Carbon storage is one of the many services provided by healthy forests. The legacy of forests past shapes recovery trajectories after fire in boreal Alaska. Carbon offsets allow landowners to monetize the carbon being stored by their trees and soils and sell it on the carbon market, where there is high demand.

Over the past decade, forest carbon offsets have emerged as one of the fastest growing finance tools to incentivize forest conservation. Environmental groups, land trusts, and municipalities are involved in deals that sell forest carbon to buyers, including major corporations like Disney, JP Morgan Chase, Delta, and Google. Are these transactions leading to reductions in greenhouse gas emissions? Cary Institute forest ecologist Charles Canham has serious reservations about the true environmental benefit of forest carbon offsets. The way credits are awarded is among his concerns. He explains, “Carbon registries are allowing gross exaggeration of the likely additional carbon storage that would be expected under an offset deal. Markets are extending credits for previously stored carbon that could be liquidated by cutting trees, yet chances of that happening are incredibly slim.”

“Credits shouldn’t be used to greenwash polluting industries when options like wind and solar present more efficient long-term carbon offset solutions.”

“Our focus should be on helping landowners protect and manage the resilience of their forests so they continue to provide a range of benefits in the face of threats like forest pests and climate change. Credits shouldn’t be used to greenwash polluting industries when options like wind and solar present more effective ways to reduce carbon emissions.”

On November 11 at 7pm ET, Charles Canham will present a virtual Cary Science Conversation on forest carbon offsets. Join the conversation by registering at: caryinstitute.org/events.
FROM OUR PRESIDENT

Dear Friends:

In the last 18 months, our patience has been tested in ways unimaginable. The rapid retreat, and then accelerating advance, of the Covid-19 pandemic brought hope, and dashed hopes, in the blink of an eye. But because the science on the value of masking and vaccinations is now indisputable, and because science is at the core of Cary’s mission and work, I mandated vaccines for employees and all visitors to Cary Institute as of October 1.

Slowly, life will return to a new normal. Planning for that eventuality, renovations of the Ecosystem Science Building are coming to a conclusion. The building is environmentally cutting edge, with electric heat pumps offset by our solar field production, masses of natural light, remarkable insulation, ‘feather friendly’ glass that reduces bird strikes, and copper siding that has a 100 year life, is 90-95% recycled, and is from Revere Copper, in Rome, NY. Quiet, elegant, light filled, the building is also healthier with increased air flow, filters, no-touch features wherever possible, and windows that actually open.

We have been remarkably productive through these 18 months, as evidenced by the grants, papers, and education and outreach activities. More importantly, we have been remarkably flexible and resilient, pivoting to virtual, using new tools to support each other – whether in research groups, in networks like GLEON and Hubbard Brook, or the way in which the Cary postdocs came together to support each other, and learn from pandemic disruptions. I am proud of these achievements, and of the strength and resilience of our community.

Yours sincerely,

Joshua R. Ginsberg, PhD

PRESIDENT

Cary Institute of Ecosystem Studies

21ST CENTURY FACILITIES FOR 21ST CENTURY SCIENCE

The Campaign for Cary is nearing its goal – but we still need your help. Please make your gift today. Your donation helps create modern, highly sustainable facilities that will allow us to live our mission, convene and collaborate, work efficiently, and think deeply.

Our scientists are tackling environmental issues that you care about – freshwater and forest health, prevention of emerging diseases, and the sustainability of cities. With your gift to the Campaign for Cary, you can be the catalyst for science-based solutions.

To give: caryinstitute.org/campaign-cary-gift

21ST CENTURY SCIENCE FOR ENVIRONMENTAL SOLUTIONS

Sciences

CONSEQUENCES OF AGING INFRASTRUCTURE

Leaky pipes are dumping tens of thousands of doses of pharmaceuticals into Baltimore’s Inner Harbor every year.

