STRI news 2008

Smithsonian Tropical Research Institute, Panamá www.stri.org December 5, 2008

Tupper 4pm seminar

Tuesday, December 9, 4pm seminar speaker will be Nikki Strong, STRI.
Climate, land-use and the rise and fall of powerful Sub-Saharan societies

Paleo-Talk

Wednesday, December 10, Paleo-talk speaker will be Fabiany Herrera, University of Florida, in Gainesville.
Panamanian fossil floras: A potential for the understanding of Neotropical forests

Bambi seminar

Thursday, December 11, Bambi seminar speaker will be Meg Eckles, University of California, San Diego.
Title to be announced.

Arrivals

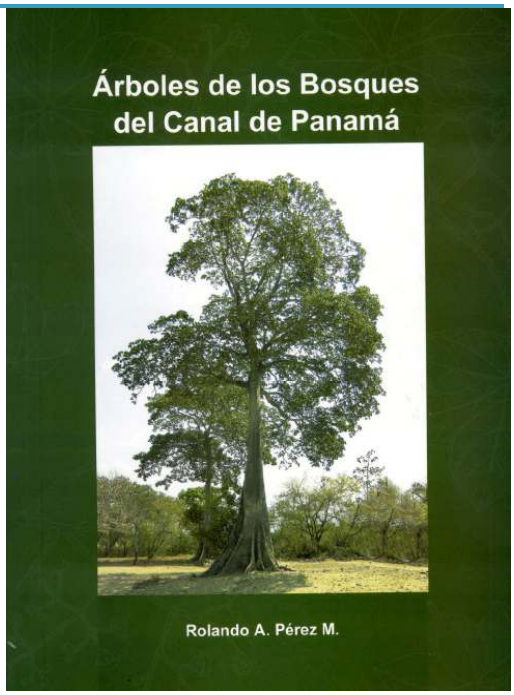
Joseph Williams, Ohio State University, to study cellular stress resistance in long- and short-lived species of birds, in Gamboa.

Departures

Carlos Jaramillo to Montreal, Canada, to attend the NEO & McGill Symposium.

STRI director Eldredge Bermingham to Montreal, to attend NEO symposium and committee meetings. Then to Kenya, to visit Mpala Research Centre to discuss current collaborative research support and outline future research opportunities at the station.

New STRI book by Rolando A. Pérez M.



The forests of the Panama Canal watershed have been under study for about 100 years. They are probably the best studied tropical forests of the world. National parks Chagres, Soberania, Camino de Cruces and Campana, San Lorenzo Protective Forest and Landscape, Metropolitan Natural Park, Gatun Lake Recreational Area and Barro Colorado Nature Monument are all in the Panama Canal Watershed. These protected areas include wetlands, and humid and very humid, dry, montane, deciduous and mangrove forests.

STRI biologist Rolando A. Pérez M. working with the Center for Tropical Forest Science (CTFS), published a guide to the trees of the Panama Canal watershed, to share with botanists and the general public, his powerful observation skills.

The book will enable users to locate and identify 210 species of trees common to the Panama Canal watershed. The role played by Pérez at the CTFS has made a great difference in the field work conducted at the BCI Forest Dynamics Plot during many years. According to STRI director Eldredge Bermingham, this book is a jewel and a valuable bibliographic resource for everybody interested in learning about the Panamanian flora.

The book will sell for $30 at the STRI bookstore. The book presentation will be held early next year.

Los bosques de la cuenca del Canal de Panamá han estado bajo estudio por cerca de 100 años. Son, probablemente, los bosques tropicales mejor estudiados del mundo. Los parques nacionales Chagres, Soberanía, Camino de Cruces y Campana, el Bosque Protector y Paisaje Protegido San Lorenzo, el Parque Natural Metropilitano, el Area Recreativa Lago Gatún y el Monumento Natural Barro Colorado se encuentran todos dentro de la cuenca del Canal de Panamá. Estas áreas protegidas incluyen humedales, y bosques húmedos y muy húmedos, secos, montanos, y manglares.

