Kentucky Woodlands Magazine

Volume 10 Issue 1

Northern Long-eared Bat

Logging Best Management Practices

Modern Genetics and Declining Forests

Kentucky Woodlands Magazine

Volume 10 Issue 1

Summer/Fall 2015

Promoting stewardship and sustainable management of Kentucky's family private forests.

In this Issue...

Editors's Note: We are also pursuing the use of SFI paper produced on SFI certified and American Tree Farm System certified land.

From the Editors of the Kentucky Woodlands Magazine:

This issue of the Magazine has a wider than usual range of topics. They were selected to give you an insight into emerging issues impacting forestry and woodland owners in the Commonwealth. Learn about GMO's (genetically modified organisms) which have turned into a worldwide agricultural controversy. The newly established Forest Health Research and Education Center (FHREC) housed at the University of Kentucky has the ability to work on forest genetics including using GMOs. The article by Ellen Crocker, with FHREC, outlines the basics of this technology. There are an increasing number of federally protected mussels in Kentucky. Dr. Wendell Haag, leading mussel researcher for the US Forest Service introduces you to our threatened and endangered mussels. The implementation of BMPs remains a source of concern for woodland owners. The article on KYs forestry best management practices provides information on how woodland owner's needs may differ from loggers. We also have our usual departments on champion trees, certification, News to Use and Research in Brief. We hope you enjoy this issue and recognize the upcoming importance of the topics it contains.

Jeff Stringer,
University of Kentucky
Department of Forestry
stringer@uky.edu

Diana Olszowy,
Kentucky Division of Forestry
diana.olszowy@ky.gov

About the Cover:

The cover photograph was provided by Aaron Stringer (www.aaronstringer.com) and was taken in the Clifty Wilderness Area of the Daniel Boone National Forest which is a rugged and undeveloped area designated as wilderness by Congress in 1985. While woodlands provide many benefits, including wilderness, it could be argued that water may be one of the most important. To learn more about water and woodlands visit http://www2.ca.uky.edu/forestryextension/publications_BMPS.php.

Several surrounding Police Departments competed in lumberjack games at the 2013 Kentucky Wood Expo.

Photo courtesy: Renee' Williams

Managing Editors:

Jeff Stringer
Cooperative Extension Service
University of Kentucky
Department of Forestry

Diana Olszowy
Kentucky Division of Forestry

Associate Editor:
Billy Thomas
Cooperative Extension Service
University of Kentucky
Department of Forestry

Assistant Editor,
Advertising & Graphic Designer:
Reneé Williams
Cooperative Extension Service
University of Kentucky
Department of Forestry

Proofreading and Web Support:
University of Kentucky
Agricultural Communications Service

Volume 10 Issue 1
Kentucky Woodlands Magazine (ISSN 2152-2391) is published under the direction of the University of Kentucky's Department of Forestry Extension and the Kentucky Division of Forestry and is sponsored by the Kentucky Forest Stewardship Coordinating Committee. Kentucky Woodlands Magazine is supported by funds from the Kentucky Forest Stewardship Program, U.S. Forest Service, Renewable Resources Extension Act, and the Cooperative Extension Services. Views and opinions expressed in the Kentucky Woodlands Magazine do not necessarily represent the opinions of its editors, the UK Department of Forestry or the Division of Forestry. The appearance of a logo, organization, manufacturer or product within the magazine does not constitute an endorsement by the editors, the University of Kentucky Department of Forestry or the Kentucky Division of Forestry.

Change of Address and Other Magazine Business:
Forestry Extension Office,
Department of Forestry,
University of Kentucky,
216 Thomas Poe Cooper Bldg.,
Lexington, KY 40546-0073
859.257.7597
E-mail: *billy.thomas@uky.edu*
www.ukforestry.org

Duplicate mailings:
For duplicate mailings, please send both mailing labels to the address above.

Forestry Extension Office
Department of Forestry
216 Thomas Poe Cooper Bldg.
Lexington, KY 40546-0073
859.257.7597
www.ukforestry.org

Kentucky
Division of Forestry
627 Comanche Trail
Frankfort, KY 40601
502.564.4496
http://forestry.ky.gov

Editor's Note: Kentucky Woodlands Magazine is committed to responsible woodland management. This magazine is printed on FSC® certified paper.

Kentucky's Woodland Owners and Logging Best Management Practices

by Jeff Stringer

When the phrase best management practices (BMPs) is used in forestry it refers to a set of practices implemented during forest operations (logging, tree planting, and pesticide use) to eliminate or reduce the potential for water pollution. Kentucky's forestry BMPs are comprised of practices used to control mud, logging debris, and trash from entering streams and to maintain trees around streams for shade.

Kentucky also has laws for landowners and loggers (see page 2) that require use of a designated set of "minimum criteria" for BMP use in forestry and agriculture. Landowners are required to ensure the BMP minimum criteria are used on their property, and the Kentucky Division of Forestry (KDF) inspects commercial logging operations for proper use of the minimum criteria. Typically loggers implement the BMP minimum criteria in the most cost-effective manner. The minimum criteria are designed to help prevent or reduce pollutants. However, implementing them in the most cost-effective manner for temporary logging operations may not meet the long-term needs of woodland owners. This discrepancy can cause problems between loggers and woodland owners. This is an important issue and is discussed with loggers during the Kentucky Master Logger program. Woodland owners should also discuss BMP issues during timber sale negotiations. The following represents some of the typical issues that arise between loggers using the minimum criteria and woodland owners conducting long-term management.

Rutting

Generally rutting is a bad thing. It is also recognized that in Kentucky we must keep the wood industry running even during the winter when conditions are conducive to rutting. Because of this situation the BMP minimum criteria allows ruts to be generated as long as they can be fixed with available equipment. Is this good or bad? It depends. If the rutting occurs on roads or trails that will remain open after the harvest, then some rutting is not necessarily a problem as roads and trails are not productive woodland soils. It is a much bigger issue if rutting occurs off of roads or trails. This means that productive ground is being disturbed, compacted, and damaged even if ruts are filled. Rutting off of main roads and trails should be avoided.

Stream and Channel Crossings

The BMP minimum criteria requires the use of bridges or culverts (or other elevated crossings) to cross streams and channels where feasible. Feasibility includes economic and topographic limits. Loggers typically, and for good reason, develop crossings that are temporary and meet their equipment requirements (Figure 1). As a woodland owner you may want a more permanent crossing that will last and be easy to maintain. If you want permanent crossings installed you should be willing to pay the logger to install them or have the logger install a crossing that you can beef up yourself. For example, a logger may use a hollow log, but you might want a culvert. If the logger uses a culvert you may want it bigger, or you may want to use something like double-walled plastic pipe instead of corrugated steel to make it self-cleaning. Modifications such as these take time and money not normally needed for a harvest. The woodland owner should be prepared to take monetary responsibility for improvements and should discuss their requirements, the time involved, and the cost prior to harvest.

Photos courtesy: Jeff Stringer

Figure 1. A skidder bridge that is temporary and will be removed after logging.

Road and Trail Water Control Structures

When logging is finished the minimum criteria requires that skid trails and roads are resurfaced, water is allowed to drain, and water control structures are put in place to prevent erosion. No one disputes resurfacing (removing the ruts) and drainage, but some water control structures that loggers construct may not be useful to you. One of the most common and effective water control structures is a water bar (Figure 2). They are designed to be constructed on trails and roads that will be retired from use and are unpassable. If you want to continue to access the roads or trails, discuss this

Figure 2. Typical water bars constructed by loggers. They work efficiently to control water but are not passable.

with the logger prior to agreeing on the sale. You want water control structures; however the types that you need installed should be appropriate for your use (Figure 3).

Photos courtesy: Jeff Stringer

Figure 3. A water control structure specifically designed for landowner use.

Debris

All logging operations generate debris (unmerchantable parts of the tree). BMP minimum criteria requires that streams and channels must be devoid of logging debris when the harvest is finished. Other than that, anything goes. Large piles of "cut offs" can be left at the log deck. These can be good for some wildlife but can also be a nuisance. Tree tops resulting from felling are typically left in place. This practice is good from a nutrient standpoint, but they can be a wildfire hazard and if in an area of high visibility they can be unsightly. If leaving the tops in place is a concern the logger, can conduct a slash treatment that places the tops in contact with the ground. However, this treatment costs money. If the logger is skidding tree length back to the landing, the tops are usually wind-rowed along skid trails. This practice can facilitate tree planting; however if you want them scattered throughout the woods it will add time and cost to the logging operation.

Seeding

Logging roads, trails, and log decks that can erode and/or contribute to muddy water runoff entering streams must be reseeded. The BMP minimum criteria requires revegetation. However, the enforcement of the minimum requirement only ensures reseeding at the time the logger leaves the site. Revegetation requires that the woodland owner restrict traffic on retired areas and that Mother Nature cooperates. Also, certain species are recommended for revegetation, but the BMP minimum criteria does not specify their use. If you want specific ground covers, discuss it, and don't expect loggers to establish specialty covers like warm season grasses or food plots (Figure 4).

Figure 4. An exceptional job of revegetation using fertilizer and lime, not commonly used by loggers.

Issues Not Covered by BMPs

A number of issues that should be of concern to woodland owners that are not addressed in the BMPs, includes damage to standing residual trees, number of skid trails, aesthetics, taking more or less timber than was agreed upon, and other non-water quality issues. All of these issues, water quality related or not, are very important for long-term woodland health and your use of the woodlands. Understanding how the BMPs work and the difference between your objectives and the BMP minimum criteria and getting professional assistance from a consulting or industry forester can help reduce tension during a logging operation on your property.

It cannot be over emphasized that these issues need to be addressed in timber sale negotiations. Waiting to discuss these issues after the timber harvest has been started can be unfair to the logger and unsatisfying for the woodland owner.

Kentucky's Forestry BMP Laws and Publications

Kentucky's Agriculture Water Quality Act (AWQA) of 1994 requires landowners possessing 10 or more contiguous acres that are engaged in silviculture (forestry) or agriculture (farming) to have a written water quality plan. The plan specifies the minimum criteria for BMPs that need to be used on the property and landowners are required to ensure that they are used. In 1998 the Kentucky Forest Conservation Act was signed into law requiring commercial logging firms be inspected by the KDF for use of the AWQA BMP minimum criteria. These two laws produce a situation where the landowner is required to make sure that the BMP minimum requirements are completed on their property and that loggers use these BMPs when conducting operations. Go to www.ukforestry.org and click on Publications and BMPs for the following resources:

FOR 67 Kentucky Forest Practice Guidelines for Water Quality Management

FOR 96 - Forestry Water Quality Plan: Preparing an Agriculture Water Quality for Your Woodlands

FORFS 00-05 - Kentucky Forest Conservation Act: Landowner Questions and Answers

FORFS 00-06 - How Logging Inspections Work

About the Author:

Jeff Stringer, *Ph.D., is an extension professor at the University of Kentucky and is responsible for continuing education and research in hardwood silviculture and forest operations. He is also an editor of the Kentucky Woodlands Magazine. The author thanks those providing peer review of this article.*

Cooperative Extension Service, Department of Forestry, University of Kentucky, 201 Thomas Poe Cooper Building, Lexington, KY 40546-0073; Phone: 859.257.5994; Fax: 859.323.1031; E-mail: stringer@uky.edu

Kentucky Master Woodland Stewards Program

Photos courtesy: Billy Thomas

by Billy Thomas

The first class of Kentucky Master Woodland Stewards at Robinson Forest pause for a picture along with instructors from the Kentucky Division of Forestry and UK Forestry Extension.

