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VIRGINIA FOREST LANDOWNER UPDATE

Events, News, and Information Promoting the Stewardship of Virginia's Forest Resources

INSIDE

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Causes of Streambank Erosion and the Importance of Streamside Vegetation

By Tess Thompson, Virginia Tech

Streams are a common part of Virginia's landscape. Nearly as common are eroding streambanks (figure 1). Streams naturally meander across valley floodplains by eroding sediment from one bank and depositing it downstream on another bank. However, stream channel erosion rates may accelerate over natural conditions when water velocity increases. Water velocity accelerates when streams are straightened, when upstream development increases stormwater runoff, or when dense forested vegetation along the banks, downed trees in the channel, or large pieces of wood are removed. Additionally, livestock can degrade and trample streambanks.

Stream channel erosion is a problem when it damages infrastructure, such as sewer and water lines, utilities, buildings, and bridges. When eroded sediment enters a stream or lake, it becomes a pollutant, making the water cloudy. Excess fine sediments (silts and clays) reduce the diversity and abundance of aquatic organisms, increase the need for dredging, reduce hydropower and water supply reservoir capacity, increase drinking water treatment costs, and serve as carriers for contaminants such as phosphorus, bacteria, heavy metals, pharmaceuticals, and pesticides. Studies show that 85% of the sediment in streams is from streambanks. While considerable effort has been directed toward reducing erosion from agricultural, silvicultural, and urban lands, only recently has attention been given to eroding streambanks.

Streambank erosion processes

Streambank erosion is a combination of subaerial processes, fluvial entrainment, and mass wasting.

1. **Subaerial processes** are climate-related phenomena, such as freeze-thaw cycling, soil drying, and cracking, that reduce soil strength. Controlled mainly by the weather conditions, subaerial processes are largely independent of stream conditions. These processes play a major role in streambank erosion along small streams, depositing soil directly in the stream channel and reducing soil density. Subaerial processes are sometimes described as *preparatory processes* because they increase the susceptibility of soil to erosion during periods of high water flow. Several researchers observed that erosion is greatest during the winter and have attributed this to freezing and thawing of streambanks (figure 2).

2. **Fluvial entrainment** is the removal of individual soil particles or soil clumps (aggregates) from a streambank by flowing water. Because the force of the flowing water on a streambank increases with water depth, the greatest amount of fluvial entrainment occurs near the bottom, or toe, of the streambank, leading to nearly vertical streambank walls. How susceptible streambank soils are to erosion depends on soil properties, including texture, density, amount and type of clay, and organic matter content.

–Streambank erosion, continued on page 3.

Figure 1. Eroding streambank along Toms Creek near Whitethorne, Virginia. Photo by Tess Thompson, Virginia Tech.

Events Calendar

For the most complete listing of natural resource education events, visit the online events calendar at https://forestupdate.frec.vt.edu

SCHEDULED EVENTS - JANUARY - MAY 2025

DATE	LOCATION / DETAILS	EVENT DESCRIPTION	CONTACT
January 28 **Rain date:** **February 11**	Blackstone 9:00 - 5:00 $45*/person	**Learn to Burn: Using Prescribed Fire to Manage Your Woodlands** Private landowners who are interested in using prescribed fire to manage their woodlands can learn how to get started. This class will provide classroom instruction and hands-on field experience.	Jennifer Gagnon jgagnon@vt.edu 540-231-6391
February 20-21	Staunton 2/20 8:00 - 5:15 2/21 8:00 - 12:15 $120* - $175*	**Virginia Association of Forest Health Professionals Conference** Learn about new, emerging, and on-going forest health concerns. Continuing education credits available.	https://www.vafhp.org
February 22	Blacksburg 9:30 - 5:15 Culpeper 8:30 - 4:30 $55*/person; $100*/couple	**Woods & Wildlife Conferences** These Conferences will provide information, tools, and personal contacts to help private woodland owners keep their woods, and the wildlife that live in them, healthy and productive. A variety of topics are offered to appeal to owners of both small & large tracts, and both new & experienced owners. **Register before January 15 and save $5/person ($50/person; $90/couple)**	Jennifer Gagnon jgagnon@vt.edu 540-231-6391 Adam Downing 540-948-6881 adowning@vt.edu
March 13	Orange 6:00 $20	**Introduction to Forest Farming** Learn innovative ways to make your woodland work for you and the environment. We will present a variety of agroforestry topics and demonstrate inoculating logs to grow shiitake mushrooms.	Luke Bello bellol@vt.edu 540-672-1361
March 28 & 29	Appomattox ·3/22 7:15 - 6:00 ·3/23 7:15 - 1:00 ·$65*/person ·$110*/couple	**Central Virginia Beginning Woodland Owner Retreat** A program for those new to active woodland management. A combination of classroom, field trip, and hands-on activities will be used to teach concepts of sustainable woodland management. On-site lodging is available for an additional $40/person/night.	Jason Fisher jasonf@vt.edu 434-476-2147
May 7-9	Roanoke Times and fees vary	**Virginia Forestry Summit** Join natural resources professionals and landowners for this annual networking and education event.	forestrysummit.com