El biólogo de STRI Rolando A. Pérez M., quien trabaja en el Centro de Ciencias Forestales del Trópico (CTFS), publicó una guía de los árboles de la cuenca del Canal de Panamá, para compartir con botánicos y público en general su poderosa habilidad de observación.

El libro permitirá a los usuarios localizar e identificar 210 especies de árboles que son comunes en la cuenca del Canal. El rol que ha jugado Pérez en el CTFS ha hecho una gran diferencia en el trabajo de campo que se lleva a cabo en la Parcela de Dinámica de Bosques de BCI durante muchos años. De acuerdo al director de STRI, Eldredge Bermingham, este libro es una joya y un recurso bibliográfico de valor incalculable para los interesados en conocer más sobre la flora panameña.

El libro se venderá por $30 en la Libería de STRI. La presentación se hará a principios del próximo año.

More departures

Allen Herre and Sunshine Van Bael to Montreal, Canada, to attend NEO and McGill Symposium.

Haris Lessios and Rachel Collin to Montreal, Canada, to attend NEO and McGill Symposium.

Nélida Gómez, to San José, Costa Rica, to attend CADAN-R meeting and present STRI programs.

William F. Laurance and Susan Laurance to Los Angeles, CA, on a short vacation.

New publications

Duda, Jr, Thomas F., Bolin, Matthew B., Meyer, Christopher P., and Kohn, Alan J. 2008. "Hidden diversity in a hyperdiverse gastropod genus: discovery of previously unidentified members of a *Conus* species complex." *Molecular Phylogenetics and Evolution* 49(3): 867-876.

Laurance, William F. 2008. "Conserving the hottest of the hotspots." *Biological Conservation* Online.

Laurance, William F. 2008. "A tropical storm." *Ecologist* (November): 86.

Seid, Mark A., Scheffrahn, Rudolf H., and Niven, Jeremy E. 2008. "The rapid mandible strike of a termite soldier." *Current Biology* 18(22): 1049-1050.

Safety number:
212-8211

PNAS: Evidence from dirty teeth

Starch grains preserved on human teeth reveal that ancient Peruvians ate a variety of cultivated crops including squash, beans, peanuts and the fruit of cultivated pacay trees. This finding by Dolores Piperno, staff scientist at STRI and the NMNH, and Tom Dillehay, professor of archaeology at Vanderbilt University, sets the date of the earliest human consumption of beans and pacay back by more than 2,000 years, and indicates that New World people were committed farmers earlier than previously thought. The article that reports these findings will be published shortly by the *Proceedings of the National Academy of Sciences*.

Piperno examined 39 human teeth, probably from six to eight individuals. "Some teeth were dirtier than others. We found starch grains on most of the teeth. About a third of the teeth contained large numbers of starch grains," Piperno said.

To identify the starch grains, Piperno compared the particles in tooth scrapings with her modern reference collection of starch grains from more than 500 economically important plants. "We found starch from a variety of cultivated plants: squash, *Phaseolus* beans—either limas or common beans, possibly, but not certainly the former, pacay and peanuts," said Piperno. "Parts of plants that often are not evident in archeological remains, such as the flesh of squash fruits and the nuts of peanuts, do produce identifiable starch grains."

Starch from squash found on the teeth affirms that early people were eating the plants and not simply using them for nonfood purposes, such as for making containers or net floats. Whether or not some of the earliest cultivated plants, such as squashes, were grown as dietary items has been a long-debated question among students of early agriculture.

Evidence that foods had been cooked was also visible on some of the starch grains. Starch grains from four of the crops were found consistently through time indicating that beans, peanuts, squash and pacay were important food sources then, as they are today.

Taken from EurekAlert!

PNAS: New movement models tested at STRI

Tracking and remote sensing data are making it easier to locate organisms and find out what they are up to. However, general theories of movement are lacking. In a special feature on "Movement Ecology" to be published in *Proceedings of the National Academy of Sciences*, researchers present integrative models for movement of organisms as diverse as gut bacteria, tree seeds, ants, marine larvae and cheetahs.