37 unique compounds

30K doses of antidepressants

1.7K doses of antibiotics

30K doses of acetaminophen

Pharmaceutical pollution is a growing problem in freshwaters around the world. A new Cary-led study revealed that leaky pipes in Baltimore, MD, are delivering billions of liters of raw sewage to the Chesapeake Bay every year, carrying tens of thousands of doses of pharmaceutical compounds. Effects to aquatic plants, animals, and ecosystem functioning remain largely unknown. Read more: caryinstitute.org/pharma-bes.

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Subscribe to our e-newsletter at caryinstitute.org.

Ecofocus is published by Cary Institute of Ecosystem Studies, an independent nonprofit center for environmental research. Since 1933, our scientists have been investigating the complex interactions that govern the natural world and the impacts of climate change on those systems. Our findings lead to more effective management and policy actions and increased environmental literacy. Staff are global experts in the ecology of: cities, disease, forests, and freshwater.
Freshwater is critical to humans and 8 million species on Earth.

Lakes are essential to the water cycle, but pollution, global warming, and inadequate waste systems increasingly threaten lake ecosystems.

Dr. Kathleen Weathers is working globally to understand these dynamics.

Please join us on April 26 to hear how we harness technology, data sharing, and team science to understand freshwater ecosystems around the world.

For more info, contact Addie at goldfranka@caryinstitute.org

THANK YOU TO THE MARY FLAGLER CARY LEGACY SOCIETY MEMBERS

We would like to extend our deepest gratitude to the following individuals, as well as several anonymous donors, for generously including Cary Institute in their estate plans:

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Winfred R. Briggs
Sandra G. Cahill
Joshua R. Ginsberg
Barbara Anapol Lowy
Frederick E. Mandorff
Violet M. Scheckley
Scott J. Ulm
Susan VanParys
Frederick E. Mangelsdorf
Joshua R. Ginsberg
Phil Higuera
Andy Mossey
Barry Haydasz
Deceased

Thank you to all of these wonderful people for generously supporting the work we do.

Videos of our virtual events can be viewed online at caryinstitute.org/lecture-videos

Science for the Future of the Hudson River
Cary Science Conversation featuring Cary's Stuart Foulday

NYS Forest Preserves: Balancing Access & Conservation
Virtual panel discussion with Cary's Josh Ginsberg, Catskill Center's Andy Mossey, NYS DEC's Kelly Turturro, and ADK Mountain Club's Michael Barrett

Disease Prediction in a Pandemic Era with Dr. Barbara Han
Cary Science Conversation with Cary's Barbara Han

Butterflies & Skippers: Tracking Nature's Clock
Virtual nature walk featuring Cary's Barry Haydasz

Wildfire in the Western US: Causes, Consequences, & Adaptation
Virtual panel discussion with Cary's Josh Ginsberg, Cary's Winslow Hansen, Northern Arizona University's Catrin Ginsberg, Cary's Winslow Hansen, Northern Arizona University's Catrin Ginsberg, and University of Montana's Phil Higuera

How are you projecting future fire activity? We use computer models and information on climate, fuel density, and ignition sources – like lightning and human error (fireworks, cigarette butts, stray campfire embers) – to tell us how fire regimes and forests may change, and what factors might alter outcomes. This allows us to develop projections of how fire will affect forests in western North America through the 21st century.

What factors influence wildfire regimes? 'Wildfire regime' describes the pattern of fire frequency, size, and severity that is typical in a landscape over long periods of time – on the scale of thousands of years. Geographic variability in factors like climate, forest types, and historic Indigenous burning practices, shape unique fire regimes across different regions.

The amount of fuel (dry leaves, branches, and dead grass) in a forest is critical. And, since some plant species burn hotter and easier than others, the type of vegetation growing in a region influences the fires that burn there.

Why are wildfires increasing?

In the western US, higher temperatures and worsening droughts create favorable conditions for wildfires to break out. More frequent, intense storms come with lightning strikes that can ignite dangerous blazes, and high winds that move fire across the landscape. Climate change is exacerbating these factors.

