

SOUTHEAST CLIMATE SCIENCE CENTER ANNUAL REPORT FY11-12

PHOTO BY ALAN CRESSLER

► FY11 FEATURED PROJECT



Thomas Bresson

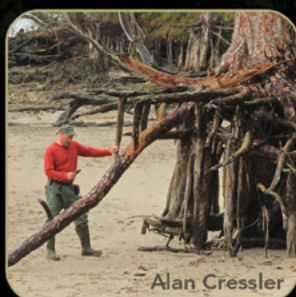
Researchers at NC State have used a combination of field experiments, lab experiments and models to understand how insect species may respond to both urban and global warming. Their results suggest that some changes in the life cycle of certain insects have already occurred in response to urban warming. Continue reading, page 2.

► RESEARCHER SPOTLIGHT



SE CSC Post-Doctoral Research Fellow Carlos Botero published his research entitled "Fluctuating Environments, Sexual Selection and the Evolution of Flexible Mate Choice in Birds" in PLoS ONE. Read more, page 3.

► NINE NEW FY12 PROJECTS



Alan Cressler

In addition to the continuation of funding of five projects from FY11, the SE CSC has funded nine new research projects in FY12. Project titles and principal investigators are listed on page 4.

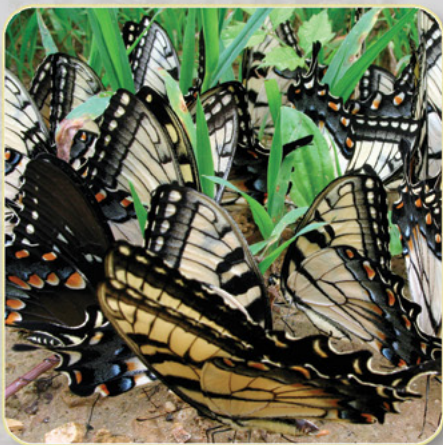
SE CSC ACCOMPLISHMENTS

- Hired a Permanent Director, Dr. Gerard McMahon
- Moved to permanent office space at Department of Biology, North Carolina State University
- Published the Science and Operational Plan for the Center
- Published multiple fact sheets that provide an overview of the Center and summarize the Science Plan
- Supported twelve graduate students representing multiple departments at NC State University
- Developed a Strategic Annual Plan for Science Planning
- Hosted a regional Science Planning Workshop in St. Petersburg, Fla.
- Developed cooperative relationships with state, NGO, and federal partners, including the Appalachian, Caribbean, Gulf Coast Prairie, Gulf Coastal Plains and Ozarks, Peninsular Florida, and South Atlantic Landscape Conservation Cooperatives
- Funded 14 research projects in Fiscal Year 2012 – nine of which were new projects and five were continuation of funding from FY11
- Held the inaugural Stakeholder Advisory Council Meeting in cooperation with the Southeast Natural Resources Leadership Group in Chattanooga, TN.

Read more about the SE Center at our website:
www.theglobalchangeforum.org/se-csc

FEATURED FY11 PROJECT: INTEGRATING THE EFFECTS OF GLOBAL AND LOCAL CLIMATE CHANGE ON WILDLIFE IN NORTH AMERICA

ROB DUNN (NCSU, Biology), STEVE FRANK (NCSU, Entomology), NICK HADDAD (NCSU, Biology), NADIA SINGH (NCSU, Genetics), and other researchers



In the southeastern U.S., urbanization and urban warming will occur in concert with global warming. Urban warming also provides a lens into the changes that might be expected with global warming. Researchers at NCSU, led by Rob Dunn, have used a combination of field experiments, lab experiments and models to understand how insect species may respond to both urban and global warming. Their results suggest that some changes in the life cycle of certain insects have already occurred in response to urban warming.

1-Butterfly species in Ohio, for example, appear to have shifted when they fly in response to urban warming. Some native butterfly species seem to be at risk due to the shortening of their flight periods caused by these shifts.

