appalachian Plateau of Pennsylvania. Mansfield University received a grant to determine if legacy sediment is stored in low-order highland watersheds of the Appalachian Plateau physiographic province within Mt. Pisgah, Lyman Run, World's End, and Hyner Run state parks.

2014 Grants Awarded (continued)

American Ginseng Garden
Photo: Eric Burkhart

American Ginseng in Pennsylvania: Long-Term Wild Population Monitoring and Supply-Chain Surveying
Pennsylvania State University

The principal goal of this study is to develop plots for continued monitoring of wild ginseng populations on DCNR forestlands. A second goal is to develop a better understanding about the state's wild ginseng trade by continuing an annual survey of those engaged in ginseng commerce.

Trillium Species
Photo: Jessica McPherson

Plant Conservation Status Updates. The Western Pennsylvania Conservancy received a grant for this project, which will include fieldwork and research to update, document, and justify the conservation status of plant taxa that DCNR has designated as high priority.

Eastern hellbender salamander
Photo: Tim Maret

The Effect of Land Use Regime on Hellbender Habitat and Population Persistence in Pennsylvania
Bloomsburg University of Pennsylvania

This project will use environmental DNA (eDNA) analysis to elucidate the current distribution of hellbenders in streams where they were historically documented, but for which recent data is not available. It will also evaluate in-stream and landscape-scale habitat characteristics to determine variables associated with hellbender distribution.

These projects will provide much-needed data and information on some of Pennsylvania's most pressing needs for education, habitat conservation and rare species assessment.

Scientist Profile— Gary Fleeger

I was born in Butler, Pennsylvania, very near the glacial border. I lived in the country and grew up playing in the outdoors. Moraine State Park was under construction, about two miles from my home, while I was growing up so I spent a lot of time riding my bicycle on the now-underwater back roads of the park. I also studied all of the maps of the area and now I am a supervisor in the Geologic Mapping Division of Pennsylvania Geological Survey in DCNR.

I was also a Boy Scout and spent a lot of time in the outdoors as a result. I earned a Geology merit badge as a scout, so I have been interested in geology for a long time. Near our troop camp was an ice-rafted boulder deposited in glacial Lake Arthur in Moraine State Park about 140,000 years ago (which I didn't realize at the time), which started my interest in glacial geology. With growing up near two state parks (Moraine and McConnells Mill) that are noted for their geology and glacial history, it's not surprising that I became interested in glacial geology. The parks were such an integral part of my life that I was even married at McConnells Mill (and my original wedding ring may still be in the boulders beside the Mill, but that's another story).

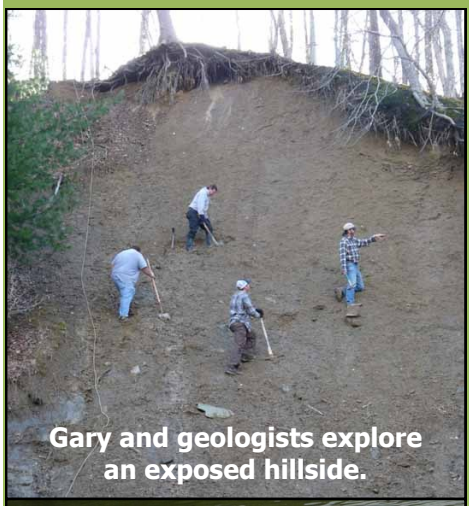
I went to school at Bucknell University and the University of Illinois at Urbana-Champaign. Geologists from University of Illinois actually did the first detailed mapping of the glacial geology of northwestern Pennsylvania.

I am currently section chief for the Stratigraphic Studies Section of the Pennsylvania Geological Survey, supervising four geologists in the bureau who do geologic mapping in various parts of the state. My specialty is glacial geology and my project work is in the glaciated part of northwestern Pennsylvania (northeastern Pennsylvania was also glaciated).

Knowledge of the three-dimensional distribution of glacial sediments is important in understanding groundwater resources, mass wasting (landsliding), sand and gravel resources, as well as plant and animal life. Our bureau is part of the Great Lakes Geologic Mapping Coalition, which is comprised of the eight states that border the Great Lakes (Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio, Pennsylvania, and New York), the Ontario Geological Survey, and the United States Geological Survey. Our goal is to map the glacial geology of those states and province in three dimensions for the various benefits stated above—understanding groundwater resources being the primary one. We all work together to provide technical assistance to each other and obtain funding to further our purpose.

