

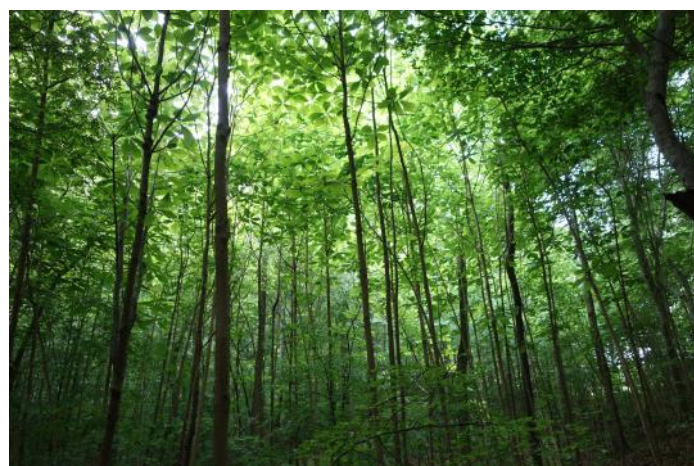
Friends of Plant Conservation

Field Notes

NEWSLETTER OF THE FRIENDS OF PLANT CONSERVATION

VOL. V, ISSUE 2, JUNE 2013

REDLAIR VISIT



There is more to Redlair Farm & Forest than bigleaf magnolia, but nothing else quite so spectacular in May. Haywood and Sabine Rankin, Redlair owners, invited members of FoPC to tour the land and see the trees in full bloom on May 19th.

Though in the midst of a rainy week, the weather cooperated and it was a beautiful day, perfect for traversing some of the many trails Haywood has cleared, past Kalmia in bloom, native bamboo, fairy wand, trillium, Jack-in-the-pulpit, and on to the towering magnolias. Many thanks to Haywood and Sabine!



June 2013

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FROM THE PRESIDENT

Now that the long, warm and humid months are stretching out in front of us, the Plant Conservation Program staff is working full time to assure that the native plants currently growing in protected state-owned and partnership preserves can survive and flourish. One of the most significant threats to these populations is presence of invasive plants in our preserves. These plants may be true invasives, spreading virtually unchecked in environments far from their native habitat, or native plants growing successfully—clearly too successfully—in areas where populations of imperiled plants share the habitat. Both of these conditions threaten the continued existence of these rare plants in their native habitats.

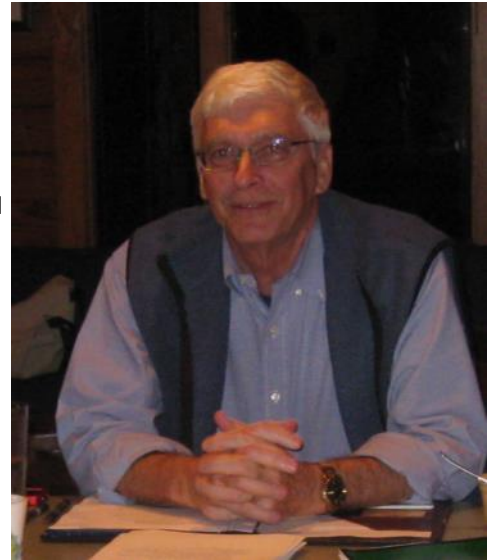
This summer, PCP staff and volunteers are attacking the remaining autumn olive (*Elaeagnus umbellata*) on parts of the Redlair tract. While Haywood Rankin (whose family currently owns Redlair), has nearly extirpated the olive from Redlair singlehandedly, a few pockets of resistance remain. Only when the olive has been eradicated or reduced to very small populations, will native plants of special concern be assured an opportunity to thrive at Redlair.

On other preserves, a native species, loblolly pine (*Pinus taeda*) threatens to alter the habitat of native plants to a point where their persistence cannot be assured. Using a combination of hand cutting, hand application of herbicides, and fire, PCP staff and volunteers have reduced competition for light and nutrients by the fast growing pines thereby giving native shrubs and herbs the opportunity to prosper on PCP Preserves.

If you are interested in joining other individuals of like mind, serving as a volunteer for the Plant Conservation Program can be a fulfilling activity. If you support the goals of the Friends of Plant Conservation, become a member and help this organization assure that populations of North Carolina imperiled plants continue to exist. In joining, you will help the Friends of Plant Conservation serve our North Carolina plant-loving community in guaranteeing that future generations will inherit natural environments replete with examples of our imperiled native plants.