"Our goal is to develop and test a general theoretical framework for movement that will integrate when, where, how and why organisms move, and will reveal the ecological and evolutionary consequences of movement," says Ran Nathan, research associate at STRI from the Hebrew University of Jerusalem working with STRI staff scientist S. Joseph Wright.

To ensure that mathematical models accurately predict real events, several have been developed and tested in the complex tropical forest on BCI. One of these is a new model for seed dispersal by wind, which accurately predicts tree seed movement under a wide range of conditions. Because trees can't simply pull up their roots and move in response to climate change or other threats, accurate modeling of tree seed dispersal has major implications for conservation across fragmented ecosystems and for understanding biological diversity.

New publications

Wcislo, William T., and Tierney, Simon M. 2008. "Behavioural environments and niche construction: the evolution of dim-light foraging in bees." *Biological Bulletin* Online.

Wright, S. Joseph, Trakhtenbrot, Ana, Bohrer, Gil, Detto, Matteo, Katul, Bagriel G., Horvitz, Nir, Muller-Landau, Helen C., Jones, Frank Andrew, and Nathan, Ran. 2008. "Understanding strategies for seed dispersal by wind under contrasting atmospheric conditions." *Proceedings of the National Academy of Sciences* Online.

Zillio, Tommaso, Banavar, Jayanth R., Green, Jessica L., Harte, John, and Maritan, Amos. 2008. "Incipient criticality in ecological communities." *Proceedings of the National Academy of Sciences* 105(48): 18714-18717.

STRI in the news

"The first aid: iceman may have dressed his own wounds" by Alexis Madrigal. 2008. *Wired Science*: December 1st.

"Dirty teeth reveal ancient diet". 2008. *AP DataStream*: December 1st.

"Old teeth reveal what was for dinner". 2008. Associated Press: December 2.

"Ancient teeth suggest Peruvians ate well" 2008. *UPI Science News*: December 2.

"El Instituto Smithsonian lanza base de datos sobre peces de aguas someras del Pacífico Oriental tropical" 2008. *DiCYT - Panamá*: December 1st.

"We add two entirely new things to this model: first, we consider dispersal in two dimensions, so that we can tell how close seeds fall to siblings who are potential competitors and sources of pests and disease. Previous investigators only considered the distance seeds moved," said STRI´s S. Joseph Wright. "In the end, we show that the direction of a seed's fall can compensate for large differences in distance moved: the ability of individual seeds and whole groups of trees to move across a landscape is a result of trade-offs with other traits that affect their survival."

Sensor systems mounted on satellites and on the ground will deliver increasing quantities of information about the changing location of organisms through time. An integrated Movement Ecology paradigm strengthens the ability of researchers to decide which information matters from a biological point of view and to make predictions essential to understanding phenomena from the spread of infectious diseases to habitat use by migratory birds.

Information taken from EurekAlert!

STRI at the SMBC Congress

Nélida Gómez, coordinator of STRI´s Office of Academic Programs, participated in the XII Congress of the Mesoamerican Society for Biology and Conservation (SMBC) in San Salvador, from November 10-14. The STRI booth promoted recent books written in Spanish by STRI authors, as well as the fellowship programs designed for Latin American students. Gómez also offered a course to write research proposals for students and young professionals. Twenty six participants from several Latin American countries benefitted from the course.

Nélida Gómez, coordinadora de la Oficina de Programas Académicos de STRI, participó en el XII Congreso de la Sociedad Mesoamericana de Biología y Conservación (SMBC), en San Salvador, del 10-14 de noviembre. La exhibición de STRI promovió libros recientes en español por autores de STRI, así como los programas de becas diseñados para estudiantes de América Latina. Gómez ofreció un curso para escribir propuestas de investigación, donde participaron 26 estudiantes y profesionales jóvenes de varios países latinoamericanos.

A Panamanian famous for its mandible

A single hit on the head by the termite *Termes panamensis* (Snyder), which possesses the fastest mandible strike ever recorded, is sufficient to kill a would-be nest invader, report Marc Seid and Jeremy Niven, STRI post-doctoral fellows working at the Neurobiology Laboratories, and Rudolf Scheffrahn from the University of Florida.

