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D o you ever wonder why people travel for vacation when they are packed into planes like sardines, sleep on lumpy mattresses in airless rooms and long for a home-cooked meal? Perhaps it’s because a vacation is less about indulging your body than about stimulating your mind, stretching your imagination and expanding your horizons. It gives you the kind of perspective that is vital for growth.

The same is true of environmental research. With all we have learned by focusing so intently on White Clay Creek over the past 35 years, it is fair to ask why we go anywhere else to do our research – or why we encourage scientists from abroad to come work with us here. After all, water is water everywhere, fish are invariably slimy and scaly, all streams flow downhill to the sea and good research is judged by its results, not its location.

But are streams that flow out of steep mountains, through desert biomes or across recently glaciated terrain similar to White Clay Creek? Do rivers in tropical climates behave like those in temperate regions? Can scientists from elsewhere add perspective to the research we do at Stroud?

These are critical questions. To answer them we need to travel beyond our comfort zone and test our theories on different streams under different conditions in different places. That is why we established a tropical field station in Costa Rica in 1989, why we pursue research in Canada, Europe, and Central and South America, why we support the efforts of our newest senior scientist, Anthony Aufdenkampe, on the Amazon River, and why we seek the cross-fertilization of ideas from such international scientists as Xianhao Cheng from China, Thy Truong from Australia and Tom Battin from Austria.

We have learned a lot about fresh water by studying one small stream in Chester County, Pa. But there is so much more we want to understand. That’s why we test our theories in watersheds across the globe and bring to the Stroud Center first-rate scientists from around the world.
Kenyan seeks Stroud collaboration

Last fall one of Africa's leading environmentalists and social activists, Wangari Maathai, captivated Stroud Center staff and friends with moving and colorful stories of how she galvanized the women of Kenya into action. Under her charismatic leadership they planted some 20 million trees and formed the Green Belt Movement, which has become an important pressure group for environmental, political and social change.

But the Stroud Center also impressed Wangari Maathai, particularly with its educational possibilities. She took home a Leaf Pack that the Stroud Center had given her, and its potential opened up for her a Pandora's box of ideas for collaborating on ways to educate young Kenyans about the importance of streams. She feels that, with the help of Leaf Packs, Kenya’s youth could become intimately involved in restoring the country’s ailing ecosystems.

Wangari Maathai is a household name in Kenya, where some 150,000 people, mostly women, are actively involved in the Green Belt Movement, which has subsequently expanded throughout Africa and to the United States and Haiti. She was the first woman in Kenya to become an associate professor and serve as chair of an academic department of a university.

Her activism and reputation have also brought trouble for her in Kenya’s male-dominated country. She knows much of ridicule and jail; and when she was campaigning for her country’s presidency, thugs from the ruling party beat her viciously and left her for dead.

Maathai was nominated for the Nobel Peace Prize. Her many honors include the Goldman Environmental Prize; the United Nation’s Africa Prize for Leadership; the Windstar Award for the environment; the Better World Society Award; the Alternative Nobel Prize, the Right Livelihood Award; and the Fuller-Maathai Chair at Connecticut College. She also serves as commissioner for Africa of the Earth Charter. She spent the spring semester as a visiting professor at Yale University.
A Stroud Center team led by senior research scientist Tom Bott is helping to develop a computer model that can predict the impact of effluent discharges on oxygen concentrations and algal growth in rivers.

Since its beginning in 1997 as a small study in the Jackson River in Virginia, the project has evolved into a groundbreaking collaboration with an environmental consulting firm (HydroQual of Mahwah, N.J.), the Academy of Natural Sciences of Philadelphia and MeadWestvaco, the sponsoring company.

The project focuses on algae (and associated microorganisms) that grow on submerged surfaces such as rocks. Collectively known as periphyton, these microscopic plants take up nutrients and consume oxygen as they respire and produce oxygen through photosynthesis. Consequently, the plants play a major role in cleaning the water.

The goals of the project are to measure the productivity and respiration of the periphyton in order to:

- determine how much oxygen will be produced and consumed over daily periods to allow prediction of daily maximum and minimum concentrations, and
- predict how much of the nutrient load discharged in the effluent the organisms can remove under a variety of water and weather conditions.