A few of the volunteers tackling autumn olive at Redlair.



~ Paul Hosier

Field Notes

STAFF REPORTS



Lesley Starke, Research Specialist, NCPCP, at Harvest Field with *Helianthus schweinitzii*.

After a long wait, spring is really here, and now it's time for the May and June flowers! The Plant Conservation Program, with help from Preserve Stewards and other volunteers, is heading out to the Preserves and a few other sites to count some of the imperiled plant populations across the state.

What are we counting, and why? This spring we are focusing our efforts on Bunched Arrowhead (*Sagittaria fasciculata*) and Mountain Sweet Pitcher Plant (*Sarracenia jonesii*) in the mountains, (Hoary Puccoon (*Lithospermum canescens*) and Smooth Coneflower (*Echinacea laevigata*) in the piedmont, and Rough-leaf Loosestrife (*Lysimachia asperulifolia*) and Venus Flytrap (*Dionaea muscipula*) in the coastal plain. Specifically, we hope to determine the relative health and stability of these populations by measuring their sizes (plant counts as well as area of occupancy) and the rates of flowering.

PCP has three primary types of survey projects: (1) assessing the impacts of management activities by comparing a population's size and vigor before and after particular treatments such as forest thinning or controlled burning, (2) resurveying sites that have been visited for several years in a row to determine longer-term trends and population fluctuations, and



***Sagittaria fasciculata*, bunched arrowhead, at Bog Fork Bog Preserve. Courtesy Tom Baugh.**



***Lithospermum canescens*. hoary puccoon. In full bloom shortly after a controlled burn .**

(3) to revisit known sites that have not been surveyed in a long time to help bring records up to date to facilitate state-wide assessments.

The information we gather during these flower surveys helps to guide management activities on the Plant Conservation Preserves and other protected lands across North Carolina.

~Lesley Starke

STAFF REPORTS



David Welch, PCP Administrator, participates in Hebron Road workday.

My first three months as Plant Conservation Program Administrator have been a whirlwind of people, properties, and plants. My transition from research-based positions in the academic and private industries to an administrative one in the public sector has been fascinating from many different perspectives. I am riding a steep learning curve that is often exciting. What has been thrilling and heartening is learning about the tremendous progress protecting imperiled plants in North Carolina. PCP preserves extend over 13,000 acres from the coast to the mountains. Restoration initiatives are augmenting population levels through targeted species propagation and are improving the habitat through prescribed burning.

We are facing uncertainty and a new set of challenges in continuing our successful land conservation and stewardship initiatives. State-based funding sources for these opportunities

are contracting due to fiscal belt-tightening. We anticipate reductions in Federal funding as well. In light of these likely reductions, PCP needs to diversify the way it obtains funds so we can protect more imperiled species and continue efforts restoring endangered plants.

One way to diversify is to strengthen private and public

partnerships. PCP is working with the NC Forest Department on establishing burning procedures in order to ensure we are doing everything we can do to keep our restoration activities safe. We are also working with the NC Forest Department's research station in order to find the best way of transforming loblolly pine plantations to long leaf pine savannas. These bonds will enable us to conduct more of the vital restoration initiatives enhancing species habitat.

With the private sector, The Nature Conservancy has been a partner in the Boiling Spring Lakes complex of Brunswick County. Also in this area we are beginning to build a relationship with Orton Plantation. They have made significant progress restoring over 3000 acres of long leaf pine savanna and other fire-dependent plant communities. We are working with them along our shared borders by addressing issues such as access and prescribed burning together. In the mountains, we are working with Carolina Mountain Land Conservancy on bog monitoring and stewardship. Most important is PCP's partnership with FOPC. Volunteer stewards log many hours on monitoring and restoration efforts. FOPC board members spearhead land protection efforts and give the program invaluable advice on program direction.

PCP has had considerable success partnering for the sake of preserve management and land conservation. We hope to leverage these achievements into funding opportunities with private foundations. FOPC is a crucial partner in this initiative because a non-profit can take advantage of opportunities a state agency cannot. PCP and FOPC will find these opportunities by cultivating new relationships and communicating the good work we have already done and the plans we have for the future.