The group is interested in the evolution of termite soldiers' brains and how they employ different types of defensive weaponry," says Seid (in the photo). Footage of the soldier termite's jaws as they strike an invader at almost 70 meters per second was captured on a high speed video camera in the laboratory at 40,000 frames per second. Why are the termites so fast? When insects become small they have difficulty generating forces that inflict damage. "To create a large impact force with a light object you need to reach very high velocities before impact," Niven explains.

"The termites need to store energy to generate enough destructive force. They appear to store the energy in their mandibles but we still don't know how they do this—that's the next question," says Niven.

These findings were published on November 25 in *Current Biology* 18(22): 1049-1050. The international media responded with great interest to this publication.

Small bugs with “big” brains

Smithsonian Tropical Research Institute December 5, 2008

Story: John Douglass
Edited by M Alvarado and ML Calderon
Photos: MA Guerra

Does the size of an insect's body constrain its "brain power?"

John Douglass, and colleagues in STRI’s Laboratory for Behavior & Evolutionary Neurobiology investigate the relationship between brain and body sizes in insects and spiders, as part of an overall effort to understand evolutionary adaptations of animals with tiny brains, yet complex behavior.

In general, having a large brain should be beneficial, providing for greater behavioral sophistication. But keeping a brain is expensive, whether it belongs to a moth or a sloth.

The tradeoffs between having a larger, more extravagant brain, or a smaller, low-budget version may be especially important for very small animals, as they face the most severe constraints on brain size.

The conventional way to measure a small brain's volume involves a complicated, time-consuming process to chemically preserve the brain, followed by making a large number of slices —like slicing sandwich meat at the delicatessen— then tracing brain outlines in each slice to calculate their areas, and stacking the slices in a computer to re-build the three-dimensional shape.

John has developed a novel device, which he calls a portable microvolumeter, and is using it to study orchid bees, which vary in size but are similar in biology.

This instrument works by precisely measuring how much fluid is displaced when a freshly dissected brain is added to an initial volume of liquid.

The results of these studies will help reveal which insects are investing more in their brains, and the extent to which brain size is indeed restricted by body size.

¿Puede el tamaño de un insecto limitar su poder cerebral?

John Douglass y sus colegas en el Laboratorio de Comportamiento y Neurobiologia Evolutiva de STRI, investigan la relación entre el tamaño del cerebro y el cuerpo en insectos y arañas, como parte de un esfuerzo general para entender las adaptaciones evolutivas de animales con cerebros pequeños, pero con un comportamiento complejo.

En general, tener un cerebro grande puede ser beneficioso si ofrece mayor sofisticación. Pero mantener al cerebro es costoso, ya sea que pertenezca a una mariposa nocturna o a un oso perezoso.

Los trueques entre tener un cerebro grande o una versión pequeña de bajo presupuesto, puede ser especialmente importante para animales muy pequeños, ya que son los que se enfrentan con las mayores limitaciones en cuanto al tamaño del cerebro.

La manera convencional de medir el volumen de cerebros pequeños representa un proceso largo y complicado para preservar el cerebro químicamente, seguido por un gran número de cortes —como cortes para emparedados de carne muy fina— y luego seguir las líneas del cerebro en cada corte, para calcular sus áreas y almacenar los cortes en una computadora para reconstruir su forma tridimensional.

John ha desarrollado una herramienta a la cual llama micro-volúmetro portátil, y lo está usando para estudiar las proporciones cerebrales en abejas de orquídeas, que varían en tamaño pero que son similares en su biología. Este instrumento funciona al medir con precisión la cantidad de líquido se desplaza cuando un cerebro recién extraído se sumerge en un volumen inicial de líquido.

Los resultados de estos estudios ayudarán a revelar cuales son los insectos que invierten más en el tamaño de su cerebro y hasta qué punto el tamaño del cerebro puede realmente ser limitado por el tamaño del cuerpo.