Smithsonian Institution

Spotlight on Science at the Smithsonian

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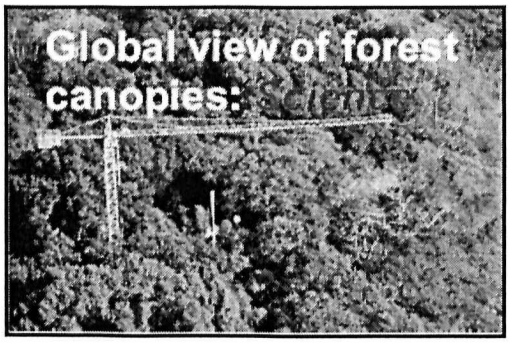


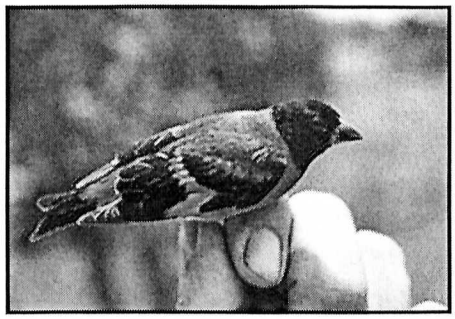
A View from the Top

Forests make up 90 percent of Earth's terrestrial biomass. Besides providing crucial habitat for countless plant and animal species, forest canopies play an interactive role in the carbon cycle and in local and regional hydrological patterns, by controlling evapotranspiration and intercepting up to 25 percent of precipitation.

The forest canopy is a key habitat for monitoring and investigating principal factors in global climate change, such as carbon dioxide enrichment and habitat disturbance. Trees respond in a species-specific manner to elevated levels of carbon dioxide, while climate change threatens plant-animal interactions in the canopy and will likely alter the production of aerosols that affect cloud formation and atmospheric chemistry.

Gaining access to forest canopies was particularly challenging for researchers, until the early 1990s, when Smithsonian Tropical Research Institute (STRI) scientist Alan P. Smith (1945–93) and Fernando Pascal, from the Office of Engineering and Operations used a construction crane.

Researchers around the globe are using the same system today, including an international group of scientists that includes STRI staff scientist S. Joseph Wright, an international authority in canopy biology. Their work promises to greatly simplify analysis of the role of species composition in determining water and carbon fluxes in forest canopies, thus allowing for better predictions of the potential effects of global climate change on forests. An article in the July 11 issue of *Science* presents some examples of their multidisciplinary research.



Adult Male Red Siskin (*Cardeulis cucullata)* from a newly discovered population in Guyana.

Rare Birds Discovered in Guyana

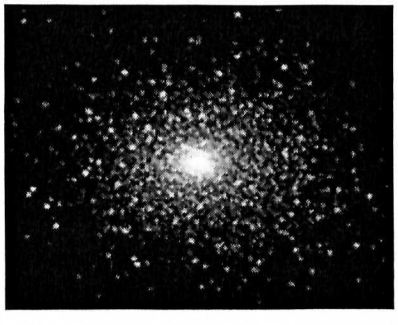
A research team led by National Museum of Natural History scientist Michael Braun and Mark Robbins of the University of Kansas has discovered a previously unknown population of red siskins, a bird feared to be nearing extinction in the wild. Once widespread in the coastal mountains of Venezuela and Colombia, the red siskin was nearly wiped out by trapping after it became popular both in that region and in Europe in the 1800s. The bird was particularly valued for its bright red feathers and in Latin America it is know as *el cardinalito*, or the little cardinal.

The research team was conducting a survey of birds in Guyana, when Robbins came across the new population. Census estimates put the population size at several thousand birds, larger than any known

elsewhere in the wild. The discovery was made in April of 2000 with sponsorship from NMNH's Biodiversity of the Guianas Program, but was kept und er wraps until a conservation plan could be developed providing legal protection for the birds in Guyana.

Conservation efforts are being undertaken by an international coalition of concerned groups, including American Bird Conservancy, American Federation of Aviculture, Bushnell Sports Optics, Guyana Environmental Protection Agency, Conservation International, the National Aviary, Rupununi Conservation Group, Rupununi Development Corporation, Smithsonian Institution, the University of Guyana and the University of Kansas. The goal of the conservation plan is to avoid damage to the wild population, and not to prevent people from raising the birds in cages. Red siskins have been protected in neighboring Venezuela since the1940s, and have a history of being bred with canaries to yield brightly colored pet birds.

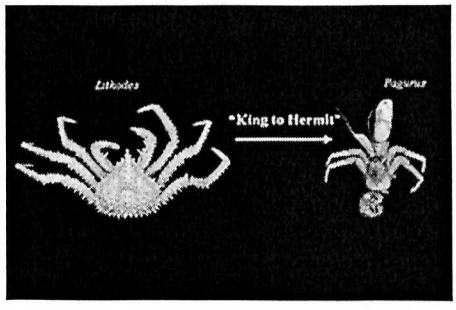
The researchers' discovery was published in the latest issue of *The Auk,* the journal of the American Ornithologists Union. Announcement of the findings has been widespread, as the story was picked up by the Associated Press.



A Hubble Space Telescope of the globular cluster, M80. Located about 28,000 light-years from Earth, M80 contain hundreds of thousands of stars, all bound together by their mutual gravitational attraction.

