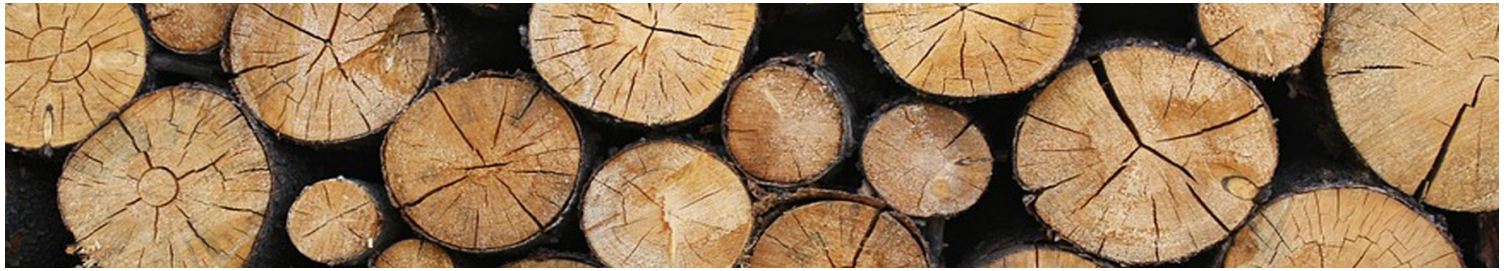


# CU IN THE WOODS

## Clemson Extension Forestry and Wildlife Newsletter



### Summertime Pond Problems

By Tancey Belken

<https://blogs.clemson.edu/fnr/2023/07/07/summertime-pond-problems/>

Warm water is something people look forward to in the summer for fishing, boating, swimming and more. Warm water also contributes to many common pond problems in the summertime. We will cover the 4 most common summertime pond issues and what can be done to lessen their impacts.

#### Excessive Weed Growth

Plants in the water are not inherently bad. In fact, a healthy pond should have some aquatic plant growth. When weeds begin to impede water flow, cover more than 20% of the surface of the water, or start to grow rapidly, they can become a problem. This is a common summertime problem because longer days with more sunlight can encourage the growth of aquatic weeds. Excessive nutrients like phosphorous and nitrogen from the surrounding watershed and warm water temperatures can combine with the sunlight to make previously manageable levels of aquatic plants grow out of control.



Excessive weed growth is a common problem in ponds in the summertime. Photo credit: Tancey Belken, Clemson University.

There are multiple options of control for pond weeds. Mechanical control includes practices like raking or seining. It can be expensive or labor intensive but can be appealing to some landowners who do not want to use other control methods. Biological control consists of practices like using triploid grass carp to manage weed growth. Stocking rates and sizes vary depending on the pond and the severity level. Certain plants are more likely to be controlled through biological control than others. Finally, there is chemical control, which is using an EPA-approved aquatically labeled herbicide. The first step with chemical or biological control is accurately identifying the nuisance weed. After you identify the weed and determine how much needs to be controlled, you can select an herbicide labeled for controlling the weed in question. Anytime you apply herbicides, by law, you must follow the label directions.

For more information on aquatic weed control, visit the HGIC Factsheet on Aquatic [Weed Control](#).

#### Harmful Algae Blooms (HABs)

Harmful algae blooms, or HABs are a hot topic in the news each year. Harmful algae blooms are when certain species of algae grows to excessive levels and can cause foul taste or smell and even produce toxins that can be harmful to humans and other animals. One type of HAB involves cyanobacteria, a type of blue-green algae that causes the water to turn bright green or blue green.

The risk for HABs increase when specific conditions are met. Risk increases

continued on page 2

### In This Edition

#### Summertime Pond Problems

Page 1-2

#### Summer Defoliators: Their Bark is Worse Than Their Bite

Page 3

#### How Your Forests Protect South Carolina Water

Page 4-5

#### Stumpage Price Trends and Resources to Find Mills in Your Local Area

Page 6

#### Grand National Treasure

Page 7-8

#### Find Your County Forestry Association

Page 8

#### Our Extension Forestry and Wildlife Staff

Page 9

#### Upcoming Events

Find out about all of our upcoming events by visiting our events page: <https://www.clemson.edu/extension/forestry/events.html>

#### Looking for more forestry and wildlife information?

Check out our blog page for past articles and other great forestry and wildlife information- [blogs.clemson.edu/fnr](https://blogs.clemson.edu/fnr)

## Summertime Pond Problems cont.



Harmful Algae Blooms (HABs) can appear bright green, or reddish brown. Photo credit: Tancey Belken, Clemson University.

when water is warm (usually above 77°F), the pond is receiving high intensity sunlight, the water is slow-moving or stagnant, and the pond has elevated nutrient levels. Heavy rainfalls after a long drought can also result in a harmful algae bloom, when nutrients from the surrounding landscape are washed into the pond.

Like aquatic weeds, algae are necessary components in

aquatic environments. It is the base of the aquatic food chain and has an important role in improving dissolved oxygen when algae is at a healthy level. However, during an algae bloom, decomposition can cause a large drop in dissolved oxygen. Not all species of algae can create a harmful algae bloom or release toxins. Signs of a HAB include a bright green film on the water, scum, foam or thick layers of floating algae, or even red patches of algae. The water can appear green, blue green, or red, but sometimes the algae is not visible. In the case of a possible algae bloom, keep all people and animals out of the water. Do not use it for livestock or crop irrigation. You can send a sample of the algae to the Clemson Plant and Pest Diagnostic Clinic to identify the type of algae, but they do not test for toxins.