The field site of the study is on the Jackson River, above and below a MeadWestvaco mill. Over the preceding decade the mass of periphyton downstream of the discharge point increased as the mill’s effluent became cleaner and lighter in color, allowing more sunlight to penetrate the water.

The task of the Stroud team is to measure periphyton photosynthesis and respiration under varied conditions of light, temperature, water velocity and nutrient concentrations. Concurrently, field staff from the Academy of Natural Sciences collect data on the amount of the periphyton in river, and MeadWestvaco personnel monitor river water chemistry, light and temperature.

Experiments are conducted by transferring a rock with attached periphyton into a clear acrylic chamber filled with river water and measuring dissolved oxygen concentrations over 24-hour periods.

Experiments performed in the field yield natural daily respiration rates. However, because environmental conditions are changing constantly and simultaneously in a natural river, it was difficult, if not impossible, for Stroud scientists to measure responses of algae to a change in any one of the
variables.

“So in 2000, we moved into the laboratory,” said Bott. “We set up our chambers inside water jackets where we could control the water temperature and installed lights that would allow constant exposures over a wide range of light intensities. We had a chamber insert, called a venturi, built to allow greater control over water velocity (see graphics) and we can add or withhold nutrients as desired.”

“In order to be able to predict the effect of a variable (e.g. temperature, light, nutrient) on a process such as photosynthesis or respiration, it is good to do experiments in which you vary one parameter while holding others constant,” said Bott.

Data from the experiments are forwarded to modelers who develop mathematical expressions for the processes taking place in the chambers. They use the data to “grow” digital models of periphyton that are consistent with the actual measurements taken by collaborating scientists under environmental conditions measured by MeadWestvaco personnel.

A working computer model, now in its final stages of development, is expected to measure the impact of different conditions on the river’s ability to handle the mill’s discharge.

For MeadWestvaco, the model will become an improved tool for managing the waste its plant discharges into the river.

For Stroud scientists, the research addresses basic questions about periphyton ecology and physiology and its role in river ecosystems.
Robert M. “Bob” Peck of the Academy of Natural Sciences enthralled a packed audience last spring with colorful slides and graphic anecdotes of his scientific expeditions to some of the most remote regions of the world.

Peck, who has for years chronicled many of the Academy’s scientific explorations, spoke at the Joan M. Stroud Lecture in the Stroud Center’s meeting room in May.

The Academy, Peck explained, has a 200-year history of sending expeditions around the world. In the process it has assembled some 17 million nature specimens, making its collection among the world’s largest. The Academy also helped launch some distinguished careers, including that of a young Philadelphia shipyard naval ensign named Robert Peary, whose epic journey to the North Pole in 1909 became a historical landmark.

The Academy’s earliest explorers kept thorough chronicles of their trips. Many took their own writers, artists and, in the late 19th century, photographers. But in the 20th century, as budgets tightened, writers and artists were the first to be cut from the expeditions.

“This gave the public the false impression that the great era of exploration was over,” Peck said.

As a young employee at the Academy, Peck would listen with envy as his colleagues described their expeditions and exciting adventures.

Concerned that the trips were no longer being documented, Peck went to the Academy administration. “What would you think about sending someone along on some of these expeditions and seeing what we could do in the way of communicating to our members and the public the excitement of science and what was being aggressively pursued in all parts of the world?” he asked.

Happily, the administration agreed to a trial run – and that was the start of Peck’s own extraordinary career as a chronicler of Academy trips, from the lush Amazon Basin to the arid deserts of Mongolia and Namibia.

His first journey was to a lake in Nepal, 17,000 feet above sea level.

“I’ll always remember this trip as the trip of bridges,” said Peck as he showed slides of rickety suspension bridges that crossed deep chasms.

“Because I’m the smallest person, I always have to go out and test them,” said Peck as the audience gasped in awe at the precarious crossing.

The warm reception his team got from the people of Nepal was a stark contrast to a trip he took in Ecuador, where the local Indian tribe put out a hit order to kill the members of his expedition. They could not believe these foreigners would put up with the difficult conditions of the rainforests just to photograph birds.

“They thought we were looking for gold and other valuables and that if we found them, their lives would be changed forever,” said Peck.

“Fortunately we heard about the hit order. We lived in a state of siege, moving from camp site to camp site. The Indian porters stayed with us, fortunately.”