Fires have also been suppressed, and Indigenous burning practices stopped, for more than a century. This fire deficit happens if we suppress all fires, or suppress none? Insights can help determine where and when certain interventions might be most effective.

What can we do to adapt?

Homeowners can take precautions such as building with fire-resistant materials, and removing trees and brush around their homes. On public lands abutting communities, we need to explore how proactive measures like prescribed burning, managed wildfire use (allowing naturally-ignited fires to burn), and clearing fuels from the landscape might influence fire risk for people.

Fire is going to be an inevitable component of many regions going forward. We need to learn how to coexist with fire, and how to implement site-specific adaptation strategies that can support people and changing ecosystems.

Learn more in this extended Q&A: caryinstitute.org/wildfire-qanda
Watch our recent panel discussion on wildfires in the western US: caryinstitute.org/lecture-videos
EXPLORING EFFECTS OF DRUG POLLUTION ON STREAM LIFE

Cary's Emma Rosi, senior author on crayfish, citalopram, a common antidepressant, researchers investigated the effects of citalopram-receiving streams were dosed with environmentally realistic concentrations of the drug. In just two weeks, citalopram caused changes in crayfish behavior. Exposed crayfish spent more time foraging and less time hiding. Over time, these changes could disrupt stream processes like nutrient cycling, oxygen levels, and algal growth.

Rosi concludes, "Even in small doses, drug pollution in freshwaters can affect organisms, and behavioral changes can have ecological consequences. Understanding how pharmaceutical pollution impacts stream life, and what these changes mean for water quality, ecosystem health, and food webs, is critical to protecting freshwater ecosystems."

Read more: caryinstitute.org/crayfish

SPIN CHECK: "You see crayfish become 'bolder' when exposed to citalopram."

Urban birds and yard management were the focus of a recent study co-authored by Cary research fellow Peter Groffman, led by a team that explored how differences in residential yard landscaping and neighborhood features like tree cover and paved surfaces, influenced the presence and diversity of birds in six cities across the US.

Groffman says, "A vast portion of the US is covered by residential land. There is an opportunity to make our yards work better for wildlife. Our results show that yard management decisions can have real effects on birds at both the yard and neighborhood level."

Cite city: "Urban yards can provide VALUABLE BIRD HABITAT."

Marissa Kordal of SUNY Cortland is investigating how ecosystem disturbances shape tree seedling survival and the quality of soils and water in the Catskill region. Stressors being explored include white-tailed deer and two invasive species (jumping worms and Japanese stiltgrass). Kordal said that while climate impacts the region individually, and in combination, along a gradient of invasion severity. Insights will help managers choose site-appropriate interventions.

Alison Derevensky of Binghamton University is exploring community engagement in the Rondout Neversink Stream Program. Unlike the Hudson River, Creek and Neversink River management plans are on the horizon. Derevensky is evaluating outreach methods and working with local stakeholders to determine which communication strategies might best increase participation in watershed conservation efforts.

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Karen Crockett, the director of the Laboratory of Environmental and Evolutionary Systematics at the University of California, is leading a study to understand how stressors shape tree seedling survival and the quality of soils and water in the Catskill region.

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EXPLORING EFFECTS OF DRUG POLLUTION ON STREAM LIFE

Pharmaceutical pollution occurs in freshwaters globally, but little is known about its effects on animals and ecosystems. In a study conducted at Cary’s artificial stream facility, researchers investigated the effects of citalopram, a common antidepressant, on crayfish.

Cary’s Emma Rosi, senior author on the study, says, “Animals living at Cary’s artificial stream facility, and ecosystems. In a study conducted known about its effects on animals Pharmaceutical pollution occurs due to chronic mix of pharmaceuticals, including antidepressants such as citalopram, which are excreted into the environment. These compounds can affect the behavior and physiology of crayfish, which can then influence the structure and function of stream ecosystems. In the study, crayfish were exposed to increasing concentrations of citalopram, and their behavior and activity were monitored.