A day in the field for me can involve a lot of variety. I may be hiking streams or driving roads looking for outcrops. I might be trying to locate water wells for which we have completion reports. I might even find myself rappelling over outcrops, measuring, describing, and sampling them. Sometimes, I am working with state park environmental education specialists in helping them understand the geology of their parks. And I might even be arguing with a state park manager to not stop erosion, but to allow it to progress

Stratigraphic Studies Section Chief, Geologic Mapping Division, Bureau of Topographic and Geologic Survey, DCNR



Gary and geologists explore an exposed hillside.

Gary enjoys kayaking in his spare time.

Gary leads a school group in a field trip.

Scientist Profile — (continued)

naturally and keep significant exposures open for study. There is a lot of variety.

Geology is the foundation of the ecological pyramid. The distribution of wildlife is largely dependent on the vegetation, and that is largely controlled by geology—distribution of landmasses, topography, rock and soil types, and groundwater as shown in our physiographic provinces map. In fact, last winter's *Keystone Wild!Notes* discussed the relationship of geology and biodiversity. The geochemistry of the rocks and sediments exerts a dominant control on soil and groundwater chemistry which, in turn, supports different vegetation. For example, the alkaline soil and groundwater of the glaciated region of northwestern Pennsylvania supports a very different plant life than the acidic bedrock in many parts of the state. And the geology of the serpentine barrens in southeastern Pennsylvania has resulted in very distinct vegetation. We can sometimes map certain rock units based on the distribution of certain plants. For example, rhododendron grows mainly on the Pottsville Formation in the Ohiopyle area. For reasons like this, mapping the geology of the state is important for all land use decisions, including the preservation of wildlife and plants.

Geology is usually associated with things like mineral extraction, but geology is all about land use, which includes preservation and conservation (as well as mineral extraction). Not many people understand the relationship between biota and geology. In fact, most people probably are not aware of many of the complex interactions of ecosystems, and the WRCP is one place that has recognized that and educates the public through *Wild! Notes*.

As for hobbies, I like outdoor activities. One of our retired geologists and I have hiked well over 300 miles of the Appalachian Trail, from northern Virginia to New Jersey. I live adjacent to over 9,000 acres of state game lands, with the Appalachian Trail passing about two miles away, so I get out walking almost every day with my dog. I also enjoy kayaking, even though a week after buying it in 2009, I suffered a herniated disk, which makes it difficult for me to load and unload it from the car without help. I still like bicycling. And of course, in all of these activities, I am making geologic observations all the time.

One of my favorite native plants is the fringed gentian, which is found in areas of alkaline soil groundwater in the glaciated region. The blazing star is another of my favorites. Both are found near my childhood home in protected areas (Western Pennsylvania Conservancy's Fringed Gentian Fen and DCNR's Jennings Environmental Education Center), and both are uncommon wildflowers in Pennsylvania that are dependent on the glacial geology of northwestern Pennsylvania for their existence there.

My favorite place in the state is, without a doubt, the Slippery Rock Gorge at McConnells Mill State Park. As I mentioned, I was even married there! I have hiked every tributary and the entire length of the gorge and written about the geology of the gorge.

"Like" us on Facebook

WRCP has a Facebook page and we hope that you "like" it. When you click on the "like" button, you will become a member of our online presence and be the first to know about upcoming events, publication debuts and important news in the world of WRCP and conservation. So please find us on Facebook by searching for **"PA Wild Resource Conservation Program"**. and join our group.

Answers to Wild! Words page 26.

Wild! Words Answer Key:

1 N	9 F
2 H	10 O
3 D	11 G
4 E	12 C
5 A	13 J
6 K	14 B
7 P	15 M
8 I	16 L

Wild! Watch

Maple Sugaring in Pennsylvania State Parks

Article and photos by Eric Rensel
Natural Resource Specialist,
Parker Dam State Park

March is the sweetest time of the year. This occasionally cold and muddy season signals maple sugaring time! A fun winter activity that helps beat cabin fever is to visit a sugaring operation in a local state park.

Tapping sugar maple trees to collect sap.

Parker Dam State Park has been producing maple syrup on a small scale since 1968; offering public programs throughout the month of March. During these 90-minute programs, visitors learn the history of sugaring, how it has changed over the years and how it is done today.