The most effective methods to prevent harmful algae blooms are to prevent stagnant water by using an aerator in the pond to keep the water moving and reduce the amount of nutrients that wash into the pond. This can include soil testing to prevent unnecessary fertilization in the yard, preventing livestock from swimming in the water, and deterring geese from residing in the pond.

To learn more about prevention and treatment, visit this HGIC Factsheet on [Cyanobacteria](#).

### Turnovers

When ponds are deep and temperatures are high, the water can stratify, or form layers of water with different temperatures. The cool water and warm water separate, with cool water sitting on the bottom of the pond and hot water at the top of the pond. In between those two layers is a warm layer of well oxygenated water where the fish will gather, called the thermocline. This nice separation of layers can be disrupted in an event called a turnover.

A turnover happens when the stratified layers in the pond suddenly mix and the dissolved oxygen level in the water drops. The mix happens when there is a sudden change in weather, like a large rain event, heavy wind, or cold front. The fish clustered in the thermocline suddenly lose the well oxygenated water and some will go to the surface of the water to “gulp” air to stay alive. If the fish are not able to breathe, they will die. This event is called a fish kill, and large fish are normally more susceptible than small fish.

The most common time of year for a turnover is late Summer and early Fall, but dissolved oxygen issues can happen any time of year. The most effective way to prevent stratification and improve dissolved oxygen levels is to keep the water moving from top to bottom by using a bottom diffuser. A continuously running bottom diffuser will aerate the water by keeping it moving and will pull the water from the bottom and push it to the top, preventing the water from ever stratifying.

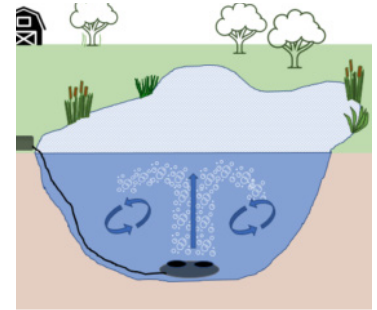
For more information on Turnovers, visit the HGIC factsheet on [Pond Turnovers](#).

### Low Water

It is common for water levels to drop in the Summer. Hot water and strong sunlight lead to increased water loss through evaporation. The impacts are even more noticeable during times of drought. Some ponds receive most or all their water from rainfall and runoff; without it, the levels can drop rapidly. Other ponds may be supplemented from surface or groundwater, in which case the loss of water may not seem as rapid.

If water levels drop significantly, the pond owner may need to harvest fish to reduce the demand for oxygen in the water that is left. The alternative is to add an aerator to the pond to introduce more oxygen into the environment and reduce stress on the fish.

You do not want to add water from a well to bring the water level back up. Well water will likely have a different temperature and/or pH and can shock the fish, killing some. Adding water that is a different temperature than the pond can also lead to stratification, or layers of different temperatures and oxygen levels forming. A change in the weather can force the pond to turnover and cause a fish kill. Lower water in the summer is something that can be expected. The most effective course of action is to aerate the water that is left.



Bottom diffusers circulate water through the entire water column. Graphic by Becky Davis, Clemson University.

# Summer Defoliators: Their Bark is Worse Than Their Bite

By Dave Coyle

<https://blogs.clemson.edu/fnr/2023/07/12/summer-defoliators-their-bark-is-worse-than-their-bite/>

The leaves on a hardwood tree make the food, so it stands to reason that any loss of foliage would be detrimental to tree health...right? Well, not always. Unlike the impacts of girdling (phloem loss) which are detrimental whenever they occur, the impact of foliage loss depends on the season in which it occurs. In early spring, when trees have used stored resources to reflush and grow new leaves, defoliation has the biggest impact because the loss of these newly formed leaves before they have had a chance to make any food means the tree has to use MORE stored resources to make new leaves. Think of it like taking food out of your pantry, going through all the work to make a nice meal, and then someone else comes in and eats it all. Now if you want to eat, you have to go back to the pantry and start over.



Fall webworms can be identified by their whiteish webs that encompass entire branches. Photo credit: Dave Coyle, Clemson University.

Defoliation later in the summer, however, removes leaves that have already been “working” for a while, contributing energy to the roots and essentially “filling the pantry”. This type of defoliation is much less detrimental to a tree. However, several types of caterpillars are known to heavily defoliate branches or trees in the summertime, and their feeding can be quite conspicuous, often looking worse than it really is. Let’s go over several common summertime defoliators on hardwood trees in South Carolina.

Fall webworms are probably the most obvious summer defoliators, as their whiteish webs can encompass entire branches. Starting as tiny caterpillars that wrap a single leaf together, as the caterpillars grow they increase their web size. While smaller trees may be injured, most of this defoliation is cosmetic only, and won’t seriously harm a tree. Common hosts include pecan, sweetgum, walnut, and many others. Adults are about an inch across and white (sometimes with black spots).



Yellownecked caterpillar make a u-shaped defensive posture when disturbed. Photo credit: Dave Coyle, Clemson University.