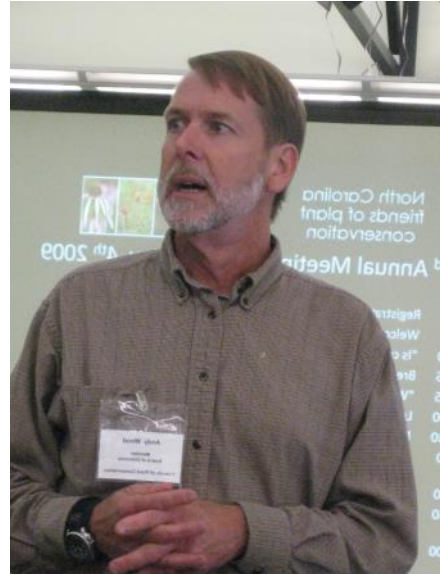
~David Welch



BOARD REPORTS



Camille Collins, FoPC Secretary



Andy Wood, Education K& Programs Committees

My background in biology started in the conservation of endangered and threatened animals such as marine sea turtles and gopher tortoises in Florida. I quickly learned that in today's world, conservation biology goes hand-in-hand with invasion biology. I found myself also working to manage invasive animal species as well as plants. Between my full-time job and extracurricular activities, I continue to work in these two areas and thoroughly enjoy it.

I currently work at NC State University in the Center of Integrated Pest Management where I research potential invasive species and maintain a database that is used by the United States Department of Agriculture. Aside from my full-time job, I am a contractor at the Museum of Natural Sciences in Raleigh that teaches environmental education programs to children between the ages of 3 - 10 years of age.

As secretary of FoPC, my main responsibility is to record the meeting minutes and distribute them to a board members, ensuring everyone is up-to-date on FoPC activities. I currently serve on the Annual Meeting Committee, which is responsible for planning the 6th Annual FoPC Meeting to be held in Wake Forest, NC this year. Outside of FoPC, I am actively involved in planning (and attending) monthly field trips for the Margaret-Reid Chapter of the North Carolina Native Plant Society. I also volunteer in the Reid garden, which entails mostly pulling weeds with a great group of people.

~ Camille

As a phenological point of interest, I have a photo of a red maple that was bearing near fully formed seeds in early February (2 Feb). This is about four to five weeks earlier than we usually see in spring. An interesting point considering recent news from the climate community telling us plant flowering may be five weeks sooner by 2100. I suggest the "predictors" step away from their computers and take a stroll outside so they can see spring is already in gear a number of weeks earlier than just a few decades ago. In other words, we don't need to wait for 2100 to see changes in plant and wildlife behavior already in play as a consequence of our ever-changing climate. And as this year is showing us, weather, also a consequence of climate, is the fickle variable that makes short-term nature predictions so unreliable. Our predictive models might be more helpful if it were not for the pesky vagaries that algorithms just can't cope with.

My point being, the longer we focus on 2100 as the time to expect changes in the world around us, as a result of climate change, the longer it will be before we take action to respond to those changes. Our real imperative of course, is to enact education programs designed to help people understand climate changes are in play now, with consequences already happening, and observations of both are available for all to see; observations we ignore at our own peril.

~ Andy

UNWANTED GUEST

For the last several years I have been noticing a plant around the Piedmont that I used to associate with the areas much further south (Florida & Texas).

It was frustrating when the plant, *Youngia japonica*, was found along various garden beds and edges at my own house, but is much more concerning on plant conservation preserves and regional natural areas. The species is apparently native to Asia and becoming well established worldwide. I found a dense, and apparently spreading colony on Preserve land just upslope from NC's only population of Tall Larkspur (*Delphinium exaltatum*).

One of our new Land Management technician, David Tart's first "on the ground" jobs has been to hand pull this infestation. Most reports consider this an annual, while others suggest biennial. Our experience is the species develops a fairly stout taproot which can be easily pulled when the soil is moist.

Most of the plants, seem to flower in April in the Piedmont, with many setting seed by mid-May. Often times, the flowers stay closed until midday, as shown below. The pale green, toothed margin rosettes emerge early and perhaps into at least the mi

~ Rob Evans



Youngia japonica.