At one stage on this trip in the area known as Cordillera de Cutucu, in mountain-
ous southeastern Ecuador, the group was down to a bowl of rice a day. One of their Indian porters had a 19th-century muzzle loader that must have come from some ill-fated expedition. He carried a bag of black gunpowder, and when it got wet, he would dry it by heating it in a frying pan over the fire. “Obviously he was very experienced at this because we had no explosions,” said Peck.

The porter went out and collected food to augment the team’s meager supplies. He shot specimens, which the others skinned for the Academy’s specimen collections. The skimpy remains were their supper. “It was a pathetic site seeing the six of us haggling over a humming bird.”

The only fish they could catch there was a type of catfish that had huge lips, which it used to hold onto rocks so it wouldn’t be washed away by the fast flowing water. The lips happened to be the only edible parts.

“At least we had a bit of protein. On a really good day we’d have bird body and a sucker fish lips served on a bed of rice, and this became known as the Cutucu surf and turf,” he said.

The food was much better in an expedition Peck joined along the Orinoco River. Though plucked toucans were a bit trying, most of the fish were absolutely delicious and fun to catch – sometimes. As Peck was photographing a piranha, the fish bit right through the thumb of the person who was holding it up for him. They also had to be careful they didn’t step on electric eels, whose 260-volt shocks are enough to knock a horse unconscious.

One morning Peck noted the tracks of a jaguar on a beach where he had been sleeping in the open. The tracks circled around and came within four inches of where his sleeping head had been.

Peck also journeyed to Mongolia where the water in the streams was just above freezing in the summer and where the Gobi desert had no water at all.

“I went back [to Mongolia] year after year. It’s been one of the most fulfilling periods of my life,” he said.

Another destination Peck described with words and pictures was Siberia, where his team sought traces of ancient human migration across the Bering Straits to the continent of North America.

People are amazed to learn that such 19th-century-style expeditions are still taking place and that new discoveries are still being made at the far ends of the Earth, said Peck.

“The physical geography of the world may be well documented, but the golden age of geography is far from over,” Peck said, wrapping up his talk. “As the scientists at the Academy and here at the Stroud laboratories demonstrate daily, there’s still much to discover in the natural world.

“Your support of the vitally important research that goes on here is what will help ensure that our children and their children and countless generations to come will be able to live in a world that is worth inheriting.”
Anthony Aufdenkampe's work crosses many international boundaries and datelines.

Having developed ways to deter "pest elephants" in Central Africa and studied coral reefs in Jamaica and rainforests in Costa Rica, he is now focusing on the "carbon sink" mystery in the Amazon Basin.

When he returns from Brazil at the end of the year, he will begin yet another new venture as head of the Stroud Center's organic chemistry section.

After his appointment was announced last spring, Aufdenkampe spent three weeks at the Center "getting to know everyone" and setting up his office. He then returned to Brazil to complete a project to which he was committed before the Stroud offer came through.

The search that brought him to Stroud began last year when Laurel Standley, who had headed the organic chemistry section for 12 years, announced she was making a career change to study environmental policy.

"Anthony was simply the best organic chemist among a group of outstanding candidates to apply for the position during our world-wide search," said Center Director Bern Sweeney.

Aufdenkampe is now alternately sweltering in the Amazon rain forests and cooling off at a base station in southern Brazil as he studies how organic carbon cycles through aquatic systems.

He is the principal investigator of a National Science Foundation project that he describes as part of a "huge international effort of scientists all over the world trying to find out what happens to carbon dioxide."

While scientists know how much carbon dioxide is released from the burning of fossil fuels such as coal and oil, they can account for what happens to only 70 percent of it. Locating the missing 30 percent has been a mystery whose solution, scientists hope, will lead to a better understanding of global warming.

In fact, Aufdenkampe and a team headed by University of Washington oceanography professor, Jeffrey Richey, have recently put rivers and streams -- which had largely been ignored in the hunt for the missing sink -- on the front page of carbon science news.

The results of their investigation in the Amazon Basin, which were published in the April issue of the prestigious journal, Nature, caused a stir in both the press and the environmental science community.

Using the data they collected in the Amazon from satellite radar imagery and stream-flow measurements, Richey’s team calculated that tropical forest rivers worldwide are emitting carbon dioxide in amounts that are about equal to the missing 30 percent.