Several other non-webmaking caterpillars often cause noticeable defoliation on hardwood trees in natural and managed areas. The rosy maple moth adult is a bright yellow

and pink moth, and these caterpillars feed on maple trees. Rarely a tree health issue, individual branches can be completely stripped of foliage. Yellownecked caterpillars are known for the U-shaped defensive posture they make when disturbed. These will feed upon many different tree species, as well as shrubs and blueberry bushes (I know this from experience, unfortunately). Adults are brownish, and look like the end of a stick. There are many species of oakworms, all of which feed on oak trees. These caterpillars have little horn-like structures on the front and back end, likely to confuse bird predators. Adults are silk moths, closely related to larger, more showy moths like the luna moth.



Oakworm moth caterpillars with horn-like structures on the front and back end. Photo credit: Dave Coyle, Clemson University.



Caterpillar of the rosy maple moth feeding on a maple leaf. Photo credit: Dave Coyle, Clemson University.

All of these caterpillars can cause noticeable damage on hardwood trees during the summer months, but rarely is this damage harmful to a tree. Of course, there are exceptions, as newly transplanted trees or young trees are more susceptible, but established trees probably won’t show any lingering ill-effects. In most cases management isn’t necessary, as there are plenty

of natural predators that love to make these big, plump caterpillars into a juicy meal. However, if management is necessary nearly any labeled contact insecticide will provide control, as will physically removing caterpillars by hand or with a strong stream of water.

Find out more about oak pests at <https://hgic.clemson.edu/factsheet/oak-diseases-insect-pests/>

Find out more about fall webworms at <https://hgic.clemson.edu/factsheet/fall-webworm/>

Find out more about maple pests at <https://hgic.clemson.edu/factsheet/maple-diseases-insect-pests/> and <https://hgic.clemson.edu/factsheet/rosy-maple-moth-dryocampa-rubicunda/>

# How Your Forests Protect South Carolina Water

By Janet Steele

<https://blogs.clemson.edu/fnr/2023/07/12/how-your-forests-protect-south-carolina-water/>

South Carolina is a diverse state, and the well-known slogan “from the mountains to the sea” reflects how varied the landscape is across the state’s 20 million acres. One feature that is common across all these landscapes is water. South Carolina has 36 rivers totaling almost 30,000 miles of waterways that can be found in 8 river basins: Broad, Catawba, Edisto, Pee Dee, Salkehatchie, Saluda, Santee, and Savannah. Thousands of miles of streams and thousands of acres of swamps feed the watersheds of these river basins. The National Oceanic and Atmospheric Administration (NOAA) defines a watershed as “a land area that channels rainfall and snowmelt to creeks, streams, and rivers, and eventually to outflow points such as reservoirs, bays, and the ocean.” Multiple watersheds can drain into a single river basin. South Carolina’s surface water accounts for 1.3 million acres, including over 1,600 bodies of water measuring more than 10 acres.

One of the most unique features of South Carolina is the bottomland hardwood forests of the lowcountry. These are the forested swamps in the broad floodplains of streams and rivers. They can vary significantly in their hydrology, from periodic or seasonal flooding to being flooded throughout the year. They serve an essential role in many watersheds since they can store floodwaters, reduce the risk of downstream flooding, and act as a water filtration system. Some researchers have valued these benefits at over \$9,000 per acre annually.



Bottomland Hardwood in Colleton County. Photo credit: Janet Steele, Clemson University.

The eventual output point for a single raindrop in South Carolina is where all South Carolina rivers end, the Atlantic Ocean. The impacts that a single drop of water can have from the time it falls as rain until it flows into the ocean can be determined by how we manage our forestlands. That is why the state’s 12.9 million acres of forests protect our water quality and maintain water resources for important uses throughout South Carolina, including recreation and drinking water.

## Water for Recreation

Outdoor recreation, including water sports and fishing, are an important contributor to South Carolina’s economy. An economic impact study conducted by Clemson University found that in 2005 34% of South Carolinians reported motor boating, 11% said canoeing, kayaking, or rafting was an outdoor sport they participated in, 37% reported freshwater fishing, and 28% reported swimming in a lake or river. While freshwater fishing was not accounted for separately in a more recent study, the South Carolina Department of Natural Resources (SCDNR) reported that the total economic impact of freshwater fishing, hunting, and wildlife viewing in 2012 in South Carolina was over \$2.7 billion. The value of clean water for recreational activities and maintaining healthy aquatic populations

directly impacts the importance of our water resources to our state’s economy.

## Water for Drinking

Less than 1% of the earth’s water is drinkable. And although South Carolina has year-round rainfall and a significant amount of surface and groundwater, a growing concern for our state’s water supply and quality is the availability of clean drinking water. South Carolina’s population is projected to increase by over 450,000 residents between 2025 and 2035. The South Carolina Department of Health and Environmental Control (SCDHEC) reports that over 75% of South Carolina’s residents depend on public drinking water systems, with about 80% of those providers using surface water and 20% using groundwater. Growing populations increase development pressure which in turn threatens forested land. Sixty percent of South Carolina’s surface drinking water passes through a forested watershed, where the trees and forest soils have intercepted, filtered, and stored it.