SPRING SURPRISE



Mimi Westervelt

In mid-April I made a brief visit to one of the isolated portions of the Eno Diabase Sill Preserve when I blundered into an unexpected plant. Two small stems (less than 8" tall) blended in almost perfectly with the surrounding hardwood leaf litter. While I immediately recognized it as an orchid, I had no idea which species. I must admit I did little to figure out the identity, until several days later I happened to mention it to Mark Rose, who immediately identified an image I sent him: *Corallorhiza wisteriana*.

When Mark & David McAdoo both mentioned they had never seen the species in NC I felt somewhat ashamed for not recognizing the identity and significance earlier and "getting the word out." I soon found that the plant flowers only for a few days and quickly fades thereafter. Although the Natural Heritage Program has reports of the species from 17 counties, almost statewide, many of these have not been observed in many decades. This is the case for Durham where the species was considered "historical" in the county. Importantly, this finding means the species is now "extant" in Durham County.

This record is a first for the Plant Conservation Preserve system where it will hopefully survive, if not thrive!

Although we have previously conducted prescribed burning on the tract where this was found, it appears this species is not a typical fire-adapted species. Apparently all members of the genus are "obligate mycoheterotrophs", which means



Rob Evans, 2012.

Wister's Coral Root (*Corallorhiza wisteriana*): Eno Diabase Preserve/Durham.

they must parasitize fungi to obtain critical nutrients; there is a strong suggestion the genus feeds on 2 main families of fungus (Russelaceae & Thelephoraceae). One group of authors found the abundance and local distribution of a related species in the genus was linked to annual precipitation and winter temperatures.

~ Rob Evans



Post-burn population explosion.

This state threatened species is known to occur in two Piedmont counties in North Carolina. We updated the population status by visiting each known site and counting the number of stems present. The following summary compares our observations to the most recent data in the Natural Heritage Program (NHP) database.

NHP records 9 sites in Durham & Granville counties. We located 3 new (previously unrecorded by NHP) sites. The largest of the new sites has the state's 2nd largest population but occurs in an unprotected powerline corridor. One site is now extirpated. Three populations exist only in artificially cleared powerlines or rights of ways where long-term persistence may be unlikely. Five populations are protected and 4 of these have recent fire management which appears necessary to increase population numbers. All 5 protected populations appear to have increased in comparison with previous population estimates. We counted 3,654 stems statewide; 74 % of these are located in Granville County spread across 5 sites; 64% of the NC stems are found on sites we considered "protected".

NOTEWORTHY PROTECTED POPULATIONS

Eno Diabase Plant Conservation Preserve: We counted 469 plants; the last observation recorded by NHP listed 50 flowering plants in 2005 (just after we acquired this tract and began to manage this property)

HOARY PUCCOON (*Lithospermum canescens*) Monitoring Update

Blue Indigo Slopes (Owned by Eno River Association; first prescribed burns on site conducted by PCP in 2012 & 2013); We counted 419 plants; the last observation recorded by NHP listed 6 plants in 2006.

Picture Creek (Managed by NCDA&CS Research Stations, with support & encouragement of PCP; 1st prescribed burned on much of the site conducted in 2012): We counted 1212; the last observation recorded by NHP listed 350 plants in 2009
Penny's Bend Nature Preserve (managed by NCBG; most recently burned jointly by NCBG & PCP in 2013). We counted 45; the last observation recorded by NHP noted "a few vegetative plants..." in 2010.

Butner Cedar Glade Plant Conservation Preserve (established 2012; the only management conducted thus far has been limited invasive species control): we counted 182 stems on the Preserve; the last NHP report noted 50-75 plants in 1986.

~ Rob Evans and Lesley Starke



Lithospermum canescens, hoary puccoon

May 10th saw a parting of the clouds after what seemed to be two solid weeks of rain, so PCP took advantage of the respite and loaded up tools and staff to tackle overgrowth and invasives at Hebron Road preserve in Durham. The area had been under agricultural use for many years before being allowed to return to a more natural state. In the intervening years, invasives and native plants not “native” to the area also moved in, crowding out some of the more desirable plants.

Hebron Road boasts a small and growing population of *Echinacea laevigata*, smooth coneflower. To keep the population healthy and expanding, carefully thinning the canopy is necessary, keeping the trees most likely to have been native to the habitat, and removing those that moved in while sitting fallow. Herb and Pat Amyx (Hebron Road Preserve Stewards), as reported earlier, have propagated some of this population and replanted them elsewhere on the Preserve.