***includes meal(s)**

Camp Woods & Wildlife

Applications are open February 1 – April 11 for the 77th annual Camp Woods & Wildlife. This residential camp features field-based exploration of natural resource career skills for Virginia residents aged 13-16. Camp will be held June 16-20 at Holiday Lake 4-H Center near Appomattox. Campers pay only $95, thanks to generous donations from organizations and forestry partners. Apply or find more information at https://dof.virginia.gov/education-and-recreation/youth-education/camp-woods-wildlife/. Contact camp coordinator Ellen Powell (ellen.powell@dof.virginia.gov) with questions.

ONGOING EDUCATIONAL PROGRAMS

Virginia Master Naturalist Volunteer Basic Training

Available statewide. Dates, times, and fees vary.

People who are curious about nature, enjoy the outdoors, and want to be a part of natural resource management and conservation in Virginia are perfect candidates to become Virginia Master Naturalists.

Visit www.virginiamasternaturalist.org to find a chapter near you. Michelle Prysby, Statewide Coordinator, 434-872-4580.

Fifteen Minutes in the Forest

Online video series. Fourth Friday of each month at 12:15 pm.

Join Virginia Cooperative Extension's Forestry Team for videos about natural resource-related topics. Connect/find past videos:

- **YouTube:** https://www.youtube.com/c/VirginiaForestLandownerEducationProgram
- **Facebook live:** www.facebook.com/VFLEP

Streambank erosion, *continued from page 1*

Research shows that increases in the amount of silt and clay in soils increase their resistance to fluvial entrainment; however, soils with high silt-clay content are more susceptible to the effects of subaerial processes.

Figure 2. Needle ice commonly forms in silt loam soils, disrupting the soil surface and making it more susceptible to water erosion. Photo by Tess Thompson, Virginia Tech.

3. **Mass wasting**, also known as bank failure, occurs when the weight of the bank is greater than the strength of the soil. It often results from increases in bank height or bank angle due to fluvial entrainment and the presence of tension cracks at the top of the bank. Mass wasting depends on the bank shape and soils, as well as the type and density of vegetation. Mass failures often occur following floods. Precipitation and rising streamwater levels increase the moisture content and weight of bank soils. At the same time, the bank height or angle may increase as floodwaters scour the channel bed or bank toe. These changes, combined with the loss of water pressure on the bank as the floodwaters recede, can trigger mass failures (figure 1).

Effects of vegetation on streambank stability

Streamside vegetation has two main effects on subaerial processes. First, dense vegetation absorbs the energy of rainfall, reducing soil detachment by raindrop impact. Second, vegetation insulates the streambank from extreme temperature fluctuations. This insulation minimizes freezing and cracking due to dryness.

Streamside vegetation also reduces fluvial entrainment. Along streams with forested buffers, fallen trees create a series of steps and pools that dissipate stream energy and provide sediment storage. Tree roots growing under stream channels may prevent the channel bed from eroding. Vegetation also provides increased channel roughness that directs high velocity flows toward the center of the channel and reduces the speed and force of water flowing along the banks. Roots physically bind streambank soils and encourage the growth of soil microorganisms that exude sticky substances which act as a type of soil glue that binds the soils together.

Mass wasting can be minimized by woody and herbaceous roots which significantly increase slope stability compared to unvegetated streambanks. The root systems of woody and herbaceous plants stabilize banks by increasing soil strength because plant roots act like rebar in concrete. Even small increases in root density can substantially increase soil strength.