## Threats to Our Water

Site conversion to other uses besides forestland can reduce the quality and quantity of freshwater. This can impact the availability of drinking water, increase water treatment costs, increase the risk of downstream flooding, and reduce recreational opportunities. Bottomland forests have seen some of the most significant impacts of land conversion in the southeast. Over the last 200 years, 60% of these forests have been converted to agriculture, development, and even other forest uses such as pine plantations. Altering the hydrology of these areas by installing drainage systems has eliminated their ability to function as they did before conversion.

Several years ago, SCDNR was tasked with developing an updated state water plan based on regional water plans for each of the eight South Carolina river basins. Models will be used in each basin to evaluate existing surface and groundwater availability and incorporate future use projections to determine threats to our state water supply. The outcome of the state water plan will be updated policy, regulation, and legislation for the state’s water resource management over the next 50 years.

The forested watersheds in these river basins will play a significant role in ensuring clean, drinkable water quality and quantity. Past studies have found that water treatment costs increase by 20% for every 10% reduction in forest cover within a watershed that provides drinking water. Because of this, funding initiatives are being implemented in regions of the state to permanently conserve forested tracts within these watersheds and improve forest management practices. A prime example is the Savannah River Clean Water Fund (<https://savannahrivercleanwater.org/>). It has brought together municipal water services, state and federal agencies, non-profits, and corporations to support watershed partnerships, conduct outreach activities, hire technical service providers, and raise funding to implement conservation and management practices on private land.

continued on page 5

# How Your Forests Protect South Carolina Water cont.

## How Forests Protect and Clean Water

Trees stabilize soils. The extensive root systems of trees that anchor and feed them hold the soil surrounding them in place. This is particularly important in sloped areas adjacent to channels, streams, and rivers since forested buffers reduce the amount of sediment entering these waterways. Even during periods of heavy rainfall when the forest soils cannot absorb the water as fast as it is falling, overland flow is slowed and spread by the organic material on the soil's surface. Tree roots also create open spaces in the soil as their old roots die, allowing water to move into the soil profile before being slowly released into groundwater recharge or moving into channels that feed above-ground water bodies. The water released by one acre of forest is equivalent to the amount coming off 40 acres of impervious surface, like a parking lot, during the same rainfall event.

The above-ground structures of trees also reduce the impact of rainfall on the soil by intercepting and slowing down raindrops. This process is called interception, and it begins in the leaves or needles of the crown, where raindrops are caught as they fall. The drops then move down the tree as stemflow and are gradually absorbed by the forest floor. Even raindrops not intercepted by the crown are slowed down as they fall through the foliage, making less impact than if falling onto a non-forested area. It has been estimated that a deciduous tree can intercept 500 to 750 gallons of rainfall a year, while coniferous trees can intercept five to eight times that amount.

Trees are also giant water pumps, moving water out of the soil and into the atmosphere through transpiration. As the water moves through the tree, it is utilized for processes the tree uses to live and grow, including photosynthesis and the movement of nutrients. Transpiration is essential in the water cycle and returns water to the atmosphere as water vapor. The amount of water a tree can transpire in a year varies by species and age, but large oak trees have been estimated to transpire 40,000 gallons yearly. The impact of transpiration on soil water levels is most apparent during the dormant season in deciduous forests. When the trees are not actively growing and pumping water, seasonal flooding or high-water tables are often evident through standing water or ponding in low areas and soft, mushy soils.

As contaminated water moves through forested soils, trees can remove nutrients such as phosphorous from animal waste and nitrogen from fertilizer. When these nutrients enter freshwater systems at too high levels, they can impact aquatic ecosystems by encouraging the overgrowth of algae. More algal growth, or bloom, than the water system can handle can reduce oxygen availability for fish and other aquatic organisms, leading to fish kills and even creating toxicity issues for humans and animals that contact the water. Forested buffers adjacent to agricultural and livestock areas can filter runoff before it enters

adjoining water systems.

## Managing Our Forests to Protect Our Water

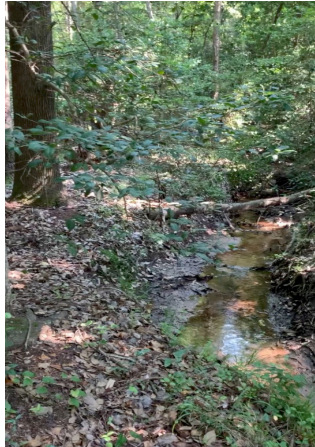
Properly managed forestland improves the quality of water entering watersheds across the state. To ensure the water from their property is not contributing to sediment or pollution issues, all forest landowners should be familiar with South Carolina's Best Management Practices (BMPs) for Forestry. The South Carolina Forestry Commission (SCFC) developed these guidelines to protect our state's water resources by minimizing the impacts of forest operations on our soils. By implementing recommended practices, contamination, soil erosion, and sedimentation into water bodies adjacent to forestry operations can be eliminated, thus maintaining water quality. The SCFC administers the BMP program, and although these guidelines are voluntary, they ensure forestry operations do not violate state and federal regulations related to water quality. The SCFC has foresters around the state who conduct courtesy exams for landowners, contractors, loggers, and forest managers before timber harvesting or other forestry operations to ensure that all BMPs will be implemented adequately on-site. The complete BMP manual can be found at [www.scfc.gov/wp-content/uploads/2021/03/best-management-practices-manual.pdf](http://www.scfc.gov/wp-content/uploads/2021/03/best-management-practices-manual.pdf). More information on the SCFC program can be found at <https://www.scfc.gov/development/best-management-practices/>,

including the most recent compliance report for forestry operations across the state and how to schedule a site visit with a BMP forester.