To further open the canopy (initial work was done by Herb, Pat, and Charlie Kidder to remove maples, poplars, sweet gums), some oaks were removed and white and green ash were selectively removed. The result of that work is seen in the photo at the bottom right, giving a natural, healthy look to the area with dappled sunlight needed by the Echinacea. This spring, a few more ash trees were removed so those remaining would grow strong. When asked why *Ilex decidua* were being removed, Rob, an ecologist who carefully studies the land and plant communities, responded that as they are not fire dependent, as are the Echinacea and other species on the site, the hollies were likely not native to the site.

While David W. was busy removing multi-flora rose and privet, which was sprouting in abundance, Herb worked his magic clearing an area for young Echinacea plants. Yari, Lesley, David T. and Rob thinned trees, which were dragged out of the site by Mimi, Kathy, April, and David W.

Other plants spotted during the day were *Parthenium integrifolium* (wild quinine), *Chrysogonum virginianum* (green & gold), *Menispermum canadense* Canada moonseed), *Hexastylis spp.* (wild ginger), *Salvia lyrata* (lyre-leaved sage), *Clematis ochroleuca* (curlyheads), *Calystegia spithamea* (low bindweed), *Zizia aurea* (golden Alexander), *Cynoglossum virginianum* (wild comfrey), and *Corylus Americana* (hazel).

Working on PCP preserves is satisfying in many ways: fresh air, sunshine, hard work, and friendship—not to mention the satisfaction of participating in habitat restoration.



Echinacea laevigata, smooth coneflower



What the forest looks like before (above) and after clearing (below).



Randall honored for work with imperiled plants



CHAPEL HILL – Dr. Johnny Randall, assistant director for conservation at the North Carolina Botanical Garden at the University of North Carolina, has won the 2013 Star Award from the Center for Plant Conservation for his work with rare and imperiled plant species. The award was presented on April 5 in conjunction with

the Center for Plant Conservation's national meeting, held this year at the Lady Bird Johnson Wildflower Center in Austin, Texas, and recognizes individuals who demonstrate the concern, cooperation and personal investment needed to conserve imperiled native plants.

Kathryn Kennedy, president and executive director of the Center for Plant Conservation said, "Johnny Randall's leadership in plant conservation has brought benefits to the local community and to the entire country in moving conservation science and practice forward. He is most deserving and we are pleased to give him this recognition."

The award honored Randall's expertise in restoring imperiled plants in degraded habitats. His dedication to a science-based, considered and pragmatic approach is clear in his leadership for producing guidance for local, regional and national plant conservation issues. Randall's teaching and mentoring of students is also noteworthy.

The Center for Plant Conservation is a non-profit organization whose mission is to conserve and restore the imperiled plants of the United States to secure them from extinction. It has established a network of 39 leading botanical institutions across the country. By developing standards and guidance, conducting hands-on work and raising awareness, the Center and its partners strive to accomplish the research and restoration work needed to return these plants to their natural habitats. The Center coordinates the National Collection of Endangered Plants, securing seed from more than 750 of America's most vulnerable native plants, and is working on hundreds of restoration projects. The Center's program is managed by their national office in St. Louis, Mo.

For additional information about the Center for Plant Conservation, visit www.centerforplantconservation.org/

Scientific Foundations for an IUCN Red List of Ecosystems

An understanding of risks to biodiversity is needed for planning action to slow current rates of decline and secure ecosystem services for future human use. Although the IUCN Red List criteria provide an effective assessment protocol for species, a standard global assessment of risks to higher levels of biodiversity is currently limited. In 2008, IUCN initiated development of risk assessment criteria to support a global Red List of ecosystems. We present a new conceptual model for ecosystem risk assessment founded on a synthesis of relevant ecological theories. To support the model, we review key elements of ecosystem definition and introduce the concept of ecosystem collapse, an analogue of species extinction. The model identifies four distributional and functional symptoms of ecosystem risk as a basis for assessment criteria: A) rates of decline in ecosystem distribution; B) restricted distributions with continuing declines or threats; C) rates of environmental (abiotic) degradation; and D) rates of disruption to biotic processes. A fifth criterion, E) quantitative estimates of the risk of ecosystem collapse, enables integrated assessment of multiple processes and provides a conceptual anchor for the other criteria. We present the theoretical rationale for the construction and interpretation of each criterion. The assessment protocol and threat categories mirror those of the IUCN Red List of species. A trial of the protocol on terrestrial, subterranean, freshwater and marine ecosystems from around the world shows that its concepts are workable and its outcomes are robust, that required data are available, and that results are consistent with assessments carried out by local experts and authorities. The new protocol provides a consistent, practical and theoretically grounded framework for establishing a systematic Red List of the world's ecosystems. This will complement the Red List of species and strengthen global capacity to report on and monitor the status of biodiversity.