Neighbors helping neighbors is a great way to explain the Kentucky Master Woodland Stewards Program recently launched by UK Forestry Extension in close partnership with the Kentucky Division of Forestry. The goals of this new program are focused on cultivating a group of people who embrace woodland stewardship, want to learn more about sustainable woodland management, and are willing to share what they learn with others. The rationale behind this program is that too few woodland owners are managing their woodlands and most are unaware of the wide variety of support available to them. In addition, a very limited number of foresters and other natural resource professionals are available to serve the estimated 450,000+ Kentucky woodland owners, and peer-to-peer learning has proven effective especially with a group of highly motivated individuals who want to make an impact. The Kentucky Master Woodland Stewards program teaches woodland management practices and skills and in return participants agree to apply these principles to property they own or manage and to actively encourage others to practice sustainable woodland management.

On June 12, 2015, more than twenty woodland enthusiasts descended on UK's Robinson Forest in eastern Kentucky for a multi-day intensive training on a wide variety of forestry practices that can be implemented in Kentucky's woodlands. The training workshop emphasized woodland management practices that have proven successful. In addition to visiting several woodland management demonstration areas, the Kentucky Master Woodland Stewards attended lectures, contributed to team activities, and participated in hands-on learning opportunities. Equally as important as the technical woodland management practices covered during the workshop is knowing who can help, what they can do, and how to work with them to get additional assistance. To facilitate these connections Kentucky Master Woodland Stewards were introduced to the more than twenty forestry and natural resources organizations and programs that are available to assist Kentucky's woodland owners. Not only do we want Kentucky Master Woodland Stewards to have a firm technical understanding of woodland management practices, we also want to empower them so they can return to their local communities to serve as ambassadors for sustainable woodland management across the Commonwealth. The program will help Kentucky Master Woodland Stewards see the potential in their woodland and others' and prepare them to recommend appropriate professional assistance and resources available to Kentucky's woodland owners so they can better manage their properties.

The Kentucky Master Woodland Stewards have already begun seeking opportunities to make a positive difference on woodland management in their communities. We believe that these Kentucky Master Woodland Stewards have the potential to become an invaluable resource for fellow woodland owners. We are planning to host another training workshop next year and look forward to meeting and working with the Class of 2016 Kentucky Master Woodland Stewards. For information about the program and to connect with some of the Class of 2015 Kentucky Master Woodland Stewards please visit www.kentuckywoodlandstewards.org.

Kentucky Master Woodland Stewards attended lectures, participated in training exercises, and experienced several demonstrations including this one where Dr. Jeff Stringer was instructing them how to evaluate log quality.

About the Author:

Billy Thomas, *Extension Associate with the University of Kentucky Department of Forestry works primarily on non-industrial private forest issues and is the associate editor for the Kentucky Woodlands Magazine.*

Cooperative Extension Service, Department of Forestry, University of Kentucky, 213 Thomas Poe Cooper Building, Lexington, KY 40526; E-mail: billy.thomas@uky.edu; Phone: 859.257.9153; Fax: 859.323.1031.

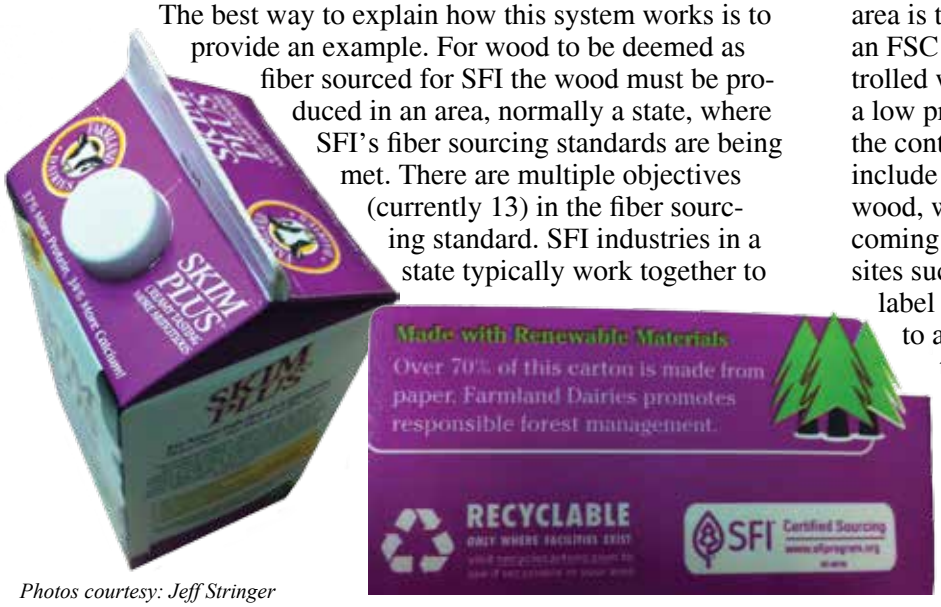
Part 3
Controlled Wood and Fiber Sourced Wood

by Jeff Stringer

A significant percentage of certified wood products are sold with a mixed label, meaning that not all of the wood in the product is wood from a certified forest. Part 2 of this series discussed how the mixed label system works. An important aspect of the mixed label is the criteria for the uncertified wood that goes into these products. Part 3 of this series explains what these criteria are and how companies obtain the non-certified wood that meets these criteria.

Mixed label wood products are manufactured using both certified and uncertified wood. However, not just any uncertified wood can be used to produce a mixed label product. In the case of the Sustainable Forest Initiative (SFI), wood that is designated as meeting the fiber sourcing standard must be used.[1] For Forest Stewardship Council (FSC), "controlled wood" must be used.[1] These terms controlled wood and fiber sourcing are specific to FSC and SFI. They are two distinct systems, but the idea behind controlled wood and fiber sourced wood is similar. In simple terms it means that the uncertified wood that is used to produce a mixed label product must come from an area (state or region) where forest and land use practices meet the controlled wood and fiber sourcing standards for FSC and SFI, respectively.

The best way to explain how this system works is to provide an example. For wood to be deemed as fiber sourced for SFI the wood must be produced in an area, normally a state, where SFI's fiber sourcing standards are being met. There are multiple objectives (currently 13) in the fiber sourcing standard. SFI industries in a state typically work together to help ensure that their state meets the objectives. This effort includes helping foster logger and landowner education, facilitate the use of forestry best management practices to protect water quality, promote forest management among landowners, conserve special areas, and a host of other related issued.



Photos courtesy: Jeff Stringer

This paper carton has a Sustainable Forestry Initiative (SFI) Certified Sourcing label indicating that all of the fiber that was used to manufacture the carton was procured from a state or region meeting the SFI's Fiber Sourcing standards or was recycled.

SFI certificate holders producing a mixed label product must obtain wood that is from an area meeting the fiber sourcing standard. These certificate holders also must ensure that they avoid stolen or controversial sources of wood. SFI industries are independently audited to ensure that they are meeting these standards and that the wood they are procuring is coming from the areas that are designated as meeting the fiber sourcing standards. It is common for the majority of important timber states to meet fiber sourcing standards and therefore a significant percentage of the wood harvested in the U.S. is considered fiber sourced.

FSC's controlled wood system works in a similar geographic manner. In this case FSC has a set of controlled wood standards that a region, normally the area that an industry is procuring wood from (this could be multiple states), meets the controlled wood standards. If it is found to meet these standards then the wood procured from this area is termed controlled wood and it can be used to make an FSC mixed label product. For an area to meet the controlled wood standard it must be evaluated to see if there is a low probability that wood coming from that area violates the controlled wood standards (currently 5). Examples include there being a low probability of illegally harvested wood, wood from genetically modified trees, or wood coming from harvesting where the degradation of special sites such as old growth would wind up in FSC mixed label products. The controlled wood standard also aims to avoid wood coming from areas where violations of traditional and civil rights are common or there is an overall loss of forest area in the region. As is the case with SFI industries, industries with FSC chain of custody certificates get independently audited to make sure that the controlled wood designation for an area is correct and all wood they are claiming comes from a controlled wood designated area is coming from that area. They also avoid any sources of wood that is known to not meet FSC standards. Similar to SFI's fiber sourcing

[1] Recycled fiber can also be used in both SFI or FSC mixed products.

Sources of Wood in Labelled Product	Common Certified End Product Labels
100% from a state/region meeting SFI Fiber Sourcing Standards or is recycled fiber.	SUSTAINABLE FORESTRY INITIATIVE Certified Sourcing www.sfiprogram.org
At least 70% is, or represents wood from, American Tree Farm System or SFI certified forests. The remainder is from a state/region meeting Fiber Sourcing Standards or is recycled fiber.	SUSTAINABLE FORESTRY INITIATIVE Certified Chain of Custody Promoting Sustainable Forestry www.sfiprogram.org
At least 70% is, or represents wood from, FSC Certified Forest. The remainder from a region meeting Controlled Wood Standards or is recycled fiber.	FSC www.fsc.org MIX Wood from responsible sources FSC® XXXXXXX
100% of the fiber (wood) in the product came from an FSC certified forest.	FSC www.fsc.org 100% Wood from well-managed forests FSC® XXXXXXX

system, a large portion of the U.S. meets FSC's controlled wood standard. In both instances these programs and designations are going on without landowners knowing about it since it does not directly deal with individual forests but rather a designation for an entire region.

There is no final wood product labelled as FSC controlled wood. It is simply wood that is used to make an FSC mixed label product. It can be bought and sold, meaning an FSC certified industry that procures controlled wood can sell this wood or fiber as controlled wood to an industry that is making an FSC mixed label product. SFI is different in this regards. Like FSC, SFI industries can buy and sell fiber sourced wood. However, unlike FSC, SFI companies can market a product that indicates that it is composed of fiber sourced material. These products carry a SFI Certified Sourcing label. The certified sourced label on a product means that the wood that was used to make the product came from a state (or region) that is meeting the SFI fiber sourcing standards. Independent auditing assures this. It is very common to see the SFI certified sourcing label on products as there is a large portion of the U.S. that meets the fiber sourcing standard (as discussed above) and thus a large volume of wood is available that can carry the Certified Sourcing label. This label means that the wood in the product, although not necessarily coming from a certified forest, is coming from a region of the country where SFI deems that good forest practices are being fostered and good forest management is occurring. As indicated above FSC does not have a label for a controlled wood product.

This paper drinking cup has a Forest Stewardship Council (FSC) Mix label indicating that at least 70 percent of paper content represents wood from an FSC certified forest with the remainder comprised of FSC Controlled Wood or recycled paper.

Photo courtesy: Jeff Stringer

The important point in the case of both SFI and FSC is that they can say they know where their wood is coming from and that area meets their fiber sourcing or controlled wood standards. This issue is not trivial. Wood is sold and moved internationally and in some instances there can be significant amounts of illegally logged wood and wood that comes from countries where little is being done to protect the environment and take care of social ills. The fiber sourcing and controlled wood systems help ensure that these sources of wood do not enter SFI or FSC labeled products. Also the controlled wood and fiber sourced wood systems were designed to indicate that wood going into a product with an FSC or SFI label meets certain broad standards of sustainability. Ultimately the standards help ensure the integrity of the FSC or SFI mixed label.