In just two weeks, citalopram caused changes in crayfish behavior. Exposed crayfish spent more time foraging and less time hiding. Over time, these changes became more pronounced like nutrient cycling, oxygen levels, and algal growth.

Rosi concludes, “Even in small doses, drug pollution in freshwaters can affect organisms, and behavioral changes can have ecological consequences. Understanding how pharmaceutical pollution impacts stream life, and what these changes mean for water quality, ecosystem health, and food webs, is critical to protecting freshwater ecosystems.”

Recent research has shown that crayfish can be sensitive indicators of environmental stressors, and that exposure to pharmaceuticals can alter their behavior and survival. This study highlights the need for further research on the effects of pharmaceutical pollution on freshwater ecosystems and the organisms that inhabit them.

CATSKILL SCIENCE COLLABORATIVE STUDENT PROJECT UPDATES

The Catskill Science Collaborative (CSC) connects research organizations working in the Catskill region to promote data sharing and collaboration on topics relevant to natural resource management.

The Catskill Research Fellowship program is a CSC initiative designed to fill research gaps identified by natural resource managers in the region. Fellowships are awarded to undergraduate and graduate students, providing opportunities for university professors with projects in collaboration with advisors from natural resource management organizations.

Here’s a look at the 2021 projects:

**Spinycheek crayfish become ‘bolder’ when exposed to citalopram**

Marissa Koral of SUNY Cortland is investigating how ecosystem stressors shape crayfish behavior. crayfish are known to be important in natural stream habitats, and their foraging behavior can influence nutrient cycling and oxygen levels. In this study, crayfish were exposed to varying concentrations of citalopram, a common antidepressant, to assess its effects on crayfish behavior.

**Urban yards can provide valuable bird habitat**

Jane Lucas collects prairie soil samples in Moscow, Idaho. Invasive species prevention efforts are critical, and urban yards can support a wide variety of birds if landscaped for wildlife. The next step is to identify specific features needed by bird species.

**Yard management can provide vital refuge for urban birds**

Grafton states, “A vast portion of the US is covered by residential land. Urban yards can provide valuable habitat for birds. Reports show that urban yards can support a wide variety of bird species if managed for wildlife. The next step is to identify specific features needed by bird species.”

**IMPACT SOIL HEALTH**

Soils are home to diverse microbial communities, essential for plant growth and nutrient cycling. Antibiotics can impact soil health in various ways, including altering microbial communities and reducing the availability of essential nutrients. This can have significant implications for plant growth and overall ecosystem health.

Lucas’ team collected samples of native prairie soil to test effects of Monensin, a common livestock antibiotic, and rising temperature, on soil organisms. Samples were treated with either a high, low, or no dose of the antibiotic; these were heated at three different temperatures and left to incubate for 21 days. The results showed that antibiotics can impact soil health, rising temperature exacerbated these antibiotic effects, with distinct microbial communities emerging at each temperature tested.

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**Specific to each region. More bird species were found in yards than parks, with parks supporting species of high conservation value, and yards supporting species of public interest.**

**There is an opportunity to make our yards work for wildlife.**

Our results show that yard management designed for wildlife has real effects on birds at both the yard and neighborhood scale. For example, in each, the number of birds in yards across four management types: wildlife certified (a National Wildlife Foundation designation, often with feeders and native plants), ‘water conservation’ (with features like rain gardens), lawn-dominated ‘high fertilizer’, and lawn-dominated ‘low fertilizer.’

**Bird surveys took place during the breeding season.**

**CITATION STYLES**

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Fires have also been suppressed, and Indigenous burning practices that can help prevent fires are no longer employed. In recent years, we have seen whole towns, like Paradise, California, and Fort McMurray, Canada, completely destroyed by fire. Other effects include health consequences of inhaling smoke, which can impact communities far from the flames. Last summer, many of us in the Northeast experienced wildfire smoke from the West. In July, skies turned pink and hazy; in some places, you could smell smoke when you went outside. This smoke pollution was from wildfires burning in western Canada, thousands of miles away.