Keith DA, Rodri'guez JP, Rodri'guez-Clark KM, Nicholson E, Aapala K, et al. (2013) Scientific Foundations for an IUCN Red List of Ecosystems. PLoS ONE 8(5):e62111. doi:10.1371/journal.pone.0062111



Full copy of the article , click on the box to the left

Big Ecosystem Changes Viewed Through the Lens of Tiny Carnivorous Plants

©Lesley Starke.

Researchers use pitcher plants to identify signs of trouble dead ahead

What do a pond or a lake and a carnivorous pitcher plant have in common?

The water-filled pool within a pitcher plant, it turns out, is a tiny ecosystem whose inner workings are similar to those of a full-scale water body. Whether small carnivorous plant or huge lake, both are subject to the same ecological "tipping points," of concern on Earth Day--and every day, say scientists. The findings are published in this week's issue of the journal *Proceedings of the National Academy of Sciences*.

In the paper, ecologists affiliated with the National Science Foundation (NSF) Harvard Forest Long-Term Ecological Research site in Massachusetts offer new insights about how such tipping points happen. "Human societies, financial markets and ecosystems all may shift abruptly and unpredictably from one, often favored, state to another less desirable one," says Saran Twombly, program director in NSF's Division of Environmental Biology, which funded the research. "These researchers have looked at the minute ecosystems that thrive in pitcher plant leaves to determine early warning signals and to find ways of predicting and possibly forestalling such 'tipping points.'"

Life in lakes and ponds of all sizes can be disrupted when too many nutrients--such as in fertilizers and pollution--overload the system. When that happens, these aquatic ecosystems can cross "tipping points" and change drastically. Excess nutrients cause algae to bloom. Bacteria eating the algae use up oxygen in the water. The result is a murky green lake.

"The first step to preventing tipping points is understanding what causes them," says Aaron Ellison, an ecologist at Harvard Forest and co-author of the paper. "For that, you need an experiment where you can demonstrate cause-and-effect." Ellison and other scientists demonstrated how to reliably trigger a tipping point.

They continually added a set amount of organic matter--comparable to decomposing algae in a lake--to a small aquatic ecosystem: the tiny confines of a pitcher plant, a carnivorous plant native to eastern North America.

...continued on following page

Photo above: *Sarracenia flava* taken by Lesley Starke at Boiling Spring Preserve.



Sarracenia rubra, taken by
Lesley Starke at Boiling Springs
Preserve.

Article reported by: National Science
Foundation (2013, April 23).

[click](#)

Each pitcher-shaped leaf holds about a quarter of an ounce of rainwater. Inside is a complex, multi-level food web of fly larvae and bacteria. "The pitcher plant is its own little ecosystem," says Jennie Sirota, a researcher at North Dakota State University and lead author of the paper.

Similar to lake ecosystems, oxygen levels inside the water of a pitcher plant are controlled by photosynthesis and the behavior of resident organisms--in this case, mostly bacteria. Ellison says that conducting an experiment with bacteria is like fast-forwarding through a video. "A bacterial generation is 20 minutes, maybe an hour," he says. "In contrast, fish in a lake have generation times of a year or more. "We would need to study a lake for 100 years to get the same information we can get from a pitcher plant in less than a week." The same mathematical models, Ellison and colleagues discovered, can be used to describe a pitcher plant or a lake ecosystem.

To approximate an overload of nutrients in pitcher-plant water, the team fed set amounts of ground-up wasps to the plants. "That's equivalent to a 200-pound person eating one or two McDonald's quarter-pounders every day for four days," says Ellison. In pitcher plants with enough added wasps, an ecosystem tipping point reliably occurred about 45 hours after the start of feeding.