Their findings have gone a long way toward reconciling the recently hotly debated question of whether this missing carbon is hiding in the world’s tropical forests. The team’s findings show that although more carbon dioxide is entering the Amazon rainforest than is leaving it, most of this carbon leaves the forest via its rivers, streams and flooded areas in the form of organic carbon.

Thus, on a whole, mature ecosystems in the Amazon give off as much carbon dioxide as they absorb.

In late July, as the jet stream stalled over Canada and the northeastern United States turned steamy, Aufdenkampe sent this e-mail in reply to a “keep cool” message from UpStream:
“For the past three weeks I’ve been far from cool, but rather sweating in both sun and shade as we collected our first samples on this extended ‘expedition’ to Brazil. However, the sweat was well worth the opportunity to take boats into the flooded forests of both the Rio Solimoes and Rio Negro at the peak of high water. It’s quite amazing to see trees up to their necks in water and know that this happens two to three months out of every year. In November we will get to return to these same places at low water, when the river surface is 30 to 35 feet below where it is today. Now I’m back in southern Brazil, at my home base near Sao Paulo, where winter temperatures drop to about 18-25 degrees C (65-80°F).”

Where does elephant pest management fit into this picture? As Aufdenkampe explains it, back in the days between his graduation from Dartmouth College in 1991 and his postgraduate studies, he spent two years in the Peace Corps developing an elephant pest management program for the World Wild Life Fund in the Dzanga-Sangha National Park in the Central African Republic.

With him in that venture was his wife, Bonnie Dickson, a biology teacher who shares his avid interest in nature.

The Stroud Center is also part of the worldwide hunt for the missing carbon sink. See Page 3 of the spring 2002 issue of UpStream, “Can carbon 13 solve water mysteries.” Past issues of UpStream are available at the Stroud Center website, www.stroudcenter.org.
The Stroud Center lost one of its oldest friends and most loyal supporters with the death of Truman Welling on Dec. 18, 2001, just one week short of his 94th birthday and about 18 months after the death of Elise, his wife of 53 years, who was also a great friend to both the Stroud family and the Center.

Mr. Welling was a founding board member of the Stroud Foundation, where his financial acumen, attention to detail and unflinching candor made him an invaluable adviser to the Stroud family. He was subsequently a founding board member of the Stroud Water Research Center Inc., following the Center’s separation from the Academy of Natural Sciences in 1999. Although not a scientist, he never hesitated to ask the pointed question or give the candid answer.

In addition to his service to the Stroud Center, Mr. Welling was a long-time trustee of Upland Country Day School, a founding trustee of the Brandywine Conservancy and a founding member of the Pennsylvania Horse Breeders Association, which he also served as Treasurer. A lifelong horseman, fox hunter and thoroughbred breeder, he was a member of Mr. Stewart’s Cheshire Foxhounds, the Cheshire Hunt Conservancy, the Swiftwater Preserve, the Red Clay Valley Association and the Wilmington Club.

After graduating from the College of William and Mary in 1930, he joined the Du Pont Company and rose to the level of district sales manager in Greensborough, N.C. before joining the Navy in WWII. During the war he saw action in the North Atlantic and the Pacific aboard the Carrier Monterey and was honorably discharge with the rank of commander. After the war he rejoined the Du Pont Company in Wilmington, where he became director of the Products Marketing Division before his retirement in 1972.

Truman and Elise Welling’s commitment to watershed protection and open space led them to preserve in perpetuity “Scarlett Thicket,” their beautiful East Marlborough farm, and the East Branch of Red Clay Creek that runs through it.

Mr. Welling is survived by his son, Peter, and missed by all the organizations he served, particularly Stroud trustees and staff, who loved the words of wisdom he shared both at board meetings and while recycling his sherry bottles at the Center.
Drought report: streams, wells near record-lows

As emergency drought conditions continued into August, the White Clay Creek at the Stroud Center approached record-low levels. Streamflow has been recorded at the Stroud Center since 1968, and since that time there have been several droughts. But only once – in September of 1995 – did the flow drop to a level lower than it reached in mid-August of 2002.