What can we do to adapt?

Homeowners can take precautions such as building with fire-resistant materials, and removing trees and brush around their homes. On public lands abutting communities, we need to explore how proactive measures like prescribed burning, managed wildfire use (allowing naturally-ignited fires to burn), and clearing fuels from the landscape might influence fire risk for people.

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We use computer models and information on climate, fuel density, and ignition sources – like lightning and human error (fireworks, cigarette butts, stray campfire embers) – to tell us how fire regimes and forests may change, and what factors might alter outcomes. This allows us to develop projections of how fire will affect forests in western North America through the 21st century.

How can models inform management?

We can use our models to test bold management interventions and evaluate consequences without risk. Using computer simulations, we can ‘treat’ large swaths of forest to see what happens if we remove all trees of a certain size, or remove fuels from the forest floor. What happens if we suppress all fires, or suppress none? Insights can help determine where and when certain interventions might be most effective.

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**SUPPORT SCIENCE**

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**EcoFocus is published by Cary Institute of Ecosystem Studies, an independent nonprofit center for environmental research. Since 1983, our scientists have been investigating the complex interactions that govern the natural world and the impacts of climate change on these systems. Our findings lead to more effective management and policy actions and increased environmental literacy. Staff are global experts in the ecology of cities, disease, forests, and freshwater.**
In their quest to become carbon neutral, many companies purchase carbon offsets as an alternative to phasing out fossil fuels. Offsets can come from renewables, like wind and solar, or increasingly from natural climate solutions, like forested lands. Forest carbon offsets allow landowners to monetize the carbon being stored by their trees and soils and sell it on the carbon market, where there is high demand.

Over the past decade, forest carbon offsets have emerged as one of the fastest growing finance tools to incentivize forest conservation. Environmental groups, land trusts, and municipalities are involved in deals that sell forest carbon to buyers, including major corporations like Disney, JP Morgan Chase, Delta, and Google. But are these transactions leading to reductions in greenhouse gas emissions?

Carbon storage is one of the many services provided by healthy forests. The result: landowners with large tracts of forest had been stored over the last 50-100 years, rather than any new and truly additional forest growth.”

“Yet forest carbon offsets grant corporations the right to emit as much CO2 as if the landowner had done that, in essence assuming the worst-case scenario and letting industry claim offsets based on forest carbon that had been stored over the last 50-100 years, rather than any new and truly additional forest growth.”

The result: landowners with large tracts of forest are being offered significant amounts of money to enter into these agreements. “Individuals, land trusts, and municipalities are all being courted by brokers, with millions of dollars changing hands.” And in most cases, Canham warns that credits have little to do with enhancing a forest’s ability to store carbon above ‘business as usual’.

Canham notes that reducing or eliminating future harvests is the most common way to bolster carbon sequestration. But this leads to a problem that economists call ‘leakage’. Reducing harvest in one area often simply leads to more logging on other lands.

Adding that, “We have been offshoring our forest products for decades. New York used to have dozens of paper mills. All but a few have moved to places like Malaysia and Borneo, where they rely on plantations of short rotation eucalyptus and pine. If you do the accounting properly, this has likely increased the net flux of carbon to the atmosphere.”

Canham also has environmental justice concerns. Inexpensive forest carbon credits leave little incentive to decarbonize businesses. “Polluting industries can buy forest carbon credits at around ten dollars per ton of emissions and keep spewing pollutants that disproportionately impact disadvantaged communities and communities of color.”

“Our focus should be on helping landowners protect and manage the resilience of their forests so they continue to provide a range of benefits in the face of threats like forest pests and climate change. Credits shouldn’t be used to greenwash polluting industries when options like wind and solar present more effective ways to reduce carbon emissions.”

On November 11 at 7pm ET, Charles Canham will present a virtual Cary Science Conversation on forest carbon offsets. Join the conversation by registering at: caryinstitute.org/events.