As forest landowners, we need to understand and accept our responsibility for protecting the watersheds our forest management practices impact. Clemson Extension area forestry agents and water resources agents are available to discuss any forested watershed issues or concerns. You can find your local agent by visiting <https://www.clemson.edu/extension/about/programs/index.html>.

## Resources:

Bottomland Hardwoods  
<https://www.epa.gov/wetlands/bottomland-hardwoods>  
Ecological Forestry Practices for Bottomland Hardwood Forests of the Southeastern U.S.  
<https://foreststewardsguild.org/research-and-management-publications/>  
The Economic Contribution of Natural Resources to South Carolina's Economy  
<https://www.dnr.sc.gov/economic/EconomicContributionsSC.pdf>  
Evapotranspiration and the Water Cycle  
<https://www.usgs.gov/special-topics/water-science-school/science/evapotranspiration-and-water-cycle>  
Frequently Asked Questions About Drinking Water  
[www.scdhec.gov/environment/your-home/drinking-water-protection-program-overview](http://www.scdhec.gov/environment/your-home/drinking-water-protection-program-overview)  
From Root to Tap: How Trees Ensure Fresh Water Supply  
<https://www.nationalforests.org/blog/earth-month-watersheds>  
Healthy Forests for Clean Water  
<https://ncforests.gov/publications/UF0115.pdf>  
Major Rivers and Lakes of South Carolina  
<https://www.dnr.sc.gov/water/river/waterbodies.html>  
Nutrient Pollution: The Issue  
[www.epa.gov/nutrientpollution](http://www.epa.gov/nutrientpollution)  
The Role of Trees and Forests in Healthy Watersheds  
<https://extension.psu.edu/the-role-of-trees-and-forests-in-healthy-watersheds>  
South Carolina Census Data Center  
<https://rfa.sc.gov/data-research/population-demographics/census-state-data-center/population-data/population-projections-2000-2035-rev2019>  
Water Planning Overview  
<https://hydrology.dnr.sc.gov/water-planning-overview.html>



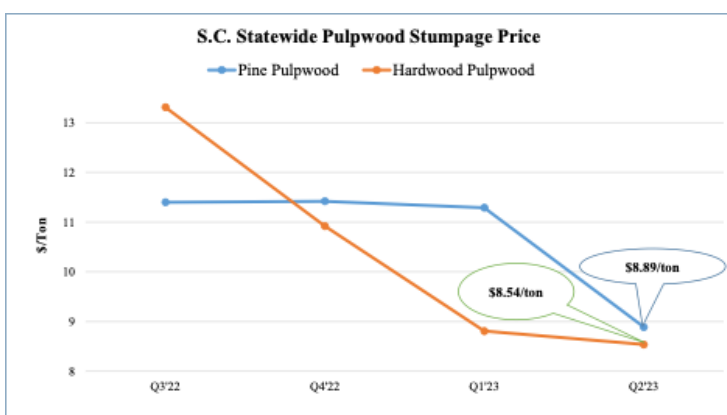
Tree roots stabilize the soil along streams preventing erosion and excess sediment. Photo credit: Janet Steele, Clemson University.

# Stumpage Price Trends and Resources to Find Mills in Your Local Area

By Puskar Khanal

<https://blogs.clemson.edu/fnr/2023/07/13/stumpage-price-trends-and-resources-to-find-mills-in-your-local-area/>

**Pulpwood Stumpage Trends:** In the second quarter of 2023, statewide pine pulpwood stumpage prices averaged \$8.89/ton, while the average hardwood rates were \$8.54/ton in South Carolina. It is a dramatic decline in pulpwood prices from the first quarter of 2022 when pine and hardwood pulpwood stumpages were above \$14/ton. The average prices for pine and hardwood in 2022 (average of all four quarters) were \$12.80/ton and \$13.30/ton, respectively. Prices have been on a downward trend for this year (see figure below). Pine pulpwood prices have seen a sharp decline as compared with hardwood pulpwood prices in this quarter, exactly opposite of what we saw in the last quarter when hardwood prices had a decline of 19% with a 2% slide in pine pulpwood prices.



Graph of S.C. statewide pulpwood stumpage price trends. Credit: Puskar Khanal, Clemson University.

**Sawtimber Stumpage Trends:** Unlike pulpwood prices, sawtimber prices for both pine and hardwood were in upward trajectory in this quarter which is a reversal from the trends seen in the last quarter. The statewide pine sawtimber prices were \$24.38/ton, while mixed hardwood trees sold at \$23.77/ton in the second quarter of 2023. Compared with prices in the last quarter, it is an increase of over 8% for both pine and hardwood trees (see figure to the right). The average sawtimber prices for both pine and hardwood in the year 2022 (average of all four quarters) were \$24.30/ton and \$23.60/ton, respectively. In contrast to the decreasing trends in stumpage prices seen in the last few quarters, average sawtimber prices in this quarter were higher than last year's rates (average of all four quarters of 2022). Sawtimber prices for both pine and hardwood have increased over 8% in this quarter, exactly opposite of what we saw in the last quarter when both prices had a sharp decline in South Carolina.