Global Clusters

Globular clusters are roughly spherical collections of stars -- up to as many as one million of them -- that are gravitationally bound together in groups whose dimensions are as small as about a hundred light-years in diameter. This is an incredibly small space in which to fit so many stars. The nearest neighbor star to our Sun, Proxima Centauri, is about three light-years away, but if the Sun were to reside near the center of one of these globular clusters it might have ten thousand such "near neighbors." Our Sun (along with the Earth and the Sun's other planets) is moving in the Milky Way galaxy; it has a velocity of about 20 km/second with respect to the nearest stars. Stars in globular clusters are also in motion. With so many stars so close together and moving, it is perhaps not surprising to learn that interactions between stars frequently occur in these clusters. The stars, while mostly not colliding, do get close enough to strongly influence each other gravitationally, or even to join up to become a binary star. In last month's Astrophysical Journal Letters, CfA astronomer Bryan Gaensler, along with an international team of 14 other astronomers, use extensive Chandra X-ray Observatory results to provide the first conclusive evidence for a link between the rate of stellar encounters in globular clusters and the number of close binary stars that exist there. Globular clusters are unique laboratories for learning how stars, including those like our Sun, behave when they encounter other stars. The result will help scientists trying to understand the Sun more thoroughly, by understanding how stars like the Sun react in these extreme situations.



Lithodes aequispinus **("golden king crab") and** ***Pagurus hirsutiusculus*** **("hairy hermit").**

How a King Became a Hermit

The delicious king crabs that we all love to eat are technically nothing more than heavily calcified hermit crabs that don't use snail shells or other forms of housing for protection. It has long been believed that king crabs evolved from asymmetrical and mostly

membranous shell-dwelling hermit crab ancestors. That female king crabs have an asymmetrical plate arrangement on their abdomen and have abdominal appendages only on the left side (the males are perfectly symmetrical except for a slight right-handedness) has been cited intuitively as evidence for more than 100 years that the king crab body must have evolved from asymmetrical, membranous hermit crab ancestors.

Rafael Lemaitre of the Smithsonian's Department of Systematic Biology, Patsy A. McLaughlin of Western Washington University, and Smithsonian research associate Christopher Tudge of American University have recently completed a two-part study indicating the flaws in this "hermit to king" hypothesis. Published in the Dutch journal *Contributions to Zoology,* their study shows that king crabs, through an evolutionary process of abdominal plate division, decalcification, and body simplification, gave rise to the membranous hermit crabs. So instead of a lowly hermit evolving into a mighty king, His Majesty evidently stepped down from the throne. Thus, Lemaitre and McLaughlin have posited the "king to hermit" theory.

Members of the Peace-Corps-sponsored Namibia team conduct an experiment in floating and sinking during the National LASER Science Education Strategic Planning Institute.

An Experiment in Science Education

On June 20, the National Science Resources Center (NSRC) concluded an intensive six-day K-8 Science Education Strategic Planning Institute in Washington, DC. Leadership teams composed of administrators, teachers, scientists, engineers, and community leaders from 10 states, Puerto Rico, and Mexico attended, along with a special Peace Corps team from Namibia, Africa. About 74 percent of the K–8 students represented on the U.S. teams are members of minority groups, and more than 64 percent of them are eligible for free or reduced-price lunch.

The teams' work resulted in first-draft strategic plans for science education reform. When fully developed, the heart of the plans will be the implementation of research-based, inquiry-centered science curricula based on the National Science Education Standards. The draft plans will incorporate a long-term strategy of ongoing professional development, will establish cost-effective systems for supplying science equipment and materials to classrooms, will actively enlist the support of district administrators and key community leaders, and will include methods for evaluating student performance and program effectiveness.

At the Institute, the Namibia team developed a one-year science education pilot project that it will consider expanding if the pilot proves successful. The Peace Corps will evaluate the progress of the Namibia team to determine whether it should use the NSRC model in future science education programs in developing nations.

Recent Publications

Hussein, A.; Bozzi, B.; Correa A.; Mireya, D.; Capson, T.; Kursar, T.; Coley, P.; Solis, P.; Pablo, N.; Gupta, M. 2003. "Bioactive Constituents from the Three Vismia Species," *Journal of Natural Products* In press.

Polley, D. et al. 2003. "Dynamical Formation of Close Binary Systems in Globular Clusters," *Astrophysical Journal Letters,* 591; (L131).

Robbins, M.B.; Braun, M.J.; Finch, D.W. 2003. "Discovery of a Population of the Endangered Red Siskin (*carduelis cucullata)* in Guyana," *Auk,* 120: 291-298.

Wildt, D. 2003. "The Role of Reproductive Technolgies in Zoos: past, present and future," *International Zoo Yearbook,* 38:111-118.Robbins,

Wright, J.; Ozanne, C.; Anhuf, D.; Boulter, S.; Keller, M.; Kitching, R.; Korner, C.; Meinzer, F.; Mitchell, A.; Nakashizuka, T.; Silva Dias, P.; Stork, N.; Yoshimura, M. 2003. "Biodiversity Meets the Atmosphere: A Global View of Forest Canopies," *Science*, July 11; 301: 183-186 (in Review).

Web Links

SERC's Marine Invasives Research Laboratory recently linked its extensive database of invasive marine species with a similar database at the Australian research organization CSIRO. Both databases can now be searched simultaneously from a single query on the web, forming a global inventory of invasive marine species.

http://invasions.si.edu/nemesis/index.html

Spotlight on Science at the Smithsonian

Spotlight on Science at the Smithsonian is a weekly electronic newsletter about Science at the Smithsonian. It is produced for the Smithsonian community by the Office of the Under Secretary for Science. To contact the editor, e-mail mellendickt@si.edu.

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