The scientists now have a way of creating tipping points. Their next step will be to identify the early warning signs. "Tipping points may be easy to prevent," says Ellison, "if we know what to look for."

Other authors of the paper are Benjamin Baiser of Harvard Forest and Nicholas Gotelli of the University of Vermont.

More on pitcher plants..

A Novel Type of Nutritional Ant-Plant Interaction: Ant Partners of Carnivorous Pitcher Plants Prevent Nutrient Export by Dipteran Pitcher Infauna

Mathias Scharmann¹, Daniel G. Thornham, T. Ulmar Grafe, Walter Federle

Abstract

Many plants combat herbivore and pathogen attack indirectly by attracting predators of their herbivores. Here we describe a novel type of insect-plant interaction where a carnivorous plant uses such an indirect defense to prevent nutrient loss to kleptoparasites. The ant *Camponotus schmitzi* is an obligate inhabitant of the carnivorous pitcher plant *Nepenthes bicalcarata* in Borneo. It has recently been suggested that this ant-plant interaction is a nutritional mutualism, but the detailed mechanisms and the origin of the ant-derived nutrient supply have remained unexplained. We confirm that *N. bicalcarata* host plant leaves naturally have an elevated $^{15}\text{N}/^{14}\text{N}$ stable isotope abundance ratio ($\delta^{15}\text{N}$) when colonised by *C. schmitzi*. This indicates that a higher proportion of the plants' nitrogen is insect-derived when *C. schmitzi* ants are present (ca. 100%, vs. 77% in uncolonised plants) and that more nitrogen is available to them. We demonstrated

direct flux of nutrients from the ants to the host plant in a ^{15}N pulse-chase experiment. As *C. schmitzi* ants only feed on nectar and pitcher contents of their host, the elevated foliar $\delta^{15}\text{N}$ cannot be explained by classic ant-feeding (myrmecotrophy) but must originate from a higher efficiency of the pitcher traps. We discovered that *C. schmitzi* ants not only increase the pitchers' capture efficiency by keeping the pitchers' trapping surfaces clean, but they also reduce nutrient loss from the pitchers by predating dipteran pitcher inhabitants (infauna). Consequently, nutrients the pitchers would have otherwise lost via emerging flies become available as ant colony waste. The plants' prey is therefore conserved by the ants. The interaction between *C. schmitzi*, *N. bicalcarata* and dipteran pitcher infauna represents a new type of mutualism where animals mitigate the damage by nutrient thieves to a plant.

[Click for article.](#)

May 10, 2013

Contact: John Ewald, 240-429-6127

On May 9, the daily mean concentration of carbon dioxide in the atmosphere of Mauna Loa, Hawaii, surpassed 400 parts per million (ppm) for the first time since measurements began in 1958. Independent measurements made by both NOAA and the Scripps Institution of Oceanography have been approaching this level during the past week. It marks an important milestone because Mauna Loa, as the oldest continuous carbon dioxide (CO₂) measurement station in the world, is the primary global benchmark site for monitoring the increase of this potent heat-trapping gas.

Carbon dioxide pumped into the atmosphere by fossil fuel burning and other human activities is the most significant greenhouse gas (GHG) contributing to climate change. Its concentration has increased every year since scientists started making measurements on the slopes of the Mauna Loa volcano more than five decades ago. The rate of increase has accelerated since the measurements started, from about 0.7 ppm per year in the late 1950s to 2.1 ppm per year during the last 10 years.

"That increase is not a surprise to scientists," said NOAA senior scientist Pieter Tans, with the Global Monitoring Division of NOAA's Earth System Research Laboratory in Boulder, Colo. "The evidence is conclusive that the strong growth of global CO₂ emissions from the burning of coal, oil, and natural gas is driving the acceleration."

Before the Industrial Revolution in the 19th century, global average CO₂ was about 280 ppm. During the last 800,000 years, CO₂ fluctuated between about 180 ppm during ice ages and 280 ppm during interglacial warm periods. Today's rate of increase is more than 100 times faster than the increase that occurred when the last ice age ended.

NOAA's Mauna Loa Observatory in Hawaii. Thursday, levels of the greenhouse gas carbon dioxide at Mauna Loa surpassed 400 parts per million for the first time since measurements began in 1958. Pre-industrial carbon dioxide levels were 280 parts per million. Mauna Kea is in the background. NOAA photo.