## CAUTION: WOOD MARKET IS LOCAL.

Stumpage prices for both sawtimber and pulpwood in your local markets could vary significantly as compared to the above statewide averages depending on: size and species composition, quality of timber, total acres and volume, logging operability, distance from nearby mills, and overall market condition. Managed timber stands with large, straight, and quality trees with clear logs (logs without knots or branches) that could be used for lumber,

veneer, or export products generally get higher price. This means, properly managed trees in good health and good quality would likely get more stumpage price than unmanaged trees.

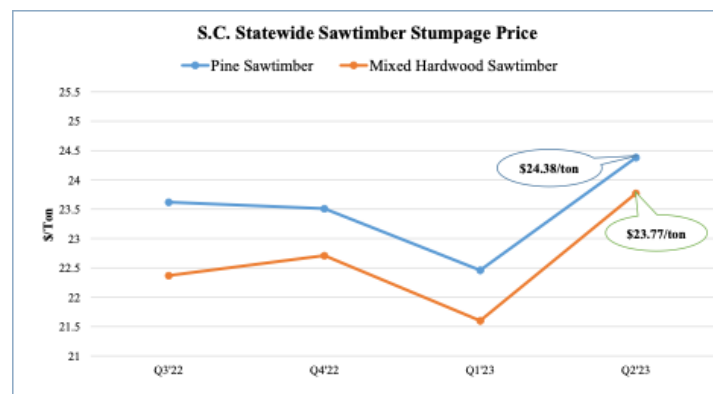
## Know Mills in Your Local Area in South Carolina:

This website (<https://primaryforestproductslocator.org/>) provides a directory of mills (primary forest product companies) that use logs to produce various wood products. It allows you to visualize it on a map or check a list of mills in your county. For example –

- **Step 1:** Select 'Mill Map' in the top menu bar to get to the search options
- **Step 2:** Select filter by location if you want to know mills in your area. Select State ("South Carolina")
- **Step 3:** Select County ("Pickens" or your other choice)
- **Step 4:** Select Wood Type ("Softwood" or "Hardwood")
- **Step 5:** Mill Type ("Sawtimber" or product of your interest). Multiple choices available here.

Now, it should generate a Google map of your interest. The website is a little slow & some choices (particularly the map option) take time to respond. It might test your patience. It would be a useful resource to understand the wood market in your area.

**Data credit:** The sawtimber and pulpwood price data included in this newsletter are published with permission from TimberMart-South Athens, GA 30605 email [tmart@timbermart-south.com](mailto:tmart@timbermart-south.com).



Graph of S.C. statewide sawtimber stumpage price trends. Credit: Puskar Khanal, Clemson University.

# Grand Natural Treasure

By Stephen Peairs

<https://blogs.clemson.edu/fnr/2023/07/12/grand-natural-treasure/>

The common theme for most of my written works have involved some aspect of forestry associated with the southeastern wood “basket”. I was inspired on my recent family vacation to visit several National parks (Grand Canyon, Petrified Forest, Arches, Canyonland, Bryce Canyon, Coastal Reef, and Zion) across northern Arizona and southern Utah. In my opinion, the most spectacular was the expansive 1.2 million+ acre Grand Canyon National Park. Of course, all of the national parks were impressive, however one should allow for at least a full day or more to experience each of the larger parks. If the reader has not visited the Colorado Plateau parks, I strongly encourage them to begin planning and make it happen. This article should provide motivation to kindle interest to take in this our southwestern majestic natural resources! Believe me, the reader will miss a transcendent life opportunity by not slowing down from everyday life and getting out there!

## Colorado Plateau Forestland

The forestland in northern Arizona and southern Utah (within the plateau physiographical region) is more simplistic in regards to species composition compared to our eastern forests. Elevation influences the species composition found across the park. The lowest areas, on the plateau, and up to the mountain peaks have mean elevations of 2,461 feet; 6,352 feet; and 12,600 feet; respectively (US National Park Service).

Arid shrublands and grasses dominate the lowest elevations with exception of boxelder, New Mexico locust, Arizona walnut, and Fremont cottonwoods immediately adjacent to river floodplains. On the mid-plateau elevations, pinyon pine, junipers, and shrubs persist. The most prevalent abundance of tree species are found at higher elevations in montane forests primarily consisting of Ponderosa pine, Gambel oak, white fir, Engleman spruce, Douglas fir, Utah juniper, alligator juniper, Colorado pinyon, and quaking aspen.

At the highest elevations, one might observe the bristlecone pine which are one of the oldest living species on earth. These species can live for thousands of years with the oldest known tree (Prometheus), which was cut down in 1964, being 4,900 years of age. This species is also of particular importance in dendrochronology (study of tree rings) as it can be used to evaluate climatology over thousands of years.

Site index quality is low/poor for the majority of the park. Site index data (timberland productivity) was “difficult” to obtain for areas outside of sites that actually contain Ponderosa pine. Use of the NRCS Soil Survey yielded low

site index values between 60 – 65 (highest values found in the area); base age 50 for Ponderosa pine and Utah juniper. Thus, these species are expected to reach heights of up to 65 feet when they are 50 years of age. Needless to say, the area has minimal potential for quality timber management given the low amount of yearly precipitation [approximately 8 inches per year (US National Park Service)].