About the Author:
Jeff Stringer, *Ph.D., is an extension professor at the University of Kentucky and is responsible for continuing education and research in hardwood silviculture and forest operations. He is also an editor of the Kentucky Woodlands Magazine.* *The authors thanks those providing peer review of this article.*

Cooperative Extension Service, Department of Forestry, University of Kentucky, 201 Thomas Poe Cooper Building, Lexington, KY 40546-0073; Phone: 859.257.5994; Fax: 859.323.1031; E-mail: stringer@uky.edu

Editor's Note – Transgenic technology allows genes from one organism to be placed into another to produce Genetically Modified Organisms (GMOs). One potential use of this technology is breeding forest trees to help them fight the exotic insects and diseases. However, as many are aware, the use of GMOs is highly controversial and there is worldwide concern over their safety to humans and the environment. The issue of GMO forest trees is particularly relevant to Kentucky as the newly established Forest Health Research and Education Center housed at the University of Kentucky was developed to work directly on forest health issues with a focus on genetics. As a concerned woodland owner you will be called upon to voice your opinion on the issue of using transgenic technology for forest protection and restoration. Ellen Crocker, post-doctoral scholar with the Forest Health Center and UK Forestry Extension, was requested by the Kentucky Woodland Magazine editors to provide all of us a sound background on this technology, enabling us to develop an informed opinion on it and its place in forest protection and restoration.

Photo courtesy: Paul Williams

The health of our forests is under attack. Invasive insects and diseases are increasingly prevalent in North American forests and can cause devastation, as seen below. How can we better defend our forests?

Decline of our Forests and Trees - Can Modern Genetics Provide a Solution?

by Ellen Crocker

As a society, it is our responsibility to decide what to do about the problems we have caused in our woodlands. If we want to protect native tree species from exotic insects and diseases, we will require solutions above and beyond traditional approaches. Modern scientific methods, including the use of transgenic technologies to create genetically modified (GM) trees, are being explored to deal with these problems. GM techniques have been met with resistance in agriculture and, in thinking about their potential use in forests and woodlands, there are many factors to consider. Should we allow GM trees at all? What if transgenic technology can help save some of our ecologically and financially important tree species or aid forest restoration? How about studying GM trees in the lab to breed better non-GM trees?

Science can provide solutions, but whether we use them is up to us. To make good decisions about which GM trees we should and shouldn't use, we first need to sort through the blind claims and profit-driven arguments to have a clearer picture of the risks and benefits associated with using genetic technologies in forestry. This series explores these topics and invites you to think for yourself about the future of our forests.

Threats on our doorstep

Our forests and woodlands are changing rapidly. But then again they have never been static, particularly when people get involved. We have been actively changing eastern North American forests for thousands of years, removing or adding tree species and determining where forests and woodlands occur. These changes are often positive. For example, by focusing on sustainable woodland management we can make our woods more healthy and productive.

People have been managing forests for many years, including these workers in the 1930s harvesting trees using donkeys.

Photo courtesy: USDA Forest Service Southern Research Station Archive, Bugwood.org

However, our forests and woodlands are increasingly facing threats that they have never encountered before and

that they might not be able to cope with. Human introductions of destructive invasive diseases and insects have decimated several tree species considered central to eastern forests. For example, American chestnut once dominated our forests, driving our local lumber economies and providing habitat and food for many animals. However, since the introduction of Asian chestnut blight in the early 1900s, American chestnut trees have been nearly eradicated.

Through the unintentional transport of contaminated plants and woody material, we have released a Pandora's box of enemies attacking our trees. American chestnut is not the only giant to fall victim to our mistakes. American elms have mostly disappeared due to Dutch elm disease. On the west coast, an invasive disease is causing the epidemic sudden oak death, resulting in millions of dead oak and tanoak trees. Meanwhile, emerald ash borers, native to Asia, have killed ash trees throughout the region and are currently decimating Kentucky's ash trees. European gypsy moth, Asian longhorned beetle, oak wilt, thousand cankers disease ... the list goes on and on, and the rate of new threats reaching our forests is only increasing as the world becomes more and more globally connected.

Many of the most destructive forest diseases and insects are invasive, unintentionally introduced to North America from other parts of the world. Increased worldwide transport (cargo ships, above, filled with shipping containers, right, and wooden packaging material) has facilitated this.

Photos courtesy: Larry R. Barber, USDA Forest Service, Bugwood.org

Photo courtesy: Ned Tisserat, Colorado State University, Bugwood.org

Thousand cankers diseases (above) and sudden oak death (right) are two of the diseases that could be devastating if they appear in Kentucky.

Photo courtesy: Bruce Moltzan, USDA Forest Service, Bugwood.org

How can we fight these threats and defend our forests and woodlands? In some cases, we need to protect the trees we have from oncoming threats. In others we need to make the hard decision of whether to develop and reintroduce disease-resistant versions of eradicated trees or accept their loss, allowing them to live on only as a shadow of their former glory in selected preserves, managed gardens and our memories.

Building a stronger forest

While immediate threats can be met with pesticides, they also are expensive and can have non-target effects. Pesticides are useful for a variety of forest and woodland health issues, but only offer a short-term fix and then must be continually reapplied.

Regulatory programs aimed at preventing the spread of potential diseases and pests, both on our shores and within the United States, may reduce or slow down their arrival. However, the current programs clearly have been unsuccessful in a number of cases. In the long run these approaches are unlikely to provide complete protection as just one introduction is needed to result in new epidemic level devastation.

Breeding resistance is a better, more long-term, and sustainable means of giving trees the leg up they need to maintain or regain their natural role in our forests and woodlands. Breeding can defend against particular insects and diseases when traditional control techniques are ineffective. Conventional tree-breeding programs take time,

Vocabulary:

- ***Cisgenic plants:*** GM plants that have genes inserted into them from a different individual of the same (or a closely related) species.
- ***Conventional (classic) plant breeding:*** Intentional and repeated crossing of different plants (of the same or closely related species) followed by careful selection for desired traits.
- ***Genes:*** Regions of DNA that carry the information for inherited traits. They provide the recipe for proteins that make organisms (plants or animals) work.
- ***Genetic modification/ genetic engineering/GM:*** Any intentional changes to an organism's genetic material using molecular biology. These changes include the mutation, insertion, deletion, or alteration of genes.
- ***Hybrid tree:*** A tree that is the offspring of two different tree species.
- ***Molecular biology:*** A scientific field focused on understanding the molecular basis of biology, genetics and biochemistry, especially involving the interactions of DNA, RNA, and proteins.
- ***Rapid cycle breeding:*** Using plants that develop more rapidly to accelerate the pace of plant breeding, especially useful for slow-developing trees. Can be developed using GM technology or conventional breeding.
- ***Subgenic plants:*** GM plants that have had genes deleted from their genome.
- ***Transgenic plants:*** GM plants that have had genes from another species inserted into their genome.

In some cases, chemical treatments are available for invasive pathogens and insects (such as the soil drench, above, and injections, right). However, these can be costly and time consuming and are typically not feasible on a landscape level.

Photo courtesy: David Cappaert, Michigan State University, Bugwood.org

much longer than breeding programs for agriculture, but there are new techniques using GM technologies that can speed up the process. Regardless, the development of resistant trees may be the best long-term solution for several of our trees species under attack.

Photo courtesy: GRSM Resource Mgmt. Archive, USDI National Park Service, Bugwood.org

Searching for resistance

Any breeding approach starts by looking for particular traits, for example, trees naturally resistant to a particular disease or insect. However, in the case of American chestnut and others, researchers have found little resistance in our native populations. Because of this, several organizations have worked to breed hybrid chestnuts between the American species and a Chinese species resistant to the disease. This process is called conventional tree breeding, where a resistant tree (in this case Chinese chestnut) is bred with a susceptible tree (in this case American chestnut). The goal is that, after many generations of breeding, you will get a tree that has the resistance from one parent but all the other characteristics of the other parent. In this case, trees that look and grow just like an American chestnut but have the resistance of the Chinese chestnut.

While this seems straightforward, the reality is that conventional breeding in trees takes many, many years. First, you have to see which hybrids are resistant, which can take a long time as trees develop slowly and in some cases do not express symptoms of disease until they are more mature. Then this slow breeding and selection process must be repeated again and again so that the resulting tree has the characteristics of the susceptible native without tag-along traits.

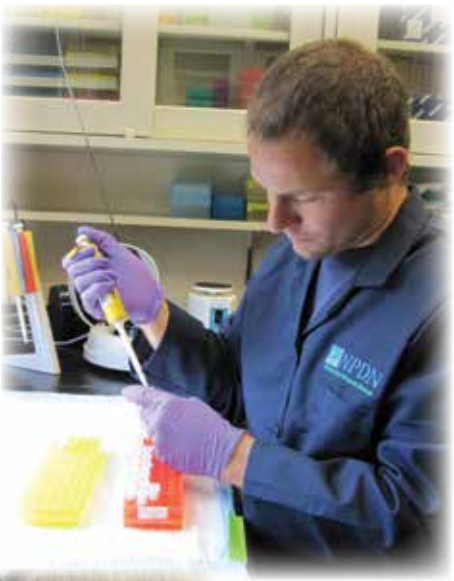
Depending on how well that works, you are still left with a hybrid tree, in this case a mix of American and Chinese chestnut. In the meantime, forests are not standing still, waiting for the return of the American chestnut. New species, including many invasives, are taking their place in forests and woodlands. The more time that passes the harder it will be for American chestnut to regain an ecologically significant role.

Using the genetic toolbox

In recent years, advances in molecular biology have opened up a whole new world of possibility in tree breeding. New technology is giving us a bigger and better toolbox to fight tree diseases and insect pests and keep pace with incoming threats.

Our increasing understanding of genetics presents many different possibilities when it comes to tree breeding. In the past we selected resistant trees somewhat blindly, waiting to see whether symptoms developed and hoping that their absence represented a genetic superiority over susceptible individuals that would be inherited by future generations. Now we can specifically look for the genetic components of resistance, enabling faster and more precise breeding.

Perhaps the most well-known—and most controversial—application of new molecular techniques is the direct changing of genetic information, either by adding, removing, or moving around genes. While everyone has heard of "genetically modified," or "GM," plants, most people envision them in the context of agricultural systems where they are used extensively. While tree plantations may be somewhat similar to a farm, forests and woodlands are different and require different types of GM approaches. For example, the trees must be self-propagating, diverse, and provide a slew of other ecosystems services, not just fill a narrow niche for our uses alone.



As with any new technology, there

Scientists have used conventional breeding approaches to develop more resilient plants for many years. Now, new technologies are enabling researchers to even better understand tree genetics and defenses.

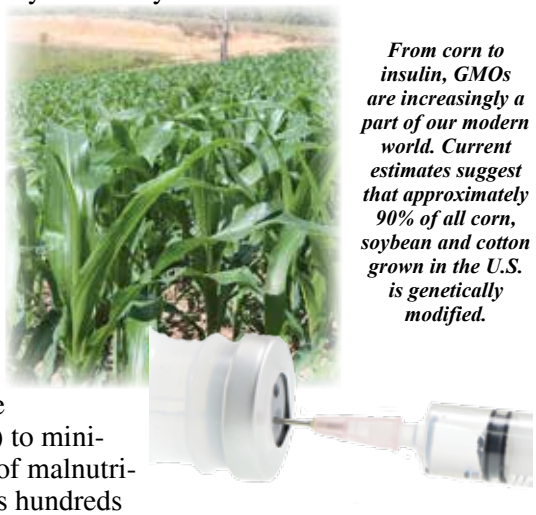
Photos courtesy: Rachel McCarthy, Cornell University - NEPDN, Bugwood.org

is plenty of confusion and misinformation regarding GM plants, especially with trees. On the one hand, unintended side-effects are possible from the use of GM trees. On the other hand, many tree species are in jeopardy because of human actions and we need to develop better solutions to maintain our strong native forests. GM forest trees are still years away from potential widespread use here, but before then, it's important to understand the science behind them and to develop informed views on their use.