Groundwater levels, monitored at the Stroud Preserve since 1992, tell a similar story. As of mid-August 2002, groundwater tables fell to record low levels, lower even than in 1995. The reason, not surprisingly, is a shortage of rain. The current drought began in 2001 with total rainfall 7 inches below the southern Chester County average (since 1949) of 45 inches. In 2002, through August 20, the 22 inches of rainfall recorded at the Stroud Center was another 7 inches below normal for that date.

The effect of rainfall on groundwater and streamflow depends not only on the quantity of rain, but also on its timing. In 1995, for example, we received 45 inches of rain – exactly the average – but most of it fell late in the year. As can be seen in the accompanying figures, the groundwater table rises only during the dormant season (roughly, October through mid-April), when vegetation does not intercept the precipitation that enters the soil. In late 2001 and 2002, when groundwater should have been rising, there was extremely little precipitation. As a result, the 2002 growing season began with water levels far lower than normal for that time of year. All of this means that, even if we receive normal rainfall during September, groundwater levels will continue to fall to even lower levels.

Denis Newbold

MALES NEED NOT APPLY

In the world of this stream-dwelling mayfly species, Centroptilum triangulifer, males are an insignificant minority and totally unnecessary. The females reproduce parthenogenetically – they lay unfertilized eggs which develop into exact clones of themselves.

The Stroud Center has a long-standing interest in this species, having obtained a patent for using it as a test organism for testing the toxicity of substances in stream and river environments.
MOUTHFUL OF MAYFLY

UpStream’s cover photograph is of a Louisiana waterthrush about to feed her nestlings with a large mayfly, subimago *Ephemera guttulata*. Louisiana waterthrushes breed throughout much of Pennsylvania, most commonly in the mountainous regions in western and central Pennsylvania. They are similar to the northern waterthrush which prefers to breed further north. Where their territories overlap in Pennsylvania, the Louisiana prefers fast-moving streams while the northern likes still waters and bogs. Both winter in southern climes.

While the waterthrushes look and act like thrushes, they actually belong to the warbler family.

The Louisiana usually builds its nest among the roots of trees on the banks of streams. It is sensitive to water quality and prefers undisturbed forested areas.

The cover photo was taken by Bob Wood on the Jonathan Run in the Powder Mill Nature Reserve, about 35 miles southeast of Pittsburgh.

According to the West Chester Bird Club, Louisiana waterthrushes are fairly common spring migrants along forested streams in southern Chester County, Pa.

If you see Louisiana waterthrush, please e-mail: kdixon@stroudcenter.org.

New staff

- Nicholas Principe started July 2 as data analyst in the Department of Information Services.
- Scott Shuler started June 2 in Department of Information services.
- David Yezuita started in May 2 and works in Lou Kaplan’s lab as a research technician.

New York project: drought conditions prevail

Stroud Center field crews completed their third year of monitoring the streams in the 2,000-square-mile watershed that provides New York City’s drinking water. Many of the streams, such as the one at right, and reservoirs had their lowest water levels since New York’s last major drought in the early 1980s.
Best ever and looking to 2003

With attendance up by 35 percent, the UpStream Festival’s wide range of attractions for all generations drew its biggest crowd ever last spring.

Responding to its theme of “Whirligigs, Stinkpots, Peepers and more,” children squealed with delight and horror as they touched live snakes, ate meal worm cookies and watched exotic cockroach racing. A highlight for the youngsters was the crafts corner where they watched as working models of whirligigs were made. Better still, they were able to take the models home.

Reportedly, Jeff Bole, the designer of the whirligigs, is already conjuring up new craft ideas for the 2003 festival on Saturday, April 26.

A new and popular attraction this year were the stream walks guided by the Center’s senior scientists.

Julia Loving, who co-chaired the 2002 festival, will serve as chair again next year. Her 2002 co-chair, Diane Belnavis, will continue to bring her bugs and cooking to the festival.

WHAT A DAY!

KATEA’S BACK

Tri-state Bird Rescue’s red-tailed hawk, Katea, was back on her perch at the UpStream Festival this spring after she was stolen and abandoned in a field in Pennsylvania. She was found near-dead on Nov. 30 last fall. Katea was taken back to Tri-State in Delaware, where her condition remained touch and go for weeks. Katea finally recovered and has now returned to doing her rounds with her Tri-state caretakers, at festivals and other events.