## The Wildlife

Multiple mammals can be readily observed while enjoying the park. Small rodents, rock squirrels and cliff chipmunks, are routinely “intermingling” with park guests, especially if they think they might get a free meal. Large ruminants including pronghorn, mule deer, and elk are likely to be seen in select settings in and around the park.

On rockier slopes, bighorn sheep flourish in groups. Even bison were observed on the trip and can be found in select grassland portions in the region. Predator species, including mountain lions and coyotes, also have a presence on the parks.

Reptiles are abundant on the Colorado Plateau as well. The Grand Canyon NP has 22 species of snakes, 18 lizard species, and one tortoise noted in literature (National Park Service). A couple notable species include the Western (Grand Canyon subspecies) rattlesnake, which is only found in Grand Canyon NP, and the venomous Gila Monster. There are five other species of rattlesnakes (Western (Great Basin subspecies), speckled rattlesnake, black-tailed rattlesnake, Prairie rattlesnake, and Western diamond-backed rattlesnake) found in the park itself. Other rattlesnake species also exist within the region and include the Arizona black rattlesnake, midget faded rattlesnake, sidewinder, and Mohave rattlesnake.

Various bird species can also be observed in the region. Two species, the California condor and Peregrine falcon, were nearly extinct but now thrive in the region. As of December 2022, there are a total of 561 condors with 116 located in Arizona/Utah. In particular, the Grand Canyon provides preferred habitat for these species. It is astonishing to watch these birds in the wind at lesser elevations than the viewer’s observation point!



Elk grazing in grassy forest opening in Grand Canyon National Park. Photo credit: Stephen Peairs, Clemson University.



Gambel Oak in Bryce Canyon National Park. Photo credit: Stephen Peairs, Clemson University.



Collared lizard having an insect meal in Petrified Forest National Park. Photo credit: Stephen Peairs, Clemson University.

## Grand Natural Treasure cont.

### Petrified Wood

The Petrified Wood NP located in Northern Arizona was once rainforest located near the equator on the southwestern edge of the supercontinent Pangaea. Most of these fossilized wood pieces are from an extinct conifer species (*Araucarioxylon arizonicum*). These trees lived approximately 225 million years ago. When they fell, the logs were quickly covered with sediment containing volcanic ash and organic matter. Silica from the ash was dissolved by groundwater and formed quartz crystals that replaced the organic matter. Iron oxide combined with the silica to create the varied color patterns observed today.



Petrified log piece at Petrified National Park. Photo credit: Stephen Peairs, Clemson University

### After-Thoughts

When one looks over the Grand Canyon Rim for the first time, an overwhelming sense of awe and grandeur touches the soul. Your minuteness is revealed as you gaze not only into the vastness of open land that stretches to both ends of your visual vantage points, but also the depth of the riverbed in the far distance (ranges from 6 – 19 miles pending hiking trail). When this moment occurs, take a deep breath, shed a tear, and stand amazed at the natural wonder. Watch the shadows of the clouds as they “dance” across



The Delicate Arch in Arches National Park. Photo credit: Stephen Peairs, Clemson University

the undulations of the landscape creating an ever-changing palette of color and contrast. The surreal feeling can be described as unbelievable at a minimum. My wife stated it best, “it feels like we are in a green screen image... how can this be real?”.

This feeling of awe can be expected at the multiple other national parks as well. The color combinations of the hoodoo formations in Bryce Canyon, the checkerboard mountain walls of rock in Zion, the timeless (but slowly vanishing) sandstone arches/windows at Arches, etc. In all of the landscapes that I have seen, none are as impressive as those I witnessed on the national park tour. I implore the reader to follow their adventurous nature and head westward. You and your loved ones will truly be blessed and even have a new perspective on life!



A section of The Hoodoos in Bryce Canyon. Photo credit: Stephen Peairs, Clemson University



Grand Canyon overlook. Photo credit: Stephen Peairs, Clemson University

## County Forestry Associations

**Abbeville County  
Forest Landowners Association**  
Contact: Stephen Pohlman  
[spohlma@clemson.edu](mailto:spohlma@clemson.edu)

**Darlington/Florence  
Landowners Association**  
Contact: TJ Savereno  
[asavere@clemson.edu](mailto:asavere@clemson.edu)

**Laurens County Forest  
Landowners Association**  
Contact: Jeff Fellers  
[fellers@clemson.edu](mailto:fellers@clemson.edu)

**Salkehatchie Forestry Association  
(Allendale, Bamberg and Barnwell)**  
Contact: Janet Steele  
[jmwatt@clemson.edu](mailto:jmwatt@clemson.edu)

**Aiken County  
Forestry Association**  
Contact: Janet Steele  
[jmwatt@clemson.edu](mailto:jmwatt@clemson.edu)

**Edgefield County  
Forestry Association**  
Contact: Stephen Pohlman  
[spohlma@clemson.edu](mailto:spohlma@clemson.edu)

**Lexington County  
Forestry Association**  
Contact: Janet Steele  
[jmwatt@clemson.edu](mailto:jmwatt@clemson.edu)

**Saluda County  
Forestry Association**  
Contact: Stephen Pohlman  
[spohlma@clemson.edu](mailto:spohlma@clemson.edu)

**Anderson Forestry &  
Wildlife Association**  
Contact: Carolyn Dawson  
[dawson4@clemson.edu](mailto:dawson4@clemson.edu)