What does genetically modified mean?

Any organism whose genetic material has been altered by modern genetic engineering techniques is considered a genetically modified organism (GMO). While this may sound simple, it actually includes a wide range of different motivations and approaches. Take a look at a few example GMOs:

- Bacteria modified to produce insulin, developed in 1978 by the biotech company Genentech
- Genetically modified mice for lab research to provide insight into human cancer and other diseases, first developed in 1984 by university researchers
- Corn and soybeans modified to be resistant to herbicides, first developed by the company Monsanto in 1995
- Vitamin A enriched rice (golden rice) to minimize a type of malnutrition that kills hundreds of thousands of children each year, first reported in 2000 by Swiss researchers at federal and university institutes
- Eucalyptus trees modified to tolerate cold weather and for plantations in North America, currently under development by a mix of tree biotech, pulp and paper firms
- American chestnuts modified to be resistant to Chestnut blight, recently developed by university researchers and a non-profit organization (American Chestnut Foundation) collaboration



From corn to insulin, GMOs are increasingly a part of our modern world. Current estimates suggest that approximately 90% of all corn, soybean and cotton grown in the U.S. is genetically modified.

Reading this list, you might have different reactions to different GMOs. Are these reactions based on their use, the type of organism being modified, the reason for their development or who developed (and is benefiting from) them? Since GM refers to a technology that can be used in many different ways, you might approve of some and not others. To help break this down further, let's focus on several particular aspects of GM development and purpose.

Genetic information used in GM plants can come from a wide variety of different sources. On the one hand, we now have the technology to move specific genes around between different individuals of the same tree species. For example, defense genes can be moved from resistant trees to susceptible trees, protecting them from infection. This type of GM plant, called "cisgenic," only has genetic information added from another of the same (or of a closely related) species. The same end effect could be reached with traditional breeding, but GM technology allows scientists to work much faster and more precisely.

On the other hand, genetic information might be brought in from a more distantly related species, referred to as "transgenic." This is the type of technology most commonly used to create herbicide- and insect-resistant agricultural crops by taking bacterial genes for those traits and putting them in plants. The use of transgenic technology to produce GMOs, of course, has raised public concern. But before this issue can be discussed rationally as it relates to forests and woodlands, it is important to know how scientists might utilize these technologies in tree-breeding programs.

GM tree motivation: from research to restoration

People want to use GM technology to breed forest trees for many different reasons. For the most part, they fall under

How Plants are Genetically Modified

How are plants genetically modified? In most GMOs, genes are either changed (mutations), added (insertions), or removed (deletions).

Mutations: Many different substances and conditions can increase the number of mutations in genetic information. These mutations usually have a random effect, making them more useful for learning about the genetic basis of traits, than field application.

Insertions: Most GM plants have a gene added. This change can be done many different ways, for example:

- "Gene guns" can physically shoot particular genes into plant cells. Sometimes, the plant then will incorporate the genes into its DNA, however it is relatively inefficient and non-targeted (the gene could wind up anywhere in the genome).
- Some bacteria and viruses have natural equipment that let them insert genes into plants, and this ability can be used to transfer the desired genes.

Deletions: Newer technologies enable targeted gene removals and replacements.

- Genome editing is a broad type of genetic modification that uses artificially engineered nucleases ("molecular scissors" that snip DNA precisely) to create breaks at specified parts of the genome and cut or add new genes.

the following major goals: research testing, improved harvested yield and forest restoration.

In highly controlled lab or greenhouse environments, GM trees can give us insight into key mechanisms that then might be applied in a broader context. One example is by developing test trees that mature more rapidly. Normally, trees take a long time (5-7 years) to mature, which makes finding and selecting particular traits a slow process. However, by modifying—for example—the genes that control flowering time, GM trees can mature much more rapidly. After, the modified DNA can be removed from the offspring trees, producing a native tree without the DNA alteration that led to early flowering in the parents. Referred to as "rapid cycle breeding," these fast-developing GM trees can be used to speed up our discoveries and let researchers know whether they are on the right track without introducing GM plants to the environment.

In contrast to this experimental use of GM trees, there's also great industry interest in developing GM trees to increase quality and quantity of harvested timber in forests and plantations. Two approved GM forest tree varieties are available internationally: poplars modified for insect resistance in China and eucalyptus designed for yield increases in Brazil. The companies behind their development argue that, as these GM trees are more efficient and can do more with less land, they could decrease the conversion of natural forests into plantations. In addition, companies are investigating a wide range of other financially beneficial uses of GM forest trees for use in the United States. Given that GM approaches have been used for several agricultural trees (apple, plum, papaya), it is likely that the same will apply to forest trees. However, the long-term ecological impacts of such trees in forested settings is less clear.

A third goal of GM technology for forest trees would be restoration. Restoration can be done by strengthening or reintroducing native species that have been decimated by invasive diseases and insects and is a fundamentally different objective from improving trees for increased economic production. In this case, the goal is restoring ecological balance, not financial gain. As with the American chestnut, an increasing number of important tree species are being jeopardized by human-introduced invasive threats. GM technology provides one pathway to addressing this problem by breeding resistance to handle the onslaught of exotic threats that are occurring at an increasing rate. However, given the long lives of trees and the rapidly changing nature of our climate and eastern forests, it will be a challenge to predict which traits are important and which are not in the long run.

"GM" is an umbrella term, covering the broad set of different techniques, origins, and goals that drive modern molecular plant breeding. You might be in favor of some GM plants while against others. Some of the concerns about GM technology may prove well founded, others overblown, but by looking at each proposed GM plant independently (the reason behind its development, the technique used to develop it) we can each develop a clearer picture of what resonates with each of us and why.

Stay tuned: Next time we will dive deeper, focusing on several case studies of potential GM trees under development.

About the Author:

Ellen V. Crocker*, Ph.D.,University of Kentucky, Department of Forestry Extension and Forestry Health Research and Education. Her focus includes eastern forest health issues, education and outreach.*

Cooperative Extension Service, Department of Forestry, University of Kentucky, 216 Thomas Poe Cooper Building, Lexington, KY 40546-0073; Phone: 859.257.3040; Fax: 859.323.1031; E-mail: e.crocker@uky.edu

Kentucky's diverse woodlands provide many benefits and are ecological and economic assets. It will likely require a variety of approaches to ensure that future generations enjoy the same abundant forest resources that we do.

Photo courtesy: Tom Barnes

Woodland Owners and the Northern Long-eared Bat

by Jeff Stringer

Northern long-eared bats, once common to a large geographical area of the eastern United States, are decreasing significantly in number from a fungus that causes a disease called white-nose syndrome. This debilitating and often fatal fungus, contracted during winter hibernation in caves, has led to the species being listed as threatened under the Endangered Species Act (ESA). This fungus is particularly devastating, not only to the northern long-eared bat, but to other species that hibernate for long periods (weeks or months) without waking. These species generally hibernate in caves where moist, cool-air conditions are ideal for the development of the fungus. The fungus can be seen as a white, cotton-like growth on their nose, but it also attacks their skin, including their wings. The fungus can cause them to rouse from hibernation, which causes them to use their stored fat reserves, thus physically and physiologically weakening them, leading to their death. Strong evidence suggests the fungus is an invasive species originally from Europe. It has spread rapidly from New England, where it was thought to have been introduced, and is now found in many states in the eastern United States, including Kentucky. The rapid advance and detrimental effects of this disease, significantly reducing northern long-eared bat populations, led to the threatened designation being established in 2015.

This designation means that you cannot harass, harm, or kill a northern long-eared bat. Violations can involve substantial fines. Harm can be viewed as eliminating or degrading habitat, for example cutting down trees that the bats roost in or disturbing hibernation. Timber harvesting can degrade habitat, and it also can harass, harm, or kill bats. The latter can occur when trees are cut that are harboring female bats that are rearing flightless young. As a part of the listing as a threatened species, the U.S. Fish and Wildlife Service (USFWS) also issued a set of rules required for forest management operations (primarily timber harvesting) in and around areas where bats are found. If these rules are followed, woodland owners are not held liable for what is called "take," the harm, harassment, or killing of a bat, in this case during forest management operations. The rules require that specific conservation measures (harvest restrictions) are adhered to in buffer areas around known locations of the species–particularly hibernacula and known roost trees. Hibernacula are caves where the bats hibernate during the winter. Sometimes the northern long-eared is the sole occupant of a cave. But it is also common for them to share caves with other species such as the Indiana bat that has been a federally listed species for a number of years. The rule also requires that a similar buffer be established around any known roost trees

Photo courtesy: Al Hicks (NYDEC)

Northern long-eared bats are common to woodlands in the eastern U.S. and are under attack from a deadly disease.

(see below) from June 1 to July 31. If these measures are not adhered to and bats are harmed, harassed, or killed, it is viewed as a take and those involved would be in violation of the ESA. If these measures are adhered to and bats are killed during timber harvesting, then it is viewed as an incidental take and there are no repercussions. The following is an explanation of the rule, background information on the biology of the bat, a reasoned approach to conducting timber harvests, and potentially acquiring an exemption, if necessary.

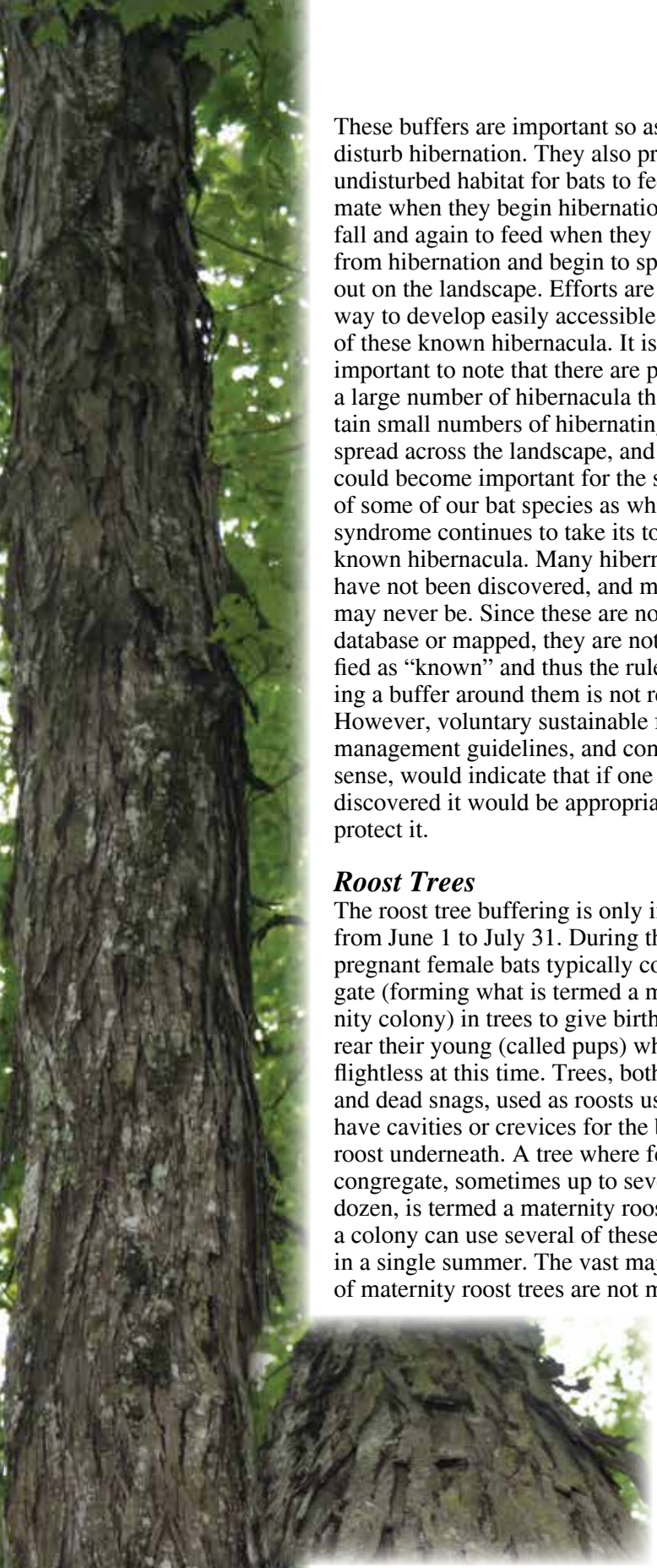
Protecting Areas around Bat Caves

The rule requires that a 0.25 mile (1,320 ft.) buffer is established around known hibernacula and known maternity roost trees. Many states, including Kentucky, have mapped their known hibernacula, so no-harvest or modified harvest buffers must generally be provided around these locations.

