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numbers decrease with canopy closure but increase with recent fire activity; and bee diversity rises as nesting opportunities (woody debris) increase. What this translates to is that bees are attracted to well-managed woodlands. Prescribed fire, timber management, encouraging natural vegetation, and leaving woody debris and snags are all part and parcel of a solid forest stewardship plan, and these management activities help bees.

Andrena erigeniae, a mining bee, collects pollen from the flower of a spring beauty. Photo by: Betty Truax, Virginia Native Plant Society.

Springtime in the forest is likely the busiest time for bees because of the abundance of spring ephemerals and flowering shrubs and trees. Virginia bluebell, Dutchman's breeches, viburnums, serviceberry, spring beauty, and a host of other spring flowering plants provide nectar and pollen to newly emerged bumblebee queens and pollen specialists. A poster child example of a native bee/host plant relationship is spring beauty and *Andrena erigeniae*, a pollen specialist in the mining bee family. *A. erigeniae* only collects pollen from spring beauty and one of its sister species, which means that if the plant does not exist in a particular area, then this bee cannot survive there. Many spring woodland plants are visited by pollen specialists with life cycles perfectly synced to coincide with their blooms. Phenological mismatch, brought on by climate change, can seriously threaten the stability of many of these sensitive bee species.

During other times of the year, research has shown that native bees are found in woodlands with open canopies and a healthy understory of wildflowers and grasses. Sunlight is important to bees and butterflies; it creates a warm micro-environment and encourages floral resources. Managing for habitat like this, whether you have a pine or hardwood forest, is probably already occurring if you have an active forest stewardship plan. Most landowners are already controlling the invasive species and managing deer populations that are impacting forest health and, subsequently, bee populations. If more guidance is desired, the U.S. Forest Service published a report in 2015, *Pollinator-Friendly Practices on Federal Lands*, that can be used as a guideline for private forest managers looking to improve habitat for bees. One important takeaway from the report is that as forest canopies have become closed over time (since colonization), bees have been negatively impacted, and the shift could be contributing to the widespread decline of their populations. It's just one more piece of the very complex puzzle of pollinator decline.

Keeping your woodlands healthy and practicing active management can improve habitat for native pollinators. Photos by Betty Truax, Virginia Native Plant Society.

From a landowner's perspective, managing for native bees is very compatible with other stewardship goals. Many other wildlife species benefit from the same management practices that help them, such as prescribed fire. Prescribed fire encourages growth of wildflowers and improves canopy structure, and if used correctly, can have a positive effect on bees. Using frequent, low intensity fire in small patches of forest has been shown to cause the least amount of mortality to bee populations while also improving floral resources. Since the vast majority of native bees nest in or near the ground, fire can have a negative impact on their survival rates. However, if prescribed fire is used thoughtfully, bees can actually flourish from its effects.

Native bees are still a mystery, in many regards, but we do know that respond to thoughtful forest management practices and healthy woodland habitat. Making room for native bees in your stewardship plan is quite easy, and your forestland will be better for it!

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VIRGINIA FOREST LANDOWNER UPDATE

VIRGINIA FOREST LANDOWNER EDUCATION

FALL 2018

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Department of Forest Resources & Environmental Conservation (0324)
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The most risky part of handling herbicide is not the spraying, but the mixing. This is the time when spills are most likely to happen and also when exposure to the product is highest. This takes us to understanding and obeying the herbicide law. This will be covered in detail in the Winter 2019 edition of the *Virginia Forest Landowner Update.*

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VIRGINIA FOREST LANDOWNER UPDATE

Events, news, and information promoting the stewardship of Virginia's forest resources.

VIRGINIA FOREST LANDOWNER EDUCATION PROGRAM

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Pollinators of the Forest

By: Celia Vuocolo, Piedmont Environmental Council

North America has over 4,000 bee species that call it home. From the tiny *Perdita minima* (at less than 2 millimeters) to the colorful blue and green *Augochloropsis anonyma*, our continent supports a wide diversity of native bees. About 400 bee species have been found in Virginia. Our native bees have evolved with local ecosystems over time, developing intricate relationships with the flora that fill our landscape. Native bees are found everywhere (in fields, gardens, overgrown hedgerows, woodlands, and along roadsides). They facilitate the reproduction of indigenous plants, which in turn supports wildlife and ecological functions that humans rely on. Research shows that native bees effectively pollinate many commercial crops like tomatoes, blueberries, and squash, sometimes even more effectively than non-native honey bees. Understanding how these valuable pollinators use our landscape can help guide conservation efforts and farming practices. But there is still much that is unknown about how native bees use Virginia's most common land use — forests!

When thinking about pollinator habitat, a sunny flower-filled garden is usually the first thing that comes to mind. Pollinators need nectar and pollen sources, nesting opportunities (dead trees, undisturbed ground), and sunlight. It's rare that a sunny flower garden fulfills all of these needs for every bee. In reality, a mosaic of diverse habitat types are needed to provide these features. Woodlands are part of the landscape and play an important role in supporting native bee populations. However, we haven't even scratched the surface on understanding how bees use forests. It's a subject that is in sore need of study.

Larval forms of pollinators, such as the spicebush swallowtail caterpillar, use spicebush, a woody forest species, to complete their lifecycles.
Photo by Betty Truax, Virginia Native Plant Society.

So bees are found in forests, but why are they there at all? Answering this question will improve our understanding of how bees use the habitat. There are likely a number of different reasons, such as pollen specialism, incidental occurrences, species with generalist habitat preferences, and forest disturbance. Pollen specialism and forest disturbance are arguably the main reasons why certain native bees use this habitat type. Specialist bees have evolved to collect pollen from either one host-plant family, genus, or sometimes only one species! These intimate relationships benefit both the bee and plant by allowing for pollination and foraging efficiency, but leave both susceptible to habitat degradation or alterations in flowering time. Forest disturbance, such as fire or timber management, opens up the tree canopy, allowing light in and encouraging the growth of herbaceous plant species that attract pollinators. Native bees that evolved with our eastern forests most likely learned to take advantage of forest disturbance events well before agriculture created open habitats across our landscape.

There are a few things that we do know about bees in forests that landowners can consider as part of their management plans. The highest bee diversity in Mid-Atlantic forests occurs in the spring; bee

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EVENTS CALENDAR			For the most complete listing of natural resource education events, visit the on-line events calendar at https://forestupdate.frec.vt.edu		
Contact	**Date**	**Location**	**Event**	**Time**	**Fee**
DCR	Oct., Nov., & Dec.	Virginia's State Parks	**A variety of events and activities** For a complete list, visit: www.dcr.virginia.gov/parks	Varies	Varies
MP	Year-round	State-wide	**Virginia Master Naturalist Volunteer basic training** www.virginiamasternaturalist.org/chapters.html	Varies	Varies
BW	Oct. 5	Buchanan Co.	**Buchanan Co. Fall Forestry & Wildlife Field Tour** The tour will begin with forestry and how markets can affect management. The remainder of the afternoon will be spent exploring the complexities of reintroducing a large charismatic mammal, the elk, to SW Virginia. Dinner should provide an excellent spot for elk viewing and great photo opportunities.	1:30 - 7:30	$45*/person, $80*/couple
NC	Oct. 12	Sussex Co.	**Sussex Co. Fall Forestry & Wildlife Field Tour** Eighty percent of the land in Sussex County is in commercial forestry. The main planted species in these forests is loblolly pine. Join us on this tour to learn how this important natural resource is managed in southeast Virginia.	8:30 - 5:00	$45*/person, $80*/couple
BEF	Oct. 18	Boyce	**Managing Invasive Plants in the Fall** Learn to identify and manage invasive plants in fall. You may bring securely bagged specimens for identification. We begin with an overview in the library and end with a walk for field identification and demonstration of techniques.	1 - 5:00	$25
AD/JF	Oct. 19	Fluvanna/ Goochland Co.	**Fluvanna/Goochland Co. Fall Forestry & Wildlife Field Tour** Join us in the heart of Virginia's Piedmont to explore the scenic and productive forests of these historic lands. We will see a variety of management tools for landowners to improve forest productivity, diversity, and habitat value. In addition, there will be plenty of fantastic scenery, food, and fellowship along the way.	8:30 - 5:00	$45*/person, $80*/couple
JMM	Oct. 21	Montpelier Station	**Working Woods Walk** Venture into the Montpelier Demonstration Forest on a hike with experts in forest conservation. Learn about conservation and cultivation strategies to generate mutual benefits to humans and nature.	2 - 4:00	$5
JG	Nov. 1 Nov. 2	Abingdon	**Preparing for Generation NEXT** In this 2-day workshop you will learn what steps are necessary to ensure your treasured woodlands stay INtact, IN family, and IN Forest when they are inherited by the next generation. Professional advisors and experienced landowners will be available to answer your questions on this important topic. Multi-generational family participation is strongly encouraged.	12:30 - 5:30; 9 - 4:00	$70* first two family members; $35* each additional family member
BEF	Nov. 27	Boyce	**Landscaping for Wildlife** Learn how to landscape strategically for the food and shelter wild animals need in each season. Also, government agency representatives will provide information about state and federal grants available to landowners establishing wildlife habitat.	7 - 8:30	$10
BEF	Dec. 8	Boyce	**Winter Tree ID and Potluck** Learn to identify common trees using winter characteristics such as bark, buds, and leaf scars. Potluck to follow workshop.	1 - 4:00	$10
VAFHP	Jan. 28 Jan. 29	Blacksburg	**27th Annual Forest Health Conference** Hear the latest on emerging pests, existing issues, and other forest ecology and health topics. Recertification credits offered for commercial pesticide applicators; CE credits offered for ISA and SAF members.	9 - 4:30 9 - 1:00	Varies
AD JG	Feb. 23	Culpeper Roanoke	**Woods & Wildlife Conferences** Join Virginia Cooperative Extension and partners in either Culpeper OR Roanoke (NEW!) for a full day of presentations and workshops geared towards helping both large and small acreage landowners become better stewards. Registration will open in December.	8:30 - 4:30	$45*/person; $80*/couple

*meals included

When Poison is Profitable
By: Adam Downing, Virginia Cooperative Extension

Poison…the word may conjure up images of skulls and crossbones or the old green Mr. Yuk faces of yesteryear. Poison, however, is much broader than this. Technically speaking, the sun is poison if our skin is exposed to it for too long; but in the right doses, it's a great source of Vitamin D. In the context of caring for your woods, poison can be a very good thing for the health of your forest. Let's shift away from using the word poison, which has a negative connotation, to a (perhaps) slightly less triggering word - pesticide.

Pesticides are a broad group of chemicals (natural or synthetic) that are used to control an alive something that is causing harm to a plant or animal; i.e., a pest. Types of pesticides include insecticides (for insects), herbicides (for plants), miticides (for mites), fungicides (for fungi), rodenticide (for rodents), and disinfectants, such as hand sanitizers, that we use to control bacteria on our hands. There are even products known as biocides (literally, killers of life) used in some types of factories. In the case of forestry, because we are primarily focused on either protecting trees from insects or killing certain plants (e.g., exotic invasives), we primarily use insecticides and herbicides. We will focus the remainder of this article on herbicides, as those are the most likely to be used by do-it-yourself woodland owners. Insecticides are more likely to be applied by professionals with specialized equipment.

Why would we want to kill certain plants in our woods? Don't we want a diverse ecosystem? Perhaps surprisingly, one reason to kill certain plants may actually be to increase diversity! Exotic invasive plants do not add to the overall diversity of a forest but instead out-compete native plants, reducing overall diversity. After I kill Japanese stiltgrass and privet bushes where I live, dozens of native plants have a chance to fill that space, improving habitat and overall forest health.

Another reason we might want to kill certain plants is to create more space for more desirable trees and/or create standing dead trees (snags) for wildlife. While we can accomplish this using mechanical tools, such as chainsaws, machetes, and other sharp-edged implements, mechanical control methods also come with a drawback. Mechanical control will most likely cause the injured tree to sprout. Most trees that grow in Virginia readily sprout from the stump or roots when cut or girdled. Sprouts can improve wildlife habitat because they provide browse, but they can also be problematic since they will eventually develop into new trees. This means you will need to regularly return to the site to treat them again. Or you can decide to kill them once and for all, using herbicides.

Risks

Are there risks associated with using herbicides? Certainly. One time I was spraying herbicide on weeds near a young tree I had planted the previous year. I ended up accidently spraying the young tree. That's called an off-target application. In this case, it was not an illegal application. And, fortunately, I only sprayed a few leaves that I immediately removed from the plant. Ta-da, young tree saved! A more serious example of off-target application is the use of an herbicide not approved for use on or near water to kill terrestrial plants on or near water. That is illegal and potentially damaging to the aquatic ecosystem.

Are critters at risk when we spray herbicides? Yes and no. Perhaps the biggest impact of herbicides on wildlife (assuming proper use) is when large acreages (such as a field or clearcut) are sprayed to kill all the plants in preparation for planting pine seedlings. The insects and wildlife that were feeding and living on those acres will experience a sudden and extreme change in habitat. It's not dissimilar to the impact that occurs when fire is used to keep warm season grasses in a field. Direct contact of herbicides on wildlife is fairly low risk. The chemistry of common forestry herbicides works on parts of a plant's physiology that are unique to that plant and not found in insects or wildlife.

Other factors influencing risk include scale (size of application) and frequency. Pine plantations are considered the most intensive forest management system. The rotation length (life cycle) of a pine plantation is generally 20-30 years. For pulpwood it may be as little as 10-15 years. In this intensive management system, the acreage would be broadcast sprayed (every square inch of land is treated) with an herbicide once or twice during the rotation. This is a large-scale application, but also very infrequent.

What about a more frequent, but smaller-scale, use of herbicides that is more applicable to the do-it-yourselfer? Such a scenario may involve spot treating individual plants instead of broadcast treating large acreages. One of my favorite things to do with herbicides is to kill tree-of-heaven. (I love trees… some of them, like this one, I love to kill – so that others I love have a chance.) I do this work for a few months every year. I may even do it every weekend, which is pretty frequent, right? The scale, however, is on the other end of the spectrum since I'm treating individual trees (spot treatment). Even for a patch of forest that is almost pure tree-of-heaven, the amount of herbicide applied per acre is very low. Furthermore, after a few years, there will be very few trees to treat and I'll be in a maintenance mode.

Another factor to consider in assessing risk is herbicide selectivity. Some herbicides are selective, while others are broad-spectrum. Selective herbicides are formulated to affect only certain types of plants. Triclopyr (the active ingredient in Garlon, Pathfinder II,

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and Remedy brands) is selective to woody plants and some broad-leaf weeds. Grasses, pines, and other monocot type plants (e.g., corn, banana, green briar, bamboo, daffodils, and more) are generally tolerant of the herbicide. Broad-spectrum herbicides, on the other hand, can kill a wide range of plants. Glyphosate (the active ingredient in Roundup, Rodeo, Accord brands) is a good example. This chemical can kill grasses, broad leaf herbaceous weeds, woody, and aquatic plants. Please note that it can kill. At low rates, it becomes selective. Recent research at Virginia Tech found that rates as low as 0.1% glyphosate can kill stiltgrass while most everything else is tolerant of this low concentration. Furthermore, the method of herbicide application will influence its selectivity.

Methods of Application

There are several different methods of herbicide application. Choosing the correct method can minimize the chance of off-target application and increase the chance of successful eradication of unwanted plants. One of my favorite methods of targeting applications is by using a simple piece of cardboard. By putting this between what you want to spray and what you don't, the application is more targeted. Recall the young tree I mistakenly sprayed…. I could have (should have) held a piece of cardboard against it while I sprayed the weeds; that way, the spray that landed on the tree would have been caught by the cardboard instead.

Another common application trick for woody plants is to apply the herbicide to a specific part of the plant; i.e., the sapwood. The sapwood contains most of a woody plant's active plumbing. This plumbing moves carbohydrates, water, and nutrients from the roots to the crown and vice versa. This same plumbing will carry herbicides throughout the woody plant. Spraying the leaves is one way to put herbicides into the plumbing, and is efficient for smaller plants, larger shrubs, and trees that can be very difficult to spray and may require a lot of herbicide.

So what are some more efficient ways to get herbicide into the sapwood? One way is to hack through the bark into the stem with a hatchet or machete. This creates a doorway into the sapwood into which you can squirt herbicide. This application method is called hack & squirt (yes, we foresters are that original). The number of hacks and squirts needed to kill a tree depends on the herbicide being used and size of the stem. Within a couple of weeks of application, you should see the tree begin to decline as the herbicide makes it way throughout the tree. Assuming the right chemical and timing were employed in the right manner, you should soon have a snag benefiting wildlife as well as more room for other plants.

As mentioned earlier, sometimes when you try to kill a tree by cutting it down, it sprouts right back. To prevent this sprouting, we can use the same basic principle just described to get the appropriate herbicide into the tree's plumbing. There are several herbicides that can be applied directly to a freshly cut stump. These will be transported through the sapwood into the root system, eventually killing it. You can spray the herbicide directly on the stump or apply it with a paintbrush. This is called a cut-stump application.

And a final method, basal bark application, can be used with certain herbicides that can be sprayed directly onto a stem. With the right kind of mix (usually an oil-based diluent), these will penetrate the bark to enter the sapwood. This application method is limited to trees with smooth bark and smaller stems. This method requires a bit more herbicide than the previous two, so a backpack sprayer is a good tool to have. This type of sprayer also leaves your hands free to move brush aside and assist with balance. Keep in mind, a 4 to 5 gallon backpack sprayer is pretty heavy when filled all the way up. But there is no mandate that you need to fill it all the way up. If you only have a small amount of work to do, mix only enough herbicide to get the job done. This will eliminate the need to store unused herbicide. Speaking of mixing….

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