



United States  
Department of  
Agriculture

Forest Service



# International Institute of Tropical Forestry

## 2013 Accomplishment Report



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## Editor's Message



Fiscal year 2013 was marked by the celebration of the 75<sup>th</sup> Anniversary of the Institute. A year full of celebratory activities across all our programs: International Cooperation, State and Private Forestry and Research and Development. It was a year of reconnecting with longer term colleagues, employees and partners; and enthusiastically developing newer friendships. Hope you enjoy reading as much as we feel grateful for the opportunities of collaboration opened via the Arts and Sciences, the 16<sup>th</sup> Caribbean Foresters Meeting and Conservation Education – among many other significant accomplishments. Once again thanks to Marinelis Talavera for helping in editing of this report.

Happy Readings!



## Message from the Director



The year 2013 already fades in my memory because we spent so much time preparing for our 75<sup>th</sup> anniversary the following year. The Institute is active on so many fronts that it is difficult to attribute accomplishments to particular years. However, I will remember 2013 for the visit to the Institute of the first Puerto Rican Astronaut, Joe Acabá. We seldom host celebrities at the Institute, and I was taken back by the behavior of our employees and visitors when Joe walked into our Conference Room. Everybody, including the President of the University of Puerto Rico, wanted a picture with Joe. You can see from pictures in this report that even the Mayor of San Juan visited with Joe and she did so at Capetillo, the location that we selected for Joe to interact with the children of Río Piedras. Our State and Private Forestry Program helped develop an urban garden as well as a conservation education and riparian restoration program in this underrepresented community in the center of metropolitan San Juan. Joe Acaba spent all