These buffers are important so as not to disturb hibernation. They also provide undisturbed habitat for bats to feed and mate when they begin hibernation in the fall and again to feed when they emerge from hibernation and begin to spread out on the landscape. Efforts are under way to develop easily accessible maps of these known hibernacula. It is also important to note that there are probably a large number of hibernacula that contain small numbers of hibernating bats spread across the landscape, and these could become important for the survival of some of our bat species as white-nose syndrome continues to take its toll in known hibernacula. Many hibernacula have not been discovered, and many may never be. Since these are not in a database or mapped, they are not classified as "known" and thus the rule requiring a buffer around them is not required. However, voluntary sustainable forest management guidelines, and common sense, would indicate that if one was discovered it would be appropriate to protect it.

Roost Trees

The roost tree buffering is only in effect from June 1 to July 31. During this time, pregnant female bats typically congregate (forming what is termed a maternity colony) in trees to give birth and rear their young (called pups) which are flightless at this time. Trees, both live and dead snags, used as roosts usually have cavities or crevices for the bats to roost underneath. A tree where females congregate, sometimes up to several dozen, is termed a maternity roost and a colony can use several of these trees in a single summer. The vast majority of maternity roost trees are not mapped



Northern long-eared bats use roost trees, snags and trees with loose bark like shagbark hickory, to rear their young in and live throughout the summer months.

Photos courtesy: Chris Osborne

Photo courtesy: University of Illinois/Steve Taylor

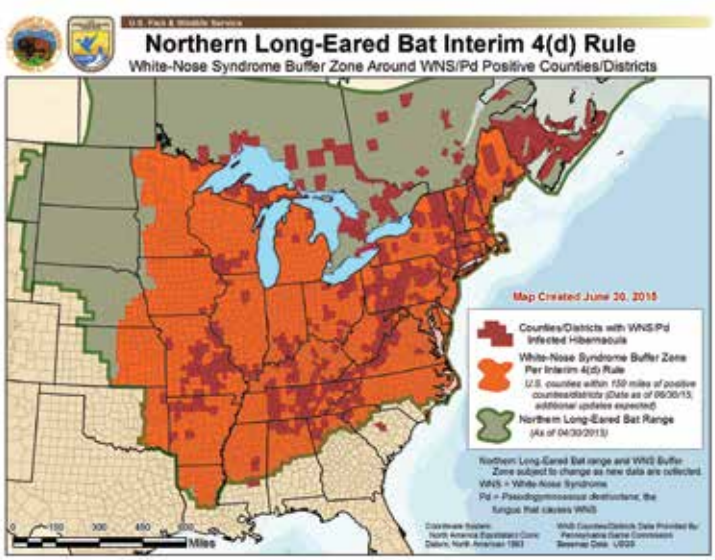
Northern long-eared bat with white-nose syndrome.

and are unknown. The bats may or may not use the same trees each year, so keeping track of this would be nearly impossible. There is no provision in the rule indicating that the woodland owner, timber buyer or logger must have a trained wildlife biologist scout for and try to find roost trees on private lands. However, if a roost tree is found it would then be considered "known" and buffering would be required June 1 to July 31 while the pups are flightless.

Bat Behavior and Buffers

The rule indicates that buffers preclude clearcuts or similar harvest methods such as seed tree or shelterwood. It is fair to say that two-aged deferment harvests would fall under this categorization as well. The USFWS does not differentiate between these practices because all of them result in the removal (in whole or part) of overstory trees (see below). It is important to note that the rule has a provision to allow for deviations or exemptions in the conservation measures (harvest restrictions) in these buffers. However, these exemptions must be approved by the state USFWS office. The rule contains wording that could help define situations where an exemption might be approved. First, it is understood that the conservation measures were developed to help reduce adverse effects on the northern long-eared population. Thus, the smaller and less intense the harvesting, the less the impact, so scale of the operation and intensity is important. Obviously light selective harvests or small group openings would be preferable. The reason clearcutting and other similar practices (practices that remove significant dominant/co-dominate [overstory] trees) are precluded is due to the risk of cutting other roost trees or potential roost trees. A little background is required to understand this concern. The congregating female bats will stay in the original maternity roost trees for several weeks and then may move to other suitable roost trees close by. This movement, often referred to as fission-fusion behavior is common and can be due to a number of factors such as disturbance of the original roost trees, predation, lice build up, and in some instances just because they want to (social-

ity). Therefore if you are conducting a harvest in a buffer around a known roost tree, there is a chance that, unknown to anyone, they have moved and snuck into a tree that is in the process of being felled, resulting in potential liability problems for the logger and/or landowner. This biological requirement for movement also indicates that to successfully rear pups, the female bats need several suitable roost trees in a stand. Obviously, forest management activities



This figure shows the location of white nose syndrome (dark red) indicating how widespread the problem is.

that do not take this into account are problematic for the bat. This is why the rule specifies that practices that remove a significant amount of overstory trees around a known roost tree are not allowed. However, since the rule indicates that the removal of other roost trees or potential roost trees is the basis for this concern, it might be possible to conduct a shelterwood or deferment harvest if suitable roost trees are retained. This would be a forest management practice that would be conducted to specifically maintain bat habitat. The occurrence of Streamside Management Zones (SMZs) or other retention areas within a harvest also helps maintain habitat for the bats. Obviously clearcutting would typically not be allowed as these practices remove all the overstory trees. The other concern that USFWS might have with activities in a roost tree buffer is the disturbance factor associated with harvest machinery and personnel in the buffer. While there is not hard data on the latter, one can certainly understand the USFWS's predisposition to be concerned about large machinery within known habitat areas.

Researchers place transmitters in northern long-eared bats to track their movements. This research provides scientific information that is necessary for the development of effective protections.

Photo courtesy: Mike Lacki

Overall, the current rule is workable for most woodland owners. Over time, we will work out the details associated with working efficiently under this rule. At this time, the following apply:

- Landowners, foresters, and loggers must understand where known hibernacula are and buffer them. This applies whether the cave is located on the property that is being harvested or on an adjacent property. Regardless, this will require good networking and information from the holders of this data, usually state U.S. Fish and Wildlife Services state office, state fish and wildlife or nature preserves or conservation commissions, in some cases there may be a fee.

Photo courtesy: USFWS

Large caves are where northern long-eared bats, and other species, hibernate during winter. There is an ongoing effort to restrict human intrusion into these caves to prevent disturbance during hibernation and to restrict the movement of the fungus causing white nose syndrome.

- Woodland owners and those working in the woods do not have to scout for or determine the presence of maternity roost trees, though they can voluntarily, if interested.
- Landowners and practitioners interested in sustainable management will eventually need to address the issue of protecting minor hibernacula and, where appropriate, provide maternity roost opportunities and other habitat conducive to the success of imperiled bat species. Some of the provisions for retention associated with sustainable forest management, such as Streamside Management Zones can be used for this purpose. Also, practices that provide overstory retention in the harvest unit or in the overall forest ownership also lend themselves to providing bat habitats.
- Sustainable forest management systems (ex. American Tree Farm System, Forest Stewardship Council, Sustainable Forestry Initiative) also may need to adopt bat Best Management Practices that encompass issues of minor hibernacula protections and habitat retention for not only northern long-eared bats but other imperiled bat species. The latter will be difficult, as bat biology and habitat requirements vary by species.

Regardless, there will be much more information coming on the bat situation. Not only for the northern long-eared bat but other species that are similarly at risk. The situation is dynamic and rule changes undoubtedly will be the norm. Woodland owners and aligned professionals including foresters, loggers, and forest industry should stay abreast of this issue and be ready to adjust management, logging, and timber procurement accordingly.

About the Author:
Jeff Stringer, *Ph.D., is an extension professor at the University of Kentucky and is responsible for continuing education and research in hardwood silviculture and forest operations. He is also an editor of the Kentucky Woodlands Magazine. The author thanks those involved with the peer review of this article.*

Cooperative Extension Service, Department of Forestry, University of Kentucky, 201 Thomas Poe Cooper Building, Lexington, KY 40546-0073; Phone: 859.257.5994; Fax: 859.323.1031; E-mail: stringer@uky.edu

Photo courtesy: Diana Olszowy

How Are Your Woodlands Changing?

Each forested area is a dynamic and ever-changing mix of plants and animals. The kind of forest that exists today did not just happen. It is there as a result of past events. Some of those events were natural occurrences, but many of them were man-made. If you own or control a tract of woodland, you have the opportunity and, I believe, a duty to make a positive difference in the kind of forest that will be there in the future. Every decision that is made regarding your woodland, every action that is taken, and every action that is not taken will have an impact on what the forest of the future will be. Some events that affect our forests--ice storms, high winds, plant diseases, and even changing climate--are clearly beyond our control, but each of us can do many things to enhance the future of our woodlands.

Invasive species pose a significant threat to the future value of Kentucky forests. Some non-native plants can become invasive because of their high reproductive capacity and their ability to out-compete the native vegetation. They are often free of the natural enemies that kept them in check in their native habitat. The best time to deal with potentially invasive species is before they become widely established. We have an unfortunate tendency to overlook alien plants until they become an obvious problem, and by then they are difficult, if not impossible, to eradicate. Because the mixed forests of Kentucky are hosts to such a wide variety of species, it can be challenging to know which plants are native and desirable, and which plants are potential invaders. It is useful for a woodland owner to develop a working knowledge of the plant species that grow on his or her land.

Participation in educational events such as the Kentucky Woodland Owners Association annual meeting, the Woodland Owners Short Course, and local Cooperative Extension Service field days can help you learn to identify the plants that grow in the forest. Several good field guides that list most of the native plant species are available at your local bookstore or online. It is a good practice to carry one of them with you when you walk in the woods. If you find plants that you cannot identify, check with your county Extension agent for Agriculture and Natural Resources. Extension agents can help identify the plant or can utilize resources at the University of Kentucky for further assistance. Once you become familiar with the native plants in your woods, you will have a better chance to identify potential invaders and deal with them early while they are more easily controlled. If you discover, as many of us have, that some invasive plants have already become established on your land, you may want to talk with your Kentucky Division of Forestry Service forester about applying for financial assistance to help pay the cost of controlling them. Management of invasive plants can have a major effect on the future of your forest.

The Kentucky Woodland Owners Association is devoted to the better management of woodlands and advocating for policies that promote good forestry. Everyone with woodlands in Kentucky is encouraged to consider joining and becoming an active member of KWOA. For more information, please visit www.kwoa.net.