Additionally, visitors learn to identify maple trees in winter when there are no leaves, how to choose the tree to tap, where to tap and the sugaring process. They discover first-hand the fun of carrying five gallon buckets of sap through wet, slippery snow to the collection tank. The park's sugar shack displays the boiling process while emitting the incredible aroma of clear, cool sap turning into hot, hissing syrup. It is a scent that makes your teeth tingle. The Parker Dam State Park maple sugaring experience culminates with a taste of syrup fresh off the evaporator and lots of smiles from those who taste it for the first time.

Have you ever eaten pancakes with pure Pennsylvania maple syrup? This liquid delight over pancakes, or vanilla ice cream, cannot be beaten. Maple syrup contains no additives, artificial sweeteners, colors or flavors. It possesses important amino acids, is high in manganese and zinc, has as much calcium as milk yet has fewer calories by volume than any other "natural" or processed syrup. So how is this amber miracle made?

Let's start with the trees. Trees make food for themselves through a process called photosynthesis. This process allows the tree to grow and, towards the end of summer, the tree begins to store extra food in its roots so it will have the energy to produce new leaves in the spring. Cold nights and warm days in late winter and early spring begin the magic of sap rise, as the food stored in the tree's roots begins moving upward for leaf production. Maple sugaring takes some of that stored food – no more than 10 percent – and turns it into food for people.

Sap is collected and boiled down to concentrate the sugars that are present. Since sap is largely made up of water, 40 gallons of sap must be collected and boiled down to make one gallon of maple syrup. Although the process of making

Real maple syrup accompanies a hearty breakfast.

maple syrup is simple, subtle complexities make it almost an art. Getting the syrup to the perfect density ensures successful, long-term storage of the product but requires a good eye.

Watching the weather forecast becomes a daily, late-winter ritual for those with sugaring operations. Nights below freezing followed by daytime temperatures in the 40s means the sap in the trees will be running. The sugarmaker must have taps in place beforehand to catch those sweet, early runs. Tapping a tree involves drilling a small hole into the sapwood then placing a spout or spile into the hole to direct the sap into a container or pipeline for collection.

Gathering sap can be a great deal of work, depending on how many buckets are hung. During a good sap run, buckets must be emptied every day or sap will overflow. Some operations use pipelines instead of using traditional buckets. This saves a lot of time and effort in gathering, but takes ample work to set up. The plastic lines must not sag and require enough downhill slope for sap to run smoothly. All sap goes into a large holding tank that feeds

The evaporator, where the sap boils down to syrup.

directly into an evaporator. Ideally, the sap is boiled the same day it is gathered, but cold temperatures often allow sugarmakers to wait until enough sap is collected to fire up the evaporator.

Most sugaring operations use large evaporators to boil the water into steam, which is released from the sugarhouse through a cupola in the roof. Removing water increases the density of the remaining fluid. The faster this evaporation occurs, the lighter the grade of syrup. Early runs of sap tend to have more sugar by volume, and so require less boiling to reach syrup density. Later runs tend to have the least amount of sugar and require a longer cooking time, resulting in darker grades of syrup. The darker the grade, the stronger the flavor.

"Sugar shack" where the sap is boiled.

The process gets tricky when the bubbling liquid is close to becoming syrup. Surface tension increases as the liquid thickens. The boiling syrup can suddenly rise in a few seconds time, bubbling over the top of the evaporator, burning the syrup and evaporator pan and making a mess. The experienced sugarmaker always watches the pan closely to avoid such catastrophes. Old timers used to flick a few drops of cream into a rising boil. The fat in the cream would break the surface tension of the syrup and safely drop the boil. Commercial sap defoamer is now used to quell the boil.

One of life's great experiences is seeing, hearing, smelling and tasting pure maple syrup being produced. Several Pennsylvania State Parks offer opportunities to experience this process. Come to a maple sugaring weekend, festival or program presented throughout the season. Check the DCNR events calendar on the DCNR homepage or call one of the parks listed on the next page for further information.

Maple syrup taste samples are provided at Parker Dam State Park.