There is some debate regarding which type of vegetation is best, herbaceous (such as grasses) or woody (such as shrubs and trees), as the interactions between vegetation and streambank retreat processes are complex. With regard to subaerial processes, the exposure of the streambank soil to solar radiation and nighttime cooling has a significant impact on soil drying and freezing. Research at Virginia Tech compared the impact of herbaceous and woody vegetation on streambank subaerial processes in western Virginia. Researchers found streambanks with herbaceous vegetation had higher soil temperatures and lower soil moisture during the summer compared to streambanks with woody vegetation. In the winter, however, the woody vegetation provided little protection for streambanks. These areas experienced daily temperature ranges two to three times greater than streambanks under dense herbaceous cover and as many as eight times the number of freeze-thaw cycles.

Both herbaceous and woody vegetation provide increased hydraulic roughness, although the effects of herbaceous vegetation are reduced during high flows because they bend over in the flowing water. Additionally, herbaceous vegetation is absent or reduced during the winter when most channel erosion occurs. In a study following the 1993 Kansas floods, Geyer et al. (2000) showed that areas with herbaceous vegetation experienced an average of nearly 80 feet of bank erosion while areas with woody vegetation had soil deposition.

–Streambank erosion, continued on page 5.

Figure 3. Dense riparian forests along Toms Creek near Blacksburg, Virginia, maintain bank stability, shade the stream, and provide food for aquatic insects. Photo by Tess Thompson, Virginia Tech.

You Ain't from Around Here! They're So Unusual: European Deer Keds (*Lipoptena cervi*)

by Jennifer Gagnon, Virginia Tech

On a Saturday in early November, my husband sent me a text from Pandapas Pond, where he was leading a tree identification walk for the New River Valley Master Naturalists. It simply said "deer keds" with a link to this Penn State publication: https://extension.psu.edu/deer-keds. Apparently, the woods at Pandapas were alive with these insects, a type of biting fly neither of us knew anything about. With over one hundred years of outdoor experience between the two of us, this is a rare occurrence. So of course, I had to do some research.

It turns out these unusual insects are well known to hikers and hunters throughout the northeastern United States. They are unusual in how they reproduce, how they look, how they feed, and how they find hosts.

There are four species of deer keds in the United States. Three are native, one is not. The nonnative European deer ked is the only one found in Virginia and is the subject of this article. It is native to most of Europe, Algeria, eastern Siberia, and northern China. Introduced to the United States in 1907, it is now found throughout the northeast and parts of the mid-Atlantic.

What are deer keds?

European deer keds are obligate parasites, meaning they require blood from a mammalian or avian host to complete their life cycle. They are a type of louse fly in the superfamily *Hippoboscidae*, a family of aberrant biting flies that give live birth. Most flies lay eggs that hatch into maggots. But larvae from flies in *Hippoboscoidea* develop individually inside the mother's body and feed on milk-like secretions in her uterus. When fully mature, the prepupae are born live and immediately pupate (similar to forming a cocoon). The dark pupae rest in the leaf litter for up to 11 months. While female deer keds can produce larvae for up to 10 months, they probably give birth to fewer than 12 larvae.

On warm days the following fall, winged adults emerge from the leaf litter and fly off in search of a host (usually deer). Once a host is located, the deer keds break off their wings to accommodate movement through feathers or fur. Once they reach skin, they begin to feed.

Adult deer keds do not look like your average house fly. They are small (0.2 – 0.28 inches long), brown, with flattened elastic bodies, and six legs. After shedding their wings, they resemble ticks. However, deer keds have segmented bodies (head, thorax, and abdomen); ticks do not.

Deer keds are typically found in the woods. This is probably because the pupae need to overwinter in leaf litter, where they are protected from harsh winter weather. If the pupae are born in snowy areas, they absorb enough heat from the sun to melt the snow, allowing them to reach the protective forest floor.

An adult winged European deer ked looking for a host. Photo by Ramune Vakare, https://creativecommons.org/licenses/by-nc-sa/4.0/.

Impacts of deer keds

European deer keds feed on blood from deer, elk, and people. The blood supplies the energy needed for females to reproduce. Since deer keds shed their wings once they land on a host, they typically feed on the same host their entire life. While increased grooming has been observed on heavily infested deer, keds do not seem to have a negative impact on overall health of deer in the United States.

In cooler weather, people in the woods can find deer keds crawling on their bare hands, necks, and heads (like ticks, they seem to enjoy creeping around in hair). However, people may not notice a bite right away. In fact, bites may not be apparent until days later when they develop into red, hard welts, which are intensely itchy (reminiscent of chigger bites). Most people will be bothered by the welts for two to three weeks; some however, may be bothered for up to a year. Additionally, unlike ticks or mosquitoes that only take one blood meal from a host, deer keds take multiple, smaller blood meals (meaning multiple bites). Adding to their charm, their flattened bodies make them difficult to remove and squish.