**Greenville Forestry &  
Wildlife Society**  
Contact: Carolyn Dawson  
[dawson4@clemson.edu](mailto:dawson4@clemson.edu)

**Lowcountry Landowners Association  
(Beaufort, Colleton, Hampton,  
Jasper)**  
Contact: Amanda Taylor  
[ast4@clemson.edu](mailto:ast4@clemson.edu)

**Sumter County Forest  
Landowner Association**  
Contact: Ryan Bean  
[rbean@clemson.edu](mailto:rbean@clemson.edu)

**Calhoun-Orangeburg  
Forest Landowners Association**  
Contact: Janet Steele  
[jmwatt@clemson.edu](mailto:jmwatt@clemson.edu)

**Greenwood County  
Forestry Association**  
Contact: Stephen Pohlman  
[spohlma@clemson.edu](mailto:spohlma@clemson.edu)

**McCormick County  
Forestry Association**  
Contact: Stephen Pohlman  
[spohlma@clemson.edu](mailto:spohlma@clemson.edu)

**Tri-county Forestry Association  
(Berkeley, Charleston, Dorchester)**  
Contact: Amanda Taylor  
[ast4@clemson.edu](mailto:ast4@clemson.edu)

**Chesterfield County  
Forestry Club**  
Contact: Ryan Bean  
[rbean@clemson.edu](mailto:rbean@clemson.edu)

**Kershaw County Forest  
Landowner Association**  
Contact: Ryan Bean  
[rbean@clemson.edu](mailto:rbean@clemson.edu)

**Newberry County  
Forestry Association**  
Contact: Jeff Fellers  
[fellers@clemson.edu](mailto:fellers@clemson.edu)

**Williamsburg County  
Forest Landowners Association**  
Contact: Tancey Belken  
[tanceyc@clemson.edu](mailto:tanceyc@clemson.edu)

**Contact the Association nearest to you to find out about upcoming meetings!**





Several members of our Clemson Extension Forestry and Wildlife Program Team had the opportunity to participate in a portable sawmill training last fall. Team members from left to right include: Jaime Pohlman, TJ Savereno, Ryan Bean, Patrick Hiesl, Matt Burns (Extension Leadership Team), Jeff Fellers, Janet Steele, Cory Heaton, Stephen Pohlman, Derrick Phinney. Photo credit: Kathy Coleman, Clemson Extension.

## Contact our Agents:

<b>Agent</b>	<b>Email</b>	<b>Counties Covered</b>
Ryan Bean	<a href="mailto:rbean@clemson.edu">rbean@clemson.edu</a>	Chesterfield, Fairfield, Kershaw, Lancaster, Sumter, Richland
Tancey Belken	<a href="mailto:tanceyc@clemson.edu">tanceyc@clemson.edu</a>	Berkeley, Charleston, Florence, Georgetown, Horry, Marion, Williamsburg
Carolyn Dawson	<a href="mailto:dawson4@clemson.edu">dawson4@clemson.edu</a>	Anderson, Cherokee, Greenville, Oconee, Pickens, Spartanburg
Jeff Fellers	<a href="mailto:fellers@clemson.edu">fellers@clemson.edu</a>	Chester, Laurens, Newberry, Union, York
Derrick Phinney	<a href="mailto:dphinne@clemson.edu">dphinne@clemson.edu</a>	Statewide Program Team Leader
Jaime Pohlman	<a href="mailto:jaime@clemson.edu">jaime@clemson.edu</a>	McCormick, Statewide Communications Responsibilities
Stephen Pohlman	<a href="mailto:spohlma@clemson.edu">spohlma@clemson.edu</a>	Abbeville, Edgefield, Greenwood, McCormick, Saluda
TJ Savereno	<a href="mailto:asavere@clemson.edu">asavere@clemson.edu</a>	Clarendon, Darlington, Dillon, Florence, Lee, Marlboro
Janet Steele	<a href="mailto:jmwatt@clemson.edu">jmwatt@clemson.edu</a>	Aiken, Bamberg, Barnwell, Calhoun Lexington, Orangeburg
Amanda Taylor	<a href="mailto:ast4@clemson.edu">ast4@clemson.edu</a>	Allendale, Beaufort, Charleston, Colleton, Dorchester, Hampton, Jasper
<b>Specialist</b>	<b>Background</b>	
Lance Beecher	Aquaponics, Aquaculture and Fisheries	
Dave Coyle	Forest Health and Invasive Species	
Cory Heaton	Wildlife Management	
Patrick Hiesl	Forest Operations and Forest Products	
Puskar Khanal	Forest Economics	
Marzieh Motallebi	Ecological Economics and Carbon Credits	
Stephen Peairs	Forestry, Silviculture, and Hardwood Management	

Newsletters are archived online at:  
<https://www.clemson.edu/extension/forestry/resources/newsletter.html>

Newsletter edited by Jaime Pohlman and reviewed by Amanda Taylor

Clemson Extension Forestry and Wildlife Program Team-  
 Contact: Derrick Phinney [dphinne@clemson.edu](mailto:dphinne@clemson.edu)

## Follow Us Online

@fnrclemson



**COOPERATIVE EXTENSION**  
 College of Agriculture, Forestry and Life Sciences

Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, gender, religion, national origin, disability, political beliefs, sexual orientation, gender identity, marital or family status and is an equal opportunity employer.