Pennsylvania State Parks that offer Maple Sugaring Programs:

State Park	Contact	Time of Operation
Parker Dam	(814)765-0630	Every Saturday & Sunday in March, 2 p.m. Maple syrup
Hills Creek	(570)724-4246	Will take part in the Potter Tioga Maple Producers Association Maple Weekend. Other events will be advertised closer to the date due to the variability of the season.
Mount Pisgah	(570)297-2734	Sugar on Snow event on Saturday, March 14, 2015, from 10 a.m. – 2 p.m. Event includes maple syrup boiling demonstration and "sugar-on-snow" pouring thickened
Jennings EE Center	(724)794-6011	Maple Sugaring for Schools - March 17-20, 2015. Registration begins February 2. Maple Sugaring for Scouts - Saturday, March 21. Registration begins February 4, scouts ages 7-11. Maple Sugaring for the community is Sunday, March 22 at 2 p.m. No fee or registration is required. Maple products including syrup, candies and more will be available for sale in the Nature Shop.
Laurel Hill	(814)445-7725	Maple sugaring programs for schools and organized
Raccoon Creek	(724)899-3611	Maple sugaring workshop focuses on small-scale evaporation. Includes a pancake dinner sampling a variety of whole grain pancakes and fresh maple syrup. Tentatively
Little Buffalo	(717)567-9255	Maple sugaring programs on March 21, 2015. Tree tapping and demonstration programs may start in late February.

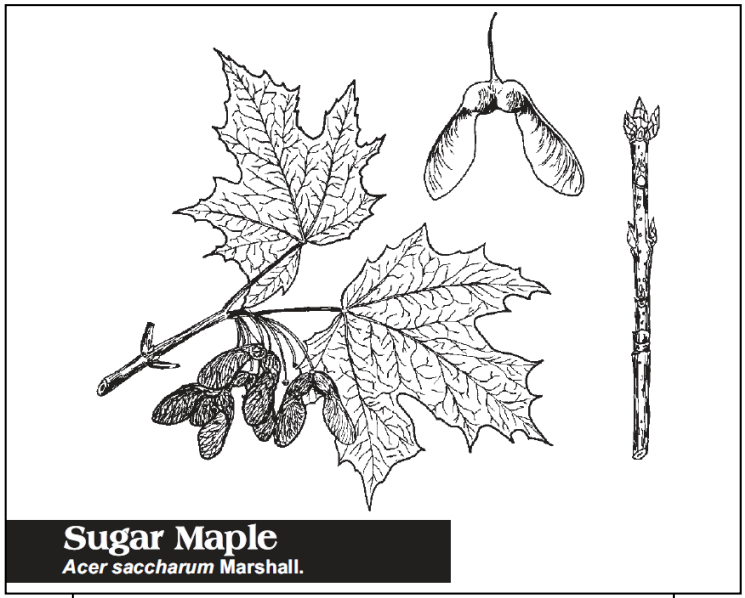
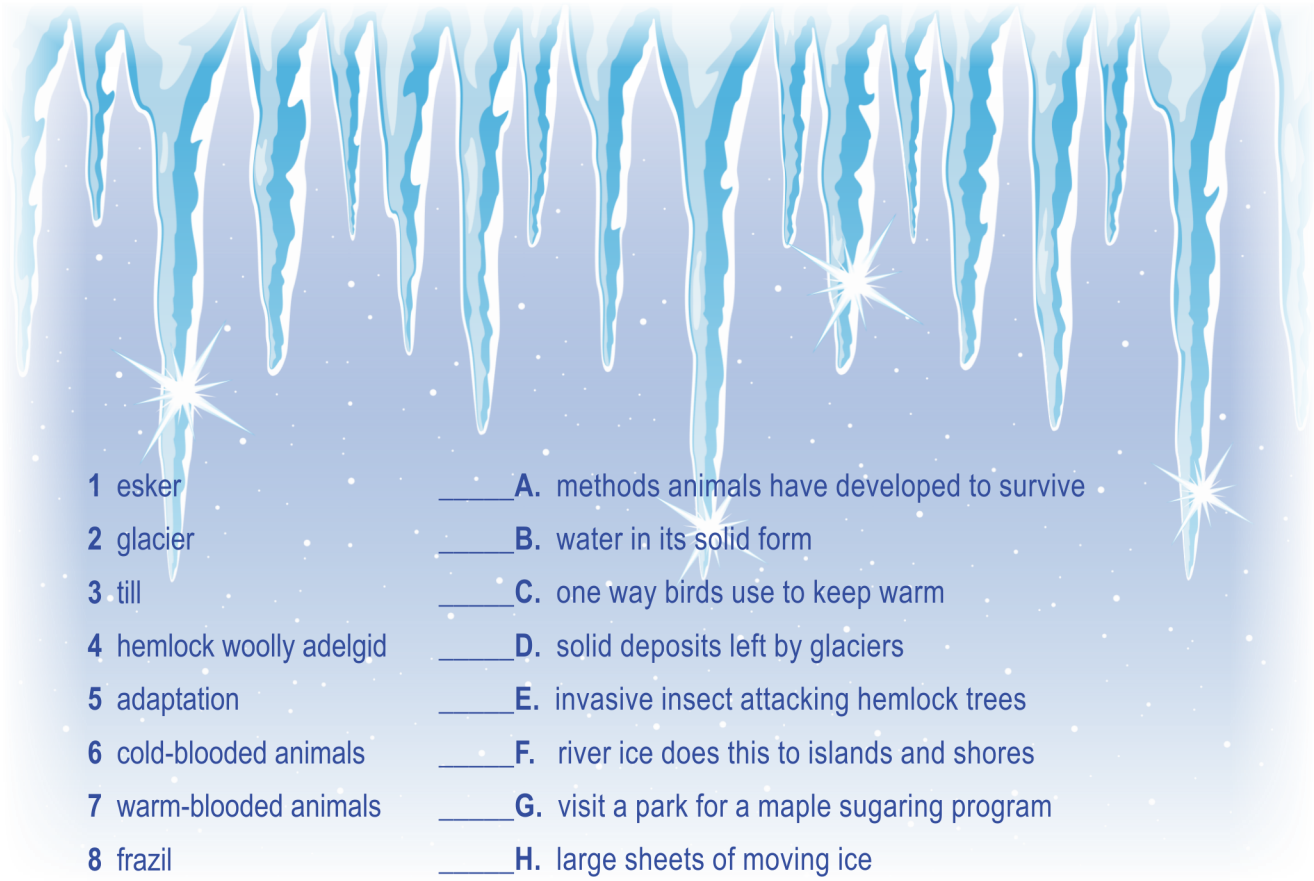