2-Certain tree pests, such as invasive scale insects, have also changed their life history in response to urban warming. Scale insects are more abundant and mature into adulthood earlier in warm areas of cities. Preliminary evidence suggests that the same occurs in experimental warming in the field and in greenhouse conditions. These shifts are not due to escape from parasites and predators but instead seem to be due to physiological responses of scale insects to warmer conditions. The increase in abundance of scale insects with warming is likely to have detrimental effects on native trees, both in warm urban areas and in areas that are warmer due to global warming.

3-A third group of insects, ants, has been studied in the most detail by researchers in Rob Dunn's lab. Dunn and his colleagues have found that warm and cement-covered areas of cities tend to be dominated by ant species from the southwestern U.S. These ant species succeed because they are more thermally tolerant. The successful urban species tend to be the same ones that succeed in experimental warming chambers in the forest, suggesting they will also succeed with global warming. The success of these ant species appears to be due to their ability to withstand temperatures above those tolerated by the proteins and enzymes in less heat tolerant native ant species. This research suggests that these thermally tolerant ant species include fire and argentine ants, two invasives that can negatively affect wildlife as well as other native species and, in the case of fire ants, human health and well-being.

In general, the results of this research conducted at NCSU suggests that many of the responses of insect species, be they butterflies of conservation concern, ants of ecological importance or scale insects of danger to native tree species, can be predicted, to a first approximation, based on relatively simple physiological traits. This is good news because for the vast majority of rare and/or dangerous insect species, very little is known about their biology, but traits related to physiological tolerance can easily be measured. Although species traits seem to be most relevant for predicting future distributions and consequences of warming, early work on a pest beetle suggests that we also need knowledge about the physiology of the beetle's mutualist bacteria and fungi.

READ COMPLETE PROJECT SUMMARIES AT: www.theglobalchangeforum.org/se-csc/

FY11-12 CONTINUING PROJECTS



SOUTHEAST REGIONAL ASSESSMENT PROJECT (SERAP)

Brian Hughes, Georgia Water Science Center



DEVELOPING LONG-TERM URBANIZATION SCENARIOS FOR THE APPALACHIAN AND GULF COASTAL PLAIN AND OZARKS LCCS AS PART OF THE SOUTHEAST REGIONAL ASSESSMENT PROJECT

Jaime Collazo, USGS North Carolina Cooperative Fish and Wildlife Research Unit



IMPACT OF OCEAN WARMING AND ACIDIFICATION ON GROWTH OF REEF-BUILDING CORALS

Ilsa B. Kuffner, USGS St. Petersburg Coastal and Marine Geology Science Center



PREDICTING VULNERABILITY OF SEA TURTLE NESTING BEACHES TO CLIMATE CHANGE

Kristen M. Hart, USGS Southeast Ecological Science Center

RESEARCHER SPOTLIGHT: CARLOS BOTERO

CARLOS BOTERO – Initiative in Biocomplexity at NC State University

Carlos is an integrative evolutionary ecologist broadly interested in how basic ecological processes can influence micro- and macro-evolution. He uses tools from behavioral ecology, phylogenetic comparative methods, and theoretical biology to study the effects of quasi-periodic oscillations in ecological conditions (particularly climate-related variables) on the dynamics and outcome of evolution. Through this line of inquiry, he is exploring questions related to the evolution of cognition, phenotypic plasticity, and biological complexity, and generating a theoretical framework that can help identify and address some of the long-term consequences of climate change.



Carlos' research focuses on the effects of geographic variation in the frequency of extreme weather events as well as in the annual variance and predictability of local climate patterns. His research addresses the SE CSCs mission by developing a better understanding of how these environmental features have shaped the evolution of phenology, morphology, physiology, and behavior, and of how their current changes may impact animal populations worldwide. His research program is also exploring the connections between environmental uncertainty and other critical features of animal life such as sociality, diet, and host-parasite interactions.