Unfortunately, pesky itching is not the only health concern. Deer keds can carry six tick-borne pathogens, including *Bartonella schoenbuchensis* (which may cause deer ked dermatitis in Europe), and *Anaplasma phagocytophilum* (which causes human granulocytic anaplasmosis). Early signs of anaplasmosis include fever, chills, severe headaches, muscle aches, and gastrointestinal distress. However, it is unclear if deer keds can transmit either of these diseases to humans.

–Deer Keds, continued on page 5.

Deer Keds, *continued from page 4*

An adult European deer ked settling in on a host after dropping its wings. Photo by Mary Lou Legrand, https://creativecommons.org/licenses/by-nc-sa/4.0/.

How to prevent deer ked bites

First, timing. Deer keds are active in the fall, so avoiding wooded areas, especially those with high deer populations, can help minimize exposure.

Second, attire. Deer keds appear to be more attracted to dark-colored clothing. So, if you want to be out in the woods in the fall, lighter colored clothing can help protect you.

Neither of these two approaches are useful, however, if you hunt deer. Hunting deer requires hunters to be in the woods, in the fall, typically dressed in dark-colored clothing. So that leaves the third approach, chemicals.

Commercial repellents interferre with insects' odor receptors, essentially hiding humans from them. A recent study found that deer keds did not react to common insect repellents. Why? Well, as we know, deer keds are unusual. Instead of using chemical signals to find their hosts, they use movement. So, while their preferred hosts are deer, they will fly to any large moving object (including people).

Commercial insecticides are designed to kill insects. While the insecticide permethrin does not prevent deer keds from getting on people, it does kill them within 15 minutes of contact. Permethrin-treated clothing can be purchased or you can have your regular clothes treated. These approaches can provide long-lasting protection against deer keds and other pests. But please do not apply permethrin directly to bare skin.

While I am not a hunter, I do hike in the fall. Fortunately, I have yet to encounter these insects… at least as far as I know. Now that I've learned about them, I'll probably see them all the time!

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Streambank erosion, *continued from page 3*

Differences in rooting density and distribution between herbaceous and woody vegetation have implications for fluvial erosion and streambank stability. In general, herbaceous vegetation has a high density of very fine roots (diameters < 0.02 inches) in the top foot of soil. In contrast, roots with diameters greater than 0.02 inches are more common for woody vegetation and those roots are more evenly distributed in the top three feet of soil.

Considering research has shown that erosion resistance has a direct relationship with the density of roots greater than 0.02 inches in diameter, woody vegetation provides better protection against streambank erosion when bank height is greater than one foot. Because herbaceous roots are concentrated in the upper soil instead of at the toe of the streambank (where hydraulic stresses are greatest), undercutting of grass banks is commonly seen (figure 1).

There is considerable evidence that vegetation significantly increases slope stability, reducing the occurrence of mass failures. This increased slope stability is due primarily to mechanical reinforcement, although reductions in soil moisture due to evapotranspiration can further strengthen streambanks.

Alternatively, increases in soil moisture due to higher infiltration rates under vegetation can decrease stability, although these decreases are typically offset by the increase in mechanical strength from the roots.

In addition to considerations of the effects of vegetation on streambank stability, the influence of vegetation on stream ecology should also be considered. Dense streamside forests shade streams, keeping water temperatures cool during the summer. Additionally, the leaves of deciduous trees serve as a significant food source for aquatic insects. Personal observations in the field have shown that forested streams in the eastern United States have nearly vertical, stable streambanks that provide habitat for aquatic species native to the region (figure 3). For streamside ecosystems that were historically dominated by native grasses, such as on the Great Plains, herbaceous riparian buffers may help maintain stream ecosystems.

Reference Cited

Geyer, W. A., T. Neppl, K. Brooks, and J. Carlisle. 2000. Woody vegetation protects streambank stability ensuring the 1993 flood in central Kansas. Journal of Soil and Water Conservation 55(4):483-488.

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If you have streams that you would like to protect, the Virginia Department of Forestry's Riparian Forests for Landowners (RFFL) program provides landowners free, flexible streamside woody buffer installation (tree planting!) plus one year of maintenance. Learn more: https://tinyurl.com/RFFLInformation.

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