Above, to the amusement of Director Bern Sweeney, Pennsylvania Attorney General Mike Fisher bites on a cricket cookie.

Left, the Crafts Corner was a roaring success. Here, Barbara, standing, and Jeff Bole made whirligigs for the children.
UpStream
Festival
2002
Day of learning and fun in the sun

The MasCar races were a popular draw as humans of all ages lost their disgust for these gigantic Madagascar cockroaches, and the crowds urged their favorites on under the watchful eye of handicapper, state Representative Chris Ross.

A new attraction this year were the stream walks. Here senior scientist Lou Kaplan leads the first walk of the day.

DRAWINGS
The winners of drawings at the 2002 UpStream Festival were:

- EMS gift certificate
  Susan Meyers

- Bonnie Timmons artwork
  Patti Diggin

- Stone Barn meal certificates
  Nancy Cox
  George Drake
  Lori Fields
  Pat Vincen
  Stephen Rossi

KEEP THIS DATE!
Herald the end of winter next year with some hot salsa dancing on March 21, the spring equinox. The dance is a fundraiser for Upstream Festival 2003 and will be held at Upland Country Day School.
Pledge your gift to fresh water

The “Friends of the Stroud Center” was started in 1992 to support the research and education programs at the Stroud Water Research Center. The 750 households that make up the “Friends” now raise over $250,000 annually. The funds support research programs such as land-use management and the impact of reforestation on water quality, and education programs such as watershed courses for middle schools, summer internships for college students, teacher scholarships and public outreach efforts.

Each contribution is fully tax-deductible, and there are no tote bags or free passes to dilute your gift. As a “Friend” you receive our twice-yearly newsletter, *UpStream*, which keeps you up to date with our latest research findings and notifies all “Friends” of upcoming events such as:
- Stream Evenings
- Joan M. Stroud Memorial Lectures
- UpStream Festival

You may also consult our website, www.stroudcenter.org, for information about scheduled events, educational programs and volunteer opportunities.

**CONTACT**
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Friends of the Stroud Center Annual Fund

I/we wish to participate in the “Friends of the Stroud Center” to meet the future environmental research and educational challenges of water. Enclosed is my/our fully tax-deductible gift to the “Friends of the Stroud Center” at the following level:

- ___ $ 10+ Every drop counts!
- ___ $ 50+ Streamkeepers
- ___ $ 500+ Rainmakers
- ___ $1000+ Riverwatchers
- ___ $ 100+ Headwaters Sponsors
- ___ $5000+ Watershed Protectors

Name(s) .................................................................
(As you wish it/them to appear on the donor list)

Address ..............................................................

City ..................... State .... Zip. ............

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Please make checks payable to the Stroud Water Research Center.

A copy of the Stroud Water Research Center official registration may be obtained from the Pennsylvania Department of State by calling toll free, in Pennsylvania, (800) 732-0999. Registration does not imply endorsement.

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MAKE A TRIBUTE TO OUR TRIBUTARIES

... and receive a stream of income in the process.

Thirty-five years ago, W. B. Dixon Stroud and Dr. Ruth Patrick foresaw the importance of research on our freshwater ecosystems. Thus, the Stroud Water Research Center began.

Please reflect on the importance of fresh water during the next 35 years - and then consider the Stroud Center as a beneficiary of your gift planning.

By naming the Stroud Center in your estate plans, you can take pride in knowing that your support will enable Stroud Center scientists to meet the challenges of understanding and preserving fresh water for future generations.

And your gift may fit with your own long-term needs as well... for a charitable gift annuity can provide a lifetime income (at very appealing yields) and substantial tax benefits.

For more information, about charitable gift annuities or other gift planning options...

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Our Mission

The mission of the Stroud Water Research Center is to:

- advance knowledge of stream and river ecosystems through interdisciplinary research;
- develop and communicate new ecological ideas; to provide solutions for water resource problems worldwide;
- and to promote public understanding of freshwater ecology through education programs, conservation leadership, and professional service.

The Rio Tempisquito, the stream that runs past the Stroud Center’s tropical stream ecology center in Costa Rica’s Guanacaste Conservation Area.

UpStream
NEWS FROM THE STRoud WATER RESEArch CENTER

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