National Park Service
U.S. Department of the Interior

Old-Growth Bottomland Forest Research and Education Center
Congaree National Park

Hopkins, SC

Liana Research at Congaree National Park

Research Summary

Above: Lianas, or woody vines, are abundant, diverse, and important at Congaree National Park. Research at the park is helping scientists around the world understand liana ecology.

What is a Liana?

Lianas are woody vines that have roots in the soil but reach for light by growing on, over, and around a tree, snag, or other "trellis." Lianas may climb using many different adaptations including twining stems (to grab around large branches or trunks), tendrils (non-stem features that grow to grab smaller features like twigs), adhesive roots (to grab rough surfaces like bark), hooks, and thorns.

Lianas affect the forest around them in many ways. They compete with other plants for light, water, and nutrients. They also increase the chance and extent of canopy damage from forest disturbances such as hurricanes and logging operations. Lianas weigh heavily on their host trees, increase the drag from high winds, and pull on their host tree if connected to another falling tree. Lianas also affect forest recovery after such a disturbance. They recover quickly because they are flexible, can grow sideways, and often grow "clonally," whereby a plant "clone" roots and re-sprouts from a broken leaf or stem. This quick recovery shades forest floor, affecting competition between recovering tree species that are more or less shade tolerant.

Scientists are still working to understand the ecological roles lianas play in forests all over the world. Recent research at Congaree National Park is helping to address many of these questions.

Congaree Lianas

Lianas are an important and diverse part of the floodplain forest ecosystem at Congaree National Park. Three common examples are poison ivy, trumpet creeper, and wild grape (sometimes known as bullace, scuppernong, or muscadine). Scientists have counted at least 28 liana species at the park. These species represent approximately four percent of the park's vascular plant biodiversity. In most temperate forests, by comparison, lianas only make up about two percent of the vascular plant biodiversity. Regionally, Congaree's 28 species represent over 62 percent of the 45 liana species found across the Carolinas.

Some lianas at Congaree National Park may even be older than the park's champion trees! Scientists have found wild grape vines almost 9.5 inches across. Although these vines' heart wood is rotted out, growth rate projections suggest that they could be over 240 years old! Many lianas may also, technically speaking, be clones that have re-sprouted from older plants through many generations. The actual, original seed may have sprouted centuries ago.

Lianas are Changing Around the World

Over the last several decades, scientists around the world have noticed that lianas are expanding their ranges and generally increasing in abundance, density, and size. Scientists are still

Continued on reverse

Continued from previous

sorting out the details, but the following factors are all related, both directly and indirectly, to human activity:

1. *Carbon dioxide (CO_2).* Lianas (especially poison ivy!) grow faster under increased CO2 levels because they have a high leaf area relative to stem size. Humans have increased CO2 levels by burning fossil fuels.
2. *Global warming.* Lianas freeze easily, but warming with climate change allows them to expand their range.
3. *Drought stress.* Lianas often grow deep roots that can tolerate drought stress associated with climate change.
4. *Habitat fragmentation.* Lianas thrive in forest margins artificially fragmented by roads, fields, and clear cuts.
5. *Invasive species.* People have introduced liana species that locally out-compete native vegetation for limited resources. Some examples include Kudzu, Chinese Wisteria, Japanese Honeysuckle, and English Ivy.

The implications of increased liana growth are not well understood. Over time, however, they will change the way forests develop, store carbon, and provide resources for countless species - including people.

Liana Research at Congaree

Scientists from the University of Georgia and the Ohio State University have included lianas in long-term forest monitoring studies at Congaree National Park. Studies have focused on areas disturbed by Hurricane Hugo (1989) as well as areas disturbed by historical logging activity. For years, scientists have systematically identified, sampled, and monitored thousands of lianas and other plants in plots around the park. The data have allowed scientists to study changes in liana populations, growth rates, and host tree relationships. These results represent some of the most detailed and significant temperate forest liana data in the world. Highlights from this research include:

1. *Lianas increased in density, basal area (stem area), and growth rate across the park during the late 20th century.* Increases were greatest in areas with significant disturbance, but not limited to these areas.
2. *Sweetgum trees were more likely to be liana host trees than other trees -* especially for poison ivy.
3. *1970's logging disturbance affected liana distribution.* Rattanvine was generally more common in logged areas. Clear-cuts had more Virginia creeper and wild grape. Select-cut areas had more wild grape. Salvage logged areas had more poison ivy.
4. *Hurricane Hugo changed liana populations.* The storm initially killed many lianas by damaging host trees, but lianas recovered very quickly. Virginia creeper and wild grape populations nearly doubled their basal area within 16 years.

Trumpet Creeper Versus Poison Ivy

In 2005-2006, scientists examined the growth histories of trumpet creeper and poison ivy by analyzing stem cores that revealed annual growth rings (basically like tree rings). The largest trumpet creeper sampled was 5.75 inches across. The largest poison ivy sampled was 5.31 inches across. Highlights from this research include:

1. *The oldest trumpet creeper was 38 years old,* while the oldest poison ivy was 58 years old. Older (larger) trumpet creeper stems were found, but these were prone to "heart rot" that removes the inner rings and makes ring counting impossible.
2. *These two species have different growth histories.* Young trumpet creeper vines initially grew very fast, but then slowed down over time. Poison ivy had a more constant growth rate for the first 30 years and then began to grow faster.
3. *These two species prefer different host trees.* Trumpet creeper prefers to grow on smaller host trees and small branches in the upper canopy. Poison ivy prefers to grow on large branches and large tree trunks (especially sweetgum). These differences make trumpet creeper generally more susceptible to host-tree wind damage than poison ivy, which has a more stable trellis.
4. *Both species experienced "releases,"* or periods of increased growth, following disturbance. In areas of high hurricane damage, poison ivy growth rates were especially high for up to 8 years. Trumpet creeper growth rates increased slightly but, over the long term, were generally slower in areas of high damage than in undamaged areas. This was because trumpet creeper vines suffered more initial host-tree-related damage and tended to grow slower with age. Conversely, in areas of low hurricane disturbance the trumpet creeper vines were generaly larger than poison ivy vines.

For More Information

1. *Check out a 2011 National Science Foundation news article about a study that included Congaree liana data with other data from around the world:* http://www.nsf.gov/news/news_summ.jsp?cntn_id=119057