Featured publication: Botero CA, Rubenstein DR (2012) [Fluctuating Environments, Sexual Selection and the Evolution of Flexible Mate Choice in Birds](#). *PLoS ONE* 7(2): e32311. doi:10.1371/journal.pone.0032311

FOR MORE INFORMATION, PLEASE VISIT OUR WEBSITE: www.theglobalchangeforum.org/se-csc

NINE NEW PROJECTS FUNDED FOR FY12

In May 2012 the U.S. Department of the Interior Southeast Climate Science Center (SE CSC) announced the award of 2012 climate science research funds that are supportive of the science goals and objectives described in the SE CSC Science Plan. For additional information about the SE CSC and updates on our research and other activities, please visit the NCSU/SE CSC website: theglobalchangeforum.org/se-csc



SYNTHESIS OF CLIMATE MODEL DOWNSCALING PRODUCTS FOR THE SOUTHEASTERN UNITED STATES

Ryan P. Boyles, NCSU



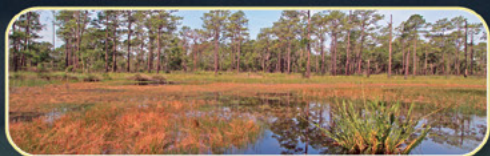
HYDROLOGICAL MODELING FOR FLOW-ECOLOGY SCIENCE IN THE SOUTHEASTERN UNITED STATES

*Jonathan Kennen, USGS NJ Water
Science Center*



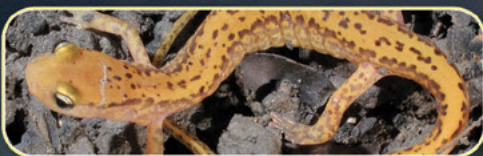
ECOLOGICAL IMPLICATIONS OF MANGROVE FOREST MIGRATION IN THE SOUTHEASTERN UNITED STATES

*Michael Osland, USGS National
Wetlands Research Center*



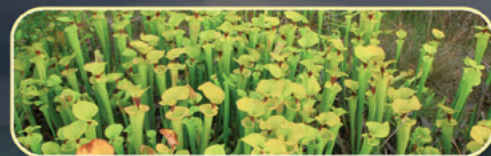
ASSESSMENT OF TERRESTRIAL AND AQUATIC MONITORING PROGRAMS IN THE SOUTHEASTERN UNITED STATES

Damian Shea and Cari Furiness, NCSU



CONNECTIVITY FOR CLIMATE CHANGE IN THE SOUTHEASTERN UNITED STATES

Nick Haddad, NCSU



ASSESSING CLIMATE-SENSITIVE ECOSYSTEMS IN THE SOUTH- EASTERN UNITED STATES

*Jaime Collazo, USGS NC Cooperative
Fish and Wildlife and William J. Wolfe,
USGS Tennessee Water Science Center*



DEVELOPING LONG-TERM URBANIZATION SCENARIOS FOR THE CARIBBEAN LCC AS PART OF THE SOUTHEAST REGIONAL ASSESSMENT PROJECT

*Jaime Collazo, USGS NC Cooperative
Fish and Wildlife Research Unit*



COMMUNICATING AND USING UNCERTAIN SCIENTIFIC INFORMATION IN THE PRODUCTION OF 'ACTIONABLE SCIENCE'

*Brian Irwin, USGS Georgia Cooperative
Fish and Wildlife Research Unit*



A HANDBOOK FOR RESOURCE MANAGERS TO UNDERSTAND AND UTILIZE SEA-LEVEL RISE AND COASTAL WETLAND MODELS FOR ECOSYSTEM MANAGEMENT UNDER FUTURE CONDITIONS

*Thomas W. Doyle, USGS National
Wetlands Research Center*

PHOTOS BY ALAN CRESSLER

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