It was researcher Charles David Keeling of the Scripps Institution of Oceanography, UC San Diego, who began measuring carbon dioxide at Mauna Loa in 1958, initiating now what is known as the "Keeling Curve." His son, Ralph Keeling, also a geochemist at Scripps, has continued the Scripps measurement record since his father's death in 2005.

"There's no stopping CO₂ from reaching 400 ppm," said Ralph

Keeling. "That's now a done deal. But what happens from here on still matters to climate, and it's still under our control. It mainly comes down to how much we continue to rely on fossil fuels for energy."

NOAA scientists with the Global Monitoring Division have made around-the-clock measurements there since 1974. Having two programs independently measure the greenhouse gas provides confidence that the measurements are correct. Moreover, similar increases of CO₂ are seen all over the world by many international scientists. NOAA, for example, which runs a global, cooperative air sampling network, reported last year that all Arctic sites in its network reached 400 ppm for the first time. These high values were a prelude to what is now being observed at Mauna Loa, a site in the subtropics, this year. Sites in the Southern Hemisphere will follow during the next few years. The increase in the Northern Hemisphere is always a little ahead of the Southern Hemisphere because most of the emissions driving the CO₂ increase take place in the north.

Once emitted, CO₂ added to the atmosphere and oceans remains for thousands of years. Thus, climate changes forced by CO₂ depend primarily on cumulative emissions, making it progressively more and more difficult to avoid further substantial climate change.

Story from: National Oceanic and Atmospheric Administration, US Dept. of Commerce.

<http://researchmatters.noaa.gov/news/Pages/CarbonDioxideatMaunaLoareaches400ppm.aspx>

More information:

NOAA carbon dioxide data: <http://www.esrl.noaa.gov/gmd/ccgg/trends/weekly.html>

Scripps Institution of Oceanography carbon dioxide data:

<http://www.keelingcurve.ucsd.edu/>

NOAA's Mauna Loa Observatory: <http://www.esrl.noaa.gov/gmd/obop/mlo/>

ANIMATION (carbon dioxide levels over 800,000 years):

<http://www.esrl.noaa.gov/gmd/ccgg/trends/history.html>

IMAGES: http://www.esrl.noaa.gov/gmd/Photo_Gallery/Field_Sites/MLO/

If a link fails, please let me know. Kathy

JOIN A PRESERVE TEAM

You may join as a team member by contacting the Steward:

Cedar Mtn Bog: Jean Woods jean14424@aol.com

Eastwood: Joan Schneier joan.schneier@ncdenr.gov

Mineral Springs Barrens: Lisa Tompkins

lestompkins@windstream.net

Harvest Field: Kathy Schlosser kathyschlosser@triad.rr.com

Hebron Road: Herb Amyx patamyx@yahoo.com

Hog Branch Pond: Charlie Kidder charleskidder@bellsouth.net

Pondberry Bay: Dale Batchelor & John Thomas

dale@gardenerbynature.com

Tater Hill: Mark Rose trilliumboy@yahoo.com

You may sign up as Steward or join an existing team by contacting Lesley Starke: Lesley.Starke@ncagr.gov

Butner Cedar Glade—Granville Co.

Bat Fork Bog—Henderson Co.

Cedar Cliff—Jackson Co.

Ochlawaha Bog – Henderson Co.

Paddy Mountain – Ashe Co.

Melrose Mountain – Polk Co

White Oak Mountain – Polk Co.

Dulany Bog – Jackson Co.

Long Mountain Slopes/Poison Fork – Montgomery Co.

Denson's Creek – Montgomery Co

Pondberry Bay – Sampson Co.

Boiling Spring Lakes – Brunswick Co.

Big Pond Bay – Cumberland Co.

Friends of Plant Conservation

*Conserving North Carolina's rare
plants and unique places.*

Membership sends a signal that you believe conservation of native plants in their natural habitat is important.

Membership contributes directly to that mission and funds raised will support the acquisition and management of critical sites.



As in the artificial garden we pass from parterre to parterre, or to conservatory or shaded fernery, each with its appropriate denizens, so in the wilds we find the worthier model, every condition of sod, of light, of shade finding its true expression...

W. H. Gibson, 1891