Illustration from *Common Trees of Pennsylvania*, DCNR publication.

Wild! Words

Icy Words by Rebecca Bowen

The icy conditions that winter brings can be a challenge for wildlife, but animals have ways to combat the weather. Ice is important in certain habitats, and ice has even helped shape Pennsylvania's landscape. Connect the word with its description.



1 esker	_____**A.** methods animals have developed to survive
2 glacier	_____**B.** water in its solid form
3 till	_____**C.** one way birds use to keep warm
4 hemlock woolly adelgid	_____**D.** solid deposits left by glaciers
5 adaptation	_____**E.** invasive insect attacking hemlock trees
6 cold-blooded animals	_____**F.** river ice does this to islands and shores
7 warm-blooded animals	_____**G.** visit a park for a maple sugaring program
8 frazil	_____**H.** large sheets of moving ice
9 scour	_____**I.** floating patches of ice crystals on a river
10 aster-like boltonia	_____**J.** bats use this method to survive winter
11 March	_____**K.** they can't regulate their body temperature
12 shivering	_____**L.** awarded for education, conservation & research projects
13 hibernation	_____**M.** hollow hair
14 ice	_____**N.** "snakes" of sand and gravel from a glacier
15 deer winter coats	_____**O.** plant that depends on ice scour
16 WRCP grants	_____**P.** they regulate their body temperatures

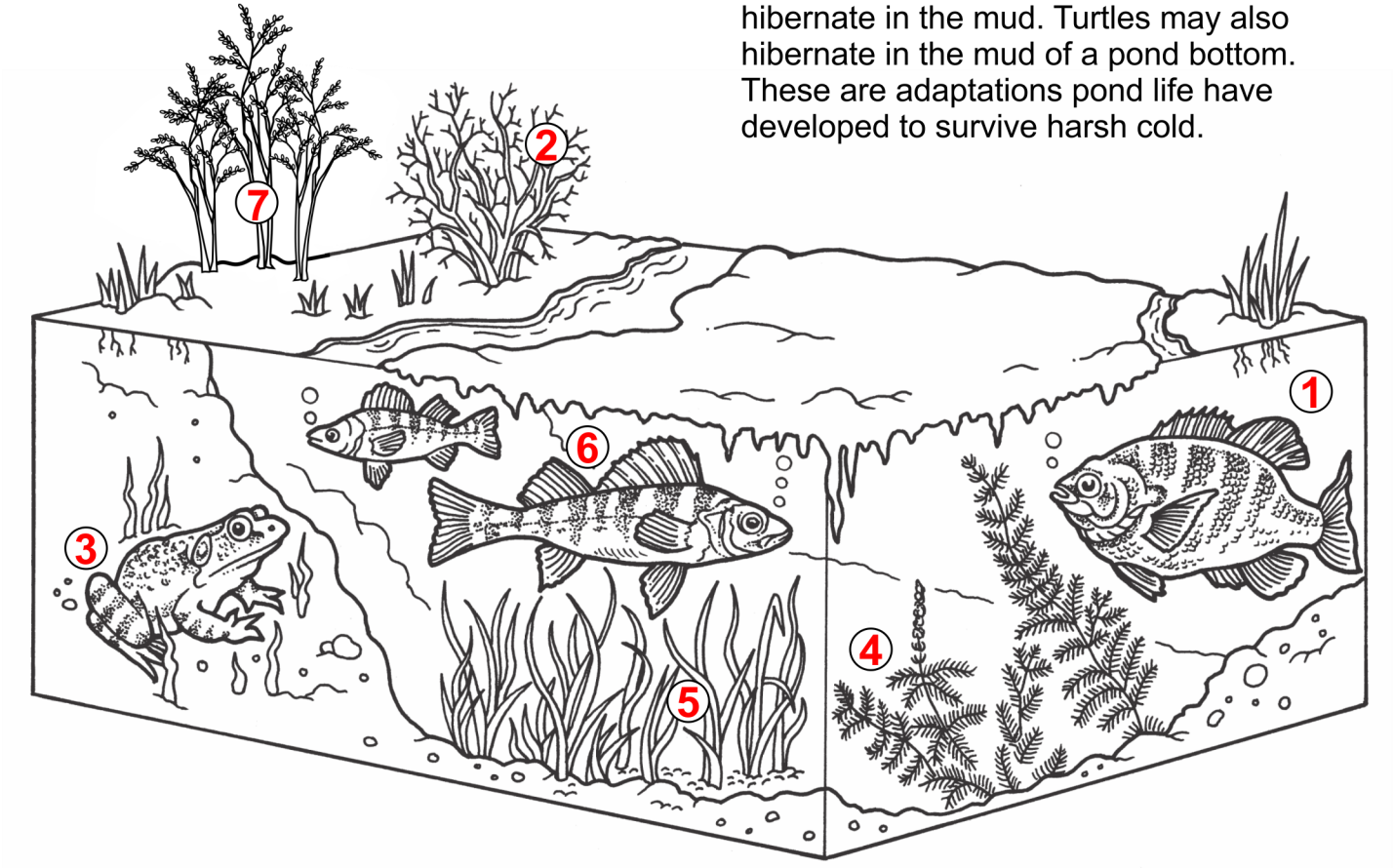
Answers are found on page 22.

Color Me Wild!

Winter Pond Life

Answers are found on page 10.

Did you know that pond life continues under the ice in the winter? Fish slow down and stay near the bottom, where the water is warmer. Frogs and other amphibians hibernate in the mud. Turtles may also hibernate in the mud of a pond bottom. These are adaptations pond life have developed to survive harsh cold.



Match the number to the correct species name.

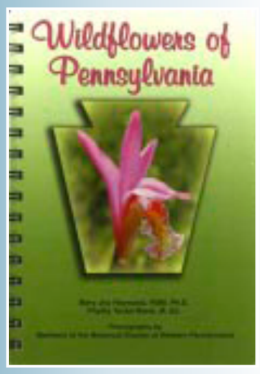
____ **Bullfrog** (*Rana catesbeiana*)
____ **Small-mouth bass** (*Micropterus dolomieu*)
____ **Banded Sunfish** (*Enneacanthus obesus*)
____ **Eelgrass** (*Zostera marina*)
____ **Milfoil** (*Myriophyllum*)
____ **Pussy-willow** (*Salix discolor*)
____ **Highbush blueberry** (*Vaccinium corymbosum*)

Use Order Form on next page

Wild! Buys

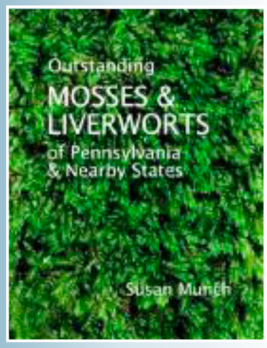
Show Your Wild Side!

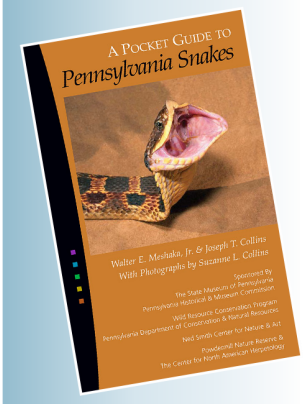
Read All About It—In Wild! Books



WILDFLOWERS OF PENNSYLVANIA
This book is for all who enjoy nature and would like to become more acquainted with wildflowers. It will help the observer to identify the plants seen on a spring, summer or fall hike in a natural area. The book uses photographs of the plants, as photos reveal much more detail than can be found in drawings.
Price: $20 (+ $1.20 tax)

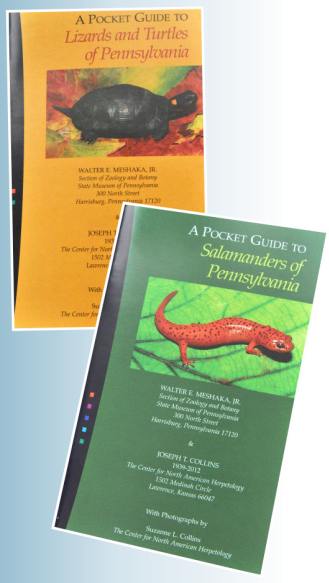
OUTSTANDING MOSSES AND LIVERWORTS OF PENNSYLVANIA
Botanist Susan Munch brings us the first full-color field guide for mosses in the Mid-Atlantic region. The guide's 89 pages contain detailed color photographs allowing for easy ID of many of the most common, yet striking, mosses and liverworts. No microscope is necessary. The guide is suitable for both professionals and non-botanists.
Price: $20 (+ $1.20 tax)





POCKET GUIDE TO PENNSYLVANIA SNAKES
WRCP teamed up with the State Museum to produce this affordable and informative little book that provides photos and natural history information about all of the state's serpents.
Price: $4.72 (+ $.28 tax) each

POCKET GUIDE TO SALAMANDERS OF PENNSYLVANIA AND POCKET GUIDE TO LIZARDS AND TURTLES OF PENNSYLVANIA
Once again WRCP has teamed up with the State Museum to create affordable and informative mini books that provide photos and natural history information about all of the state's turtles, lizards and salamanders. Price: $4.72 (+ $.28 tax) each



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Wild! Buys

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Please make check payable to: **"Wild Resource Conservation Program"**	**TOTAL ENCLOSED***	
SHIP TO: Name		
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WRCP
400 Market St., 6th floor
Harrisburg, PA 17105
Info: (717) 787-3212
or email: jgirton@pa.gov

To Order Merchandise:

Print out and fill in the form above. Mail with check payable to Wild Resource Conservation Program. and add Pa. sales tax and appropriate shipping fees. For more information, call (717) 787-3212 or e-mail jgirton@pa.gov

PA State Sales Tax

WRCP is responsible for collecting 6% Pennsylvania sales tax on most items we sell, excluding apparel. The amount owed on each item is noted next to the item price.

Shipping Fees

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$40.01 - $70.00	$6
$70.01 - $100.00	$7
$100.01 or more	$8

Pennsylvania
Wild Resource Conservation Program

Wild Resource Conservation Board

Advisory Committee

Keystone WILD! Notes

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717-787-3212
Website: **www.dcnr.state.pa.us/conservationscience/wrcp/index.htm**
Rebecca Bowen, Editor
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Do Something Wild!
Keystone Wild! Notes

Keystone Wild! Notes is the official online publication of the Pennsylvania Wild Resource Conservation Program. Its goal is to inform people about the activities of the program, which supports research and protection efforts for the state's natural heritage—its unique collection of native nongame animals and wild plants. The program is funded by the Pennsylvania Department of Conservation and Natural Resources and by public contributions: voluntary checkoffs on the state income tax return form, direct donations the purchase of the Wild Resource license plate. If you have comments about *Keystone WILD! Notes*, please send them to The Editor, Wild Resource Conservation Program, P.O. Box 8552, Harrisburg, PA 17105-8552, or e-mail to ra-wrcp@pa.gov. To subscribe, please go to **www.dcnr.state.pa.us/wrcp/wildnotes/subscribe.html** and enter your e-mail address.