-- Frank Hicks, KWOA President

For more information log on to www.kwoa.net

Kentucky Tree Farm Committee Newsletter

New Tree Farmers: Bill and Chris Lagermann

We started looking for land in Kentucky in 2004 around the Mammoth Cave area. We ended up purchasing land in Metcalfe County, which has picturesque Red Lick Creek running along the edge. Because our son Steve wanted it to be called a ranch, we named our property "Red Lick Ranch." We have approximately 280 acres that are primarily wooded. All but about 50 acres have had the timber harvested, and we wanted to restore the forest. Our original plan was to plant bare-root trees, but the success rate wasn't very good. We decided to seek help from the Metcalfe County Extension office, and they suggested we check out the EQIP program. We started with 70 acres and, once approved, we met with Kentucky Division of Forestry forester Mark Wiedewitsch. Mark showed us and marked which trees needed to be removed. Over the next few years I cut the marked trees and sprayed their stumps.

Chris (red shirt) and Bill Lagermann (flag shirt) have made it a priority to include family members in their Tree Farm activities. The Lagermann's named their Tree Farm Red Lick Ranch because of their properties proximity to Red Lick Creek and their son's desire to have a "ranch" in the family.

The most important thing I learned was that you can restore a forest faster using the new growth from the stumps of cut trees versus planting new trees. Because the old tree has an established root system, using it resulted in new growth of 6 to 8 feet a year compared to the 6 to 8 inches a year we were getting using bare root tree seedlings. Within a few years we were seeing the difference. Once the marked trees were removed, the preferred trees grew faster. We are now getting more acorns and other fruit from the trees, which is great for wildlife. Someday we hope to be able to raise some quail on our property too. Our biggest challenge was finding the time to do the work. You don't see the results for several years, but results are definitely worth it and should bring in more money when the timber is sold.

My wife and I are very proud to have our children and grandchildren seeing this process work. The reason we wanted to buy land was so our sons and their families would have a place to come and enjoy. We all love riding through the property and seeing deer, turkey, rabbits, squirrels, and many different birds. Our oldest son, Mike, and his wife, Lynn, purchased 42 adjacent acres and he is starting to use the same improvement processes so his daughter Rachel can enjoy it for many years to come. David's sons Luke and Reed visit and David helps with maintaining the property. The boys already hunt with their dad—Luke got his first turkey recently. Our youngest grandsons, John Thomas and Peter, mostly enjoy hiking through the woods and playing in the creek with their parents, Steve and Sarah. We didn't plan to live here full-time, but absolutely love the peace and beauty of living in Metcalfe County surrounded by our beautiful forest. We wouldn't want to live anywhere else.

Our advice to all landowners is to contact the Kentucky Division of Forestry. Forester Tammy Rogers has been instrumental in helping us get our Tree Farm designation, and we appreciate her assistance and advice. My wife and I attended the Woodland Owners Short Course in order to learn more about what programs are available to learn better timber management skills. There are also programs that can provide financial support for improving the forest. We are happy to encourage others to get involved in these programs.

Steve Gray to assume role as Kentucky Tree Farm Committee Vice-Chair

The Kentucky Tree Farm Committee (KTFC) is proud to announce Steve Gray as the 2014-2015 Vice Chair. Mr. Gray brings a significant amount of knowledge and experience to the KTFC leadership from his consulting forester business, Steve Gray Consulting Forester LLC, and his previous career as the Central District Forester with the Kentucky Division of Forestry. Mr. Gray will become KTFC chair in 2016. Please join the KTFC in welcoming Mr. Gray to his new role and responsibilities.

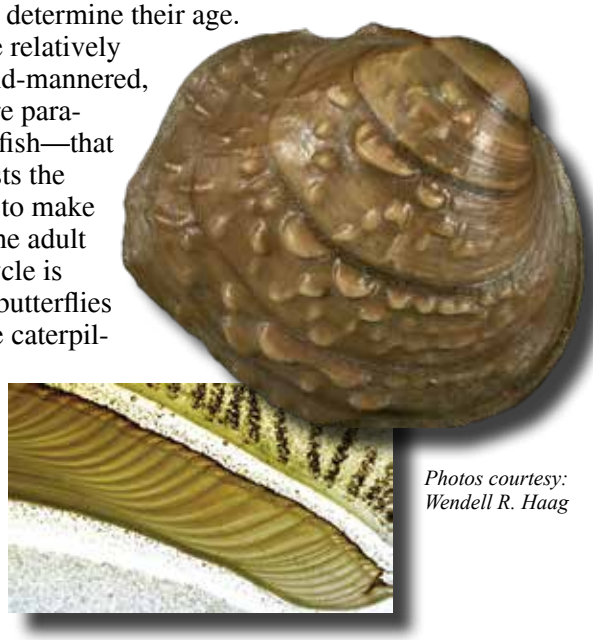
For more information about the Kentucky Tree Farm Program, please visit www.kytreefarm.org or call 502.695.3979.

The Hidden and Imperiled Gems of Kentucky's Rivers

by Wendell R. Haag

Kentucky is well known for its diversity of plants and animals. The forests of Eastern Kentucky and streams throughout the state are some of the most biologically diverse compared to other temperate regions of the world. Another aspect of Kentucky's biodiversity, which is even more remarkable from a global perspective, is unknown to many people. Kentucky, along with Alabama, Georgia, and Tennessee, is home to the richest freshwater mussel fauna, not just in temperate regions, but anywhere on Earth. Each of these states has over 100 native mussel species, which exceeds by far even tropical areas such as the Amazon, Congo, and Mekong river basins. Several of Kentucky's rivers are home to more than 40 mussel species, and in some places, one can find more species in one square foot of river bottom than occur on the entire continent of Europe. This diversity is not widely known because mussels spend most of their lives out of sight, buried in the gravel or sand. Consequently, many people think mussels and other bivalves live only in the ocean, and they are surprised to find the beautiful shells of freshwater species on river bars or shorelines right here in the Commonwealth.

Mussels have a fascinating life cycle. Some mussel species live only a few years, but many live decades and a few can live well past 100 years, making them among the longest-lived animals on Earth. Mussels produce annual rings in their shells–similar to tree rings–that can be counted to determine their age. Adult mussels are relatively sedentary and mild-mannered, but their larvae are parasites—usually of fish—that get from their hosts the energy necessary to make the transition to the adult stage. This life cycle is similar to that of butterflies and moths, whose caterpillar larvae must feed on plants in order to emerge as an adult. Like butterflies, most mussel species are specialists whose larvae can use only certain types of hosts. Some mussels use only bass, some use minnows, others use only



Photos courtesy: Wendell R. Haag

Mussel shell age rings. Like tree rings, mussels produce a conspicuous ring in their shell each year, which is associated with a slowing of growth in the winter. These rings are visible on the exterior of the shell in many cases (top), but they are interrupted more accurately and consistently by examining thin sections of the shell under a microscope (bottom).

Mussels have beautiful shells, which come in a wide variety of shapes, sizes, and colors.

Photo courtesy: Monte McGregor

catfish, and so on; one mussel species is a specialist on the mudpuppy, a large, aquatic salamander.

The most unusual aspect of this life cycle is the array of strategies by which mussels ensure their larvae find the appropriate type of host. Mussels whose larvae require bass as a host display large lures that mimic bass prey such as minnows or crayfish. When a bass tries to attack these lures, they receive a mouthful of mussel larvae instead of a meal. Similarly, mussels that use fish that feed on insects—fish such as darters and minnows—release their larvae in small packets that mimic insect larvae or other prey items to an astonishing degree. Mussel larvae remain on the host usually for a few weeks after which they drop off and fall to the bottom wherever the fish has carried them. This dispersal on fishes is important in allowing mussels to colonize new habitats. For the fish's part, mussel larvae usually are only a minor annoyance–like ticks or lice–and the fish is usually unharmed by the experience.

Mussel lures. Mussels use astonishing mimicry to ensure that their parasitic larvae encounter a suitable host. The wavy-rayed lampmussel (top) displays a lure resembling a small fish, which attracts bass (second), the larval host for the species. The fluted kidneyshell releases its larvae in small packets that closely mimic blackfly pupae (third), a major food item for their darter hosts. Similarly, the fanshell releases its larvae in packets that resemble small worms (bottom).

Photos courtesy: Chris Barnhart (all photos except second), and Wendell R. Haag (second).

Mussels are important for reasons other than their diversity, beauty, and interesting life cycle. Like most bivalves, freshwater mussels are filter feeders that eat algae and other material suspended in the water. This filtered material is deposited in the stream bottom where it is broken down further by other organisms. Mussels filter nearly around the clock, and in streams with large populations, the combined filter feeding of thousands of mussels can improve water quality tremendously, which benefits fish and other aquatic organisms as well as people who use the water. This service is provided free of charge with no maintenance costs. Mussels also are important as a food source for a wide array of animals including many fish species, turtles, and mammals such as muskrats and otters.

Sadly, this vital filtering service and unique part of our natural heritage is disappearing rapidly. In the last 100 years, over 30 North American species have become extinct, including at least 12 species native to Kentucky. Most of these species were driven to extinction by dams, which transformed the shallow, free-flowing habitats on which these species depended into deep, still reservoirs. For example, construction of Wolf Creek Dam in 1950, which transformed the Cumberland River into Lake Cumberland, directly contributed to the extinction of at least three mussel species and left several other species critically endangered.

The era of large dam construction came to a close in the 1970s, but mussel populations in remaining free-flowing streams nationwide continue to decline rapidly. In Kentucky since the 1970s, mussels have disappeared almost completely from many streams, and dozens of species either have disappeared from the state or now teeter on the verge of extinction. In some cases, mussels appear to have been eliminated by severe water pollution from coal mining, oil and gas extraction, or other sources. But mussels have disappeared even from many streams that lack obvious sources of pollution. These enigmatic declines are particularly worrisome because, without knowledge of their causes, we have no way to protect other streams from similar declines or to restore affected streams.

Research Is Under Way

A main focus of my job as a fisheries biologist is to study how land management practices affect the health of aquatic ecosystems. This summer, I am conducting a study that will attempt to identify specific causes of enigmatic mussel declines. This study is a collaborative effort between the U.S. Forest Service, the Kentucky Division of Water, and the Kentucky Department of Fish and Wildlife Resources' Center for Mollusk Conservation [see sidebar on page 18].

Beginning last November, the Center for Mollusk Conservation raised several thousand juvenile mussels by artificially infecting largemouth bass with larvae of the pocketbook mussel. In May, when these mussels were about six months old, we placed them in 24 streams across Kentucky, from Trigg County in the west to Greenup County in the east, and from Pendleton County south to the Tennessee border. These streams represent a range of conditions, from streams in which mussels have declined or disappeared to those that still support healthy populations.

In each river, we placed the mussels in two types of enclosures so we could relocate them at the end of the summer. One type, called a silo, primarily exposes mussels to the stream water, but we also placed

Juvenile mussels. *Photo courtesy: Monte McGregor*

All photos this page courtesy: Monte McGregor

Mussel silos and cages. For experimental purposes, juvenile mussels (page 17) are held in streams in concrete silos (top), through which flows a steady current, ensuring that mussels have adequate oxygen and food. Mussels also are held in small plastic cages that are buried in the stream bottom (bottom).

mussels in small cages buried in the river bottom, which provides exposure to stream sediments. We used these two types of enclosures because some types of contaminants are more prevalent in the water while others are more prevalent in sediments.

At the end of the summer, we will retrieve the enclosures and record mussel survival and growth.

Simultaneous with the experiment, the Kentucky Division of Water is conducting detailed measurements of water and sediment quality in each river as part of their statewide Ambient Water Quality monitoring program. If we find differences in mussel survival or growth among sites, we hope to be able to relate these differences to the presence of specific contaminants or other water or sediment quality factors. It is possible that whatever factors were responsible for mussel declines are no longer present in streams. For example, DDT or other older pesticides may have negatively affected mussels—similar to their effects on birds and other organisms—but because these chemicals are no longer used, conditions may have improved such that these streams once again are capable of supporting mussels. If so, we should see high mussel survival even in these previously affected streams, meaning that those streams may be candidates for restoration and restocking with mussels raised by the Center for Mollusk Conservation.

Regardless of the outcome, our experiment should provide valuable information needed to conserve the extraordinary mussel fauna of Kentucky and North America in general. Stream ecosystems that have lost their mussels and the vital services they provide are severely compromised, and their ability to support a wide range of uses is diminished. Together with information from our experiment and other research efforts occurring across the country, we hope one day to restore the full function of stream ecosystems, which will provide immeasurable benefits to all people.

The Center for Mollusk Conservation

The Center for Mollusk Conservation (CMC) was founded in 2002 by the Kentucky Department of Fish and Wildlife Resources in Frankfort, KY. The mission of the CMC is to

restore and recover rare and imperiled mussels in Kentucky. Dr. Monte McGregor, director of the CMC, and his staff, have refined, and in some cases perfected, many methods for the culture and propagation of freshwater mussels in a hatchery environment. For example, CMC staff have developed the ability to culture large quantities of

algae and other mussel food sources, which is critical for optimal mussel survival and growth. The CMC also has pioneered methods for raising mussels in artificial culture media and thus bypassing the requirement of the parasitic phase on host fishes. These and other advances allow production of large numbers of healthy mussels, which can be used to restock depleted streams. The production capacity of the CMC is an integral part of efforts to restore the mussel fauna of Kentucky and beyond.

About the Author:
Wendell R. Haag, *is a Research Fisheries Biologist with the U.S. Forest Service.*

U.S. Forest Service, 3761 Georgetown Road, Frankfort, KY 40601; Phone: 502.573.0330 ext. 228; E-mail: whaag@fs.fed.us

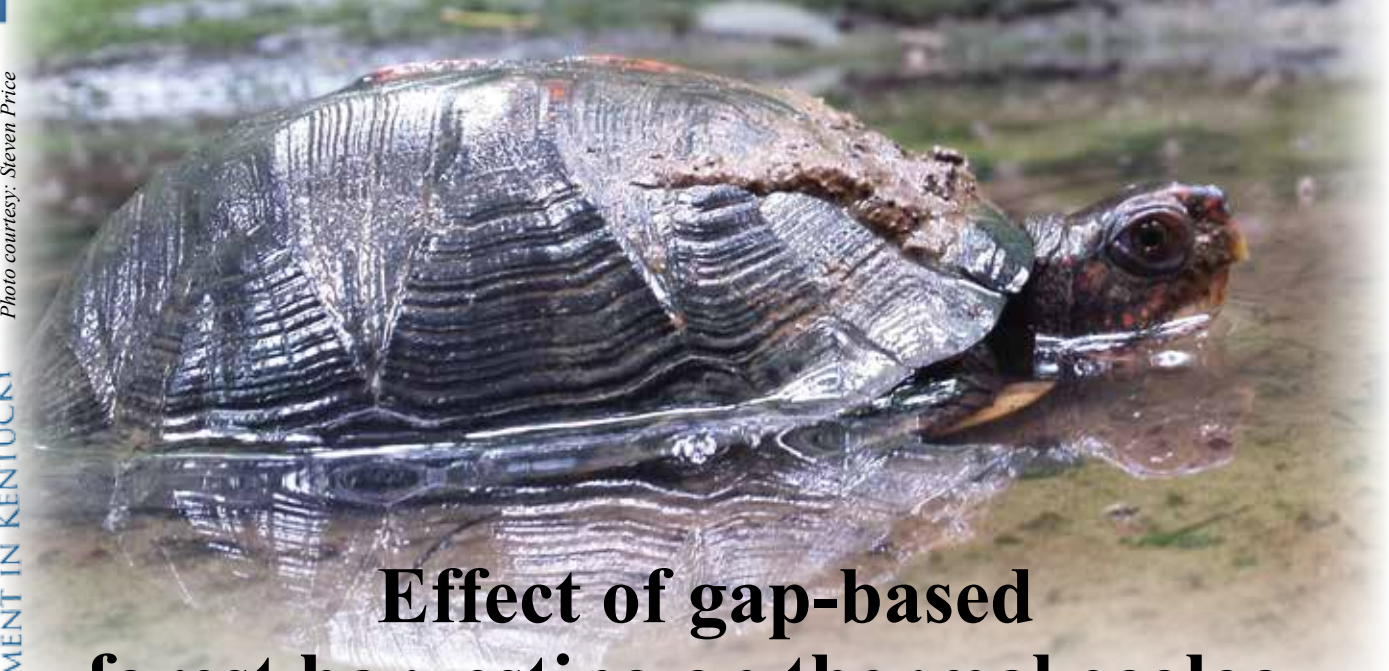


Photo courtesy: Steven Price

Effect of gap-based forest harvesting on thermal ecology of Eastern box turtles

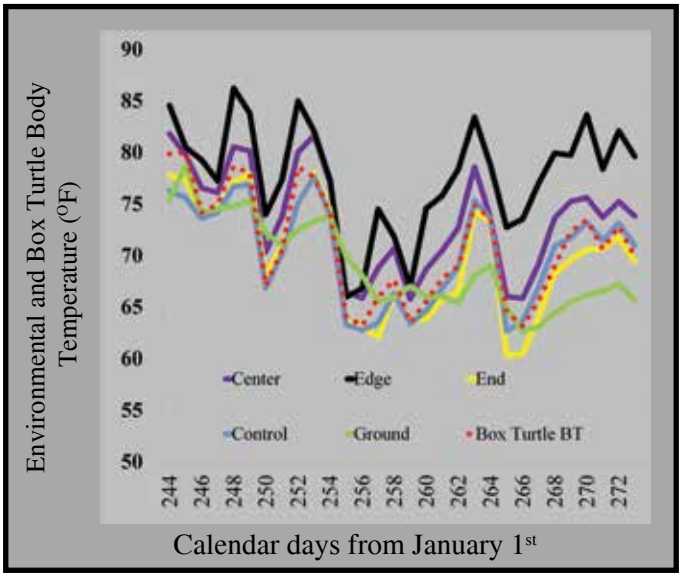
Eastern box turtle taking a swim at Berea College Forest.

by Mickey Agha, Benjamin Augustine, Steven J. Price

Introduction

The Eastern box turtle *(Terrapene carolina)* is one of the most commonly encountered reptiles in Kentucky forests. Box turtles, like all reptiles, are ectotherms (i.e., "cold-blooded"), meaning an external source of heat is required to warm their body temperatures. When air temperatures are cool, reptiles bask in areas with ample sunlight to reach their preferred body temperature. Conversely, reptiles seek refuge in a burrow or shift habitats when air temperatures are above their preferred body temperatures; this behavioral response is called thermoregulation. Box turtles prefer to keep body temperatures between 77°- 89.6°F, since they lose their ability to function at 102.2°- 107.6°F (i.e., critical thermal maximum). Although abundant in Kentucky, box turtle populations have declined in many areas in Eastern North America due to commercial collection, road mortality, and habitat fragmentation or loss. In 2011, the International Union for Conservation of Nature categorized the species as "vulnerable," or likely to become endangered unless conditions improve.

Silviculture techniques, such as canopy gap-based harvesting, promote ecological and ecosystem functionality by emulating natural disturbances to the forest canopy. Forest gaps change microclimatic conditions, such as light levels and temperature; this silvicultural technique offers potential for restoring native vegetation communities, maintaining forest biodiversity, and offering wildlife habitat. Reptiles, like box turtles, may utilize forest gaps for thermoregulation. Indeed, several studies have documented increases in abundances, diversity, or use by reptile species in forests thinned or altered through forest management. These studies hypothesize that increased temperatures in gaps lead to increased use by reptiles. Our objective was to test this hypothesis using box turtles as a model species.



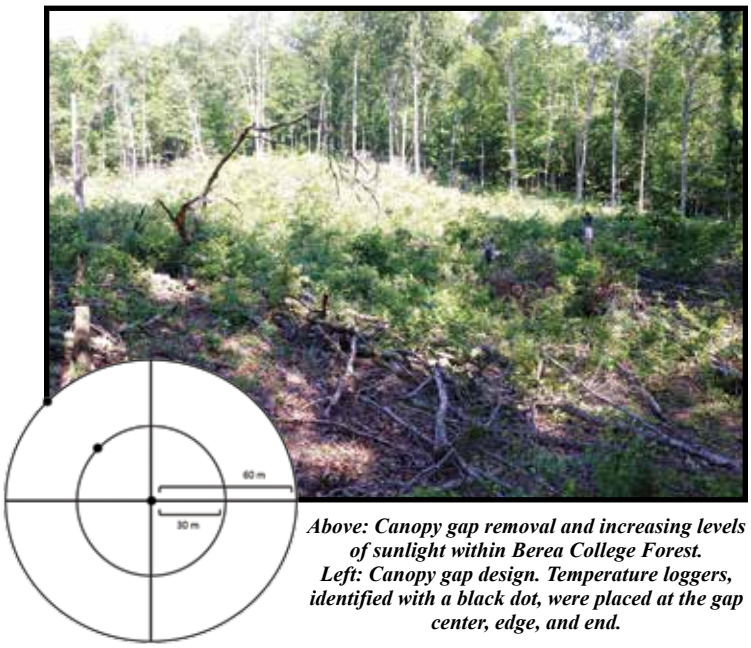
Daily average body temperature of a single box turtle during the month of September 2014.

Approach

This research took place within the 8,500 acre Berea College Forest in Madison County, Kentucky. The property is managed by Berea College and used for research, timber harvest, recreation and education. Since 2012, Berea College and UK have implemented gap-based harvesting to study the survival and growth of oak seedlings. Ten circular canopy gaps (including midstory and complete removal treatments) were created on east-facing slopes in fall 2012. Each of the canopy gaps were

harvested by removing all trees over 1.4 m within a 30 m radius of the gap center. All non-oak trees within a 60 m radius of the gap center were cut and treated with herbicide.

Box turtle surveys were conducted from early September 2013 to late April 2014. We used intensive time-area constrained searches to capture box turtles within and around canopy gaps. Twenty-four adult box turtles (13 male, 11 female) were fitted with radio transmitters, and temperature dataloggers were attached to the carapace. We used carapace temperatures as our measure for body temperature. Radio-transmitted turtles were relocated every 7-10 days from May to October, 2014. Temperature dataloggers recorded carapace temperatures (accurate to ± 1.8°F) every 30 minutes.



Above: Canopy gap removal and increasing levels of sunlight within Berea College Forest. Left: Canopy gap design. Temperature loggers, identified with a black dot, were placed at the gap center, edge, and end.

To investigate thermal characteristics of habitats within our study area, we measured ambient environmental temperatures using dataloggers placed at the center, edge, and end of canopy gaps. We also placed dataloggers in three undisturbed areas and one datalogger 15 cm under leaf litter and soil to mimic conditions when turtles were underground or within natural thermal shelters (i.e., rotting logs, mammal burrows, or mud). We then assessed differences in the thermal environment among habitats. To infer habitat use, we examined box turtle home range overlap with canopy gaps and modeled the relationship between box turtle carapace temperatures and environmental temperatures.

Group of eastern box turtles in a mud hole located within the research study area.

Results

Mean overall home range size for female turtles was 3.36 ± 0.62 acres and for male turtles, 4.27 ± 1.06 acres; these home range sizes equal about 2½ and 3 football fields, respectively. On average, 5%-25% of box turtle home range areas were calculated as occurring within canopy gaps. In our thermal assessment, we discovered that, in general, environmental temperatures of microhabitats were similar at sunrise and sunset, but by mid-day all habitats were significantly different. For instance, over the entire study, at midday, the gap center temperature average was 89.23°F (max: 100.85°F, one degree difference from critical thermal maximum temperature), while the control temperature average was 75.2°F. Mean box turtle temperatures changed throughout the day (sunrise: 65.48°F, midday: 75°F, sunset: 73.92°F), and tracked control temperatures or end of gap most closely in May-August. In September, when average ambient control air temperatures started to lower (mean 70.05°F), box turtle body temperatures resembled that of canopy gap center and gap edge environmental temperatures (mean 75.29°F), suggesting the turtles selected canopy gaps to effectively thermoregulate.

Management Implications

Results from this study suggest that box turtles select closed canopy forests throughout most of the summer, even when located in close proximity to warmer canopy gaps. However, when air temperatures began to decrease in September, box turtle body temperatures were most similar to the canopy gap centers. Therefore, our study supports the idea that increased temperatures in gaps lead to increased use by reptiles, especially during cooler months. During autumn (and perhaps spring), it is imperative to keep an eye open for turtles (and other reptiles) within canopy gaps because they offer preferable thermal environments.

Mickey Agha

This research was conducted as part of a research project by Mickey Agha (mickey.agha@uky.edu), who is a technician in Dr. Steven J. Price's lab at the University of Kentucky, Department of Forestry. Benjamin Augustine, a researcher at Virginia Polytechnic Institute, provided statistical computations for box turtle temperature assessments. This research project was overseen and directed by Dr. Steven J. Price (steven.price@uky.edu), assistant professor of stream and riparian ecology in the Department of Forestry.

Kentucky Champion Tree Program: The Sweet Splendor of Sugar Maple

The Kentucky champion sugar maple is located in Daviess County.

Photos courtesy: Diana Olszowy

The sugar maple leaf is not only the national emblem of Canada but is also a sweet reminder of the delicious maple syrup this species produces.

by Diana Olszowy

Sugar maple is one of those multi-talented species that has significant value for several different reasons. First, it has become a very popular landscape tree due to its growth habit, shading ability and outstanding fall color, which, by the way, is like none other. Second, its wood is considered to be one of the most dense and hard of all tree species. Third, sugar maple is important for its role in the production of maple syrup.

Sugar maple has an extensive range, from Ontario and Manitoba, Canada, east to the New England states, west to Minnesota and Missouri and south to Georgia and Alabama. It grows best in well-drained, moist soils that have no threat of compaction, salt or restricted root zones. Kentucky's current champion sugar maple is a magnificent specimen measuring more than 16 feet in circumference and nearly 90 feet in height. The crown spread of this Daviess County champ is nearly 95 feet, which is unusual for the species since the normal crown spread averages two thirds of the tree's height. Sugar maples are a very long-lived species, capable of reaching 500 years of age.

The bark of sugar maple is light gray to gray-brown and with age becomes deeply furrowed and rough.

Photo courtesy: Bill Cook, Michigan State University, Bugwood.org

The wood of sugar maple is heavy, light brown, and close-grained. It is called "hard maple" by the lumber industry and is a popular wood for furniture, cabinets, flooring, bowling pins and lanes. Of particular value is maple wood with abnormal grain patterns called "curly maple" and "bird's eye maple;" which are used to make gun stocks and musical instruments, as well as other specialty products.

Maple syrup is considered one of the oldest naturally made products in North America, beginning when American Indians discovered this sweet product hundreds of years ago. The sap from sugar maple is collected from the trees early in the spring; and the best maple syrup season is from mid-February through early April, depending on the weather. Spring is the best time for production because at this time the tree has high sugar content and sap flow; therefore the most sap can be collected. And it requires a lot of maple sap to make maple syrup. It has been estimated that it takes approximately 40 gallons of sap to produce just one gallon of syrup.

In a forested situation, sugar maples are shade-tolerant and can persist in the understory for a long period of time waiting for a disturbance opportunity. They produce copious amount of helicopter seeds (called samaras), which drop in the fall and can germinate as quickly as the following spring. Fall coloration varies from green to brilliant yellow, orange and red, and the color's intensity is influenced by the shorter days and cooler temperatures. Sugar maples are indeed a sweet and magnificent addition to Kentucky's landscape.

About the Author:
Diana Olszowy *is Stewardship Branch Manager with the Kentucky Division of Forestry. She is also an editor of the Kentucky Woodlands Magazine.*

Kentucky Division of Forestry, 627 Comanche Trail, Frankfort, KY 40601; Phone: 502.564.4496; Fax: 502.564.6553; E-mail: diana.olszowy@ky.gov

kentucky WOODLANDS

Kentucky Wood Expo Returns to Lexington September 18-19

The 2015 Kentucky Wood Expo is coming back to Lexington and you are invited! Sponsored by the Kentucky Forest Industries Association (KFIA), the Wood Expo will be held on Friday, September 18, and Saturday, September 19 at Masterson Station Park in Lexington, KY. The show offers the entire family a chance to see lumberjack games put on by local Police Departments and forestry students, different types of logging demonstrations and equipment, and finished wood products by Kentucky craftsmen, plus numerous educational opportunities.

What will be at the show this year?

If you attended in 2013, many of the great things will be back such as the Critter Tent, a tent full of snakes, reptiles, and spiders and bugs such as Emerald Ash Borer; Skidder and Knuckleboom competitions; educational events dealing with all types of forestry and wildlife topics; the ever-so-popular create your own cutting board tent, and a new addition this year: a build your own bird feeder tent are just to name a few.

A participant at the 2013 Wood Expo puts the finishing touches on his cutting board.

In addition to the many inside and outside exhibits, Friday will feature an educational program for area students. Local FFA students and surrounding areas will compete for prizes in forestry-related events and learn about the importance of the wood industry. And once again, Friday at 3 p.m. local Police Departments will be competing for bragging rights while they participate in the Expo's lumberjack games with events such as axe throw and cross cut.

On Saturday, an assortment of activities will continue for everyone. The University of Kentucky Forestry Extension team will have several educational programs from tree and wood identification to residential tree care. Also new this year our Forestry Extension team will be putting on our One Acre at A Time - A Kentucky Woodland Owner Seminar. During this seminar, woodland owners that aren't sure of how to go about caring for their property will learn how they can get started. Woodland owners will learn about woodland management options as well as the numerous organizations that can assist them and hear from representatives of the Kentucky Division of Forestry, Kentucky Department of Fish and Wildlife Resources, Kentucky Association of Consulting Foresters, and UK Forestry Extension. This two-hour program is a great opportunity to make the critical connections to allow you to start managing your property one acre at a time.

UK Forestry student participates in the forestry competitions.

Chain saw carvers will also be sharing their love of sculpting by creating some of the most amazing wood carvings ever seen. Carvings will be auctioned at the show both days.

Chain saw carver cuts a leaf design at the Expo.

For a full schedule of events or to order advance tickets contact KFIA at 502.695.3979. The Expo is open from 9 a.m. to 5 p.m. on Friday and from 8:30 a.m. to 4:30 p.m. on Saturday. Admission is $7 ($5 in advance) at the gate for adults and $5 for children 6-12 (under 6 is free). For more Expo information visit www.kywoodexpo.org

Upcoming Dates To Remember:

2015 Dates:	Event:	Location:	Contact:
Sept. 18 - 19	KY Wood Expo	Lexington, KY	www.kfia.org
Sept. 19	One Acre at a Time—A Kentucky Woodland Owner Seminar	Lexington, KY	www.ukforestry.org
Sept. 26	East Woodland Owners Short Course	Carter/Rowan counties	www.ukforestry.org
October 8	Tree Farmer of the Year Field Day	Whitley County	www.ukforestry.org

NEWS TO USE

Best Management Practices Board Evaluating Current BMPs

The Kentucky Forestry Best Management Practices Board has been busy evaluating the current forestry best management practices in light of new research conducted by the University of Kentucky Department of Forestry at Robinson Forest. The board has developed a series of recommended changes that have been submitted for further review. The Kentucky Forestry Best Management Practices Board has members representing woodland and farm owners, forest industry, timber harvesting operators, and staff of the University of Kentucky's Department of Forestry and the Kentucky Division of Forestry.

Photo courtesy: Renee' Williams

UK Forestry Extension Introduces Newest Team Members

Ellen Crocker

Dr. Ellen Crocker
Ellen is a Postdoctoral Scholar with the Forest Health Research and Education Center at the University of Kentucky and will be part of the Forestry Extension team too. She will be focusing on education and outreach relating to forest health issues, such as invasive pathogens and insect pests. Her research has focused on plant pathogens in natural ecosystems (particularly forests and wetlands), and her expertise is in oomycete pathogens, a group including the Sudden Oak Death pathogen. You can reach Ellen at e.crocker@uky.edu.

Chad Niman
Chad will focus on primary forest products throughout the Commonwealth. Through this position he will provide statewide support to the wood products industry. Prior to this position, Chad has had experience working in consulting for Central Kentucky Forest Management, Inc. and forest management for Colorado State University. Along with his other roles Chad will be taking over as editor of the Kentucky Wood Industry E-News publication. You can reach Chad at chad.niman@uky.edu.

Chad Niman

Kentucky Division of Forestry Introduces Statewide Team Members

Abe Nielsen

Abe Nielsen, Forest Health Specialist with the Kentucky Division of Forestry will coordinate/perform activities within the Forest Health Program and will serve as the technical and scientific advisor for the agency. You can reach Abe at abe.nielsen@ky.gov or 502.564.2860 x 121.

Peter Stutts, Urban Forestry Partnership Coordinator with the Kentucky Division of Forestry, serves as the scientific and technical advisor for the Urban Forestry Program and provides assistance to communities, organizations/nonprofit organizations, educational institutions and others interested in urban forestry. You can reach Peter at peter.stutts@ky.gov or 502.564.2860 x 117.

Peter Stutts

Triplett Creek Grant Supports Woodland Owner Programming

The Triplett Creek watershed is a sub-watershed of the Licking River and comprises about 65 percent or 180 square miles of Rowan County and parts of Bath, Menifee and Morgan counties. This watershed is unique not only because of its proximity to the Daniel Boone National Forest, but also because of its wildland fire and forest management needs. To address these needs UK Forestry Extension in partnership with the Kentucky Division of Forestry and the US Forest Service is administering a grant that is helping support this issue of Kentucky Woodlands Magazine, a series of forestry factsheets, and field programs including the East Region Woodland Owners Short Course coming up on September 26.

UNIVERSITY OF KENTUCKY
Forestry Extension Office
Department of Forestry
University of Kentucky
216 Thomas Poe Cooper Bldg.
Lexington, KY 40546-0073

PRSRT STD
U.S. POSTAGE
PAID
Lexington, KY
PERMIT NO. 51

Make plans to attend the 2015 Kentucky Wood Expo

Details inside...

Make your own cutting boards and bird feeders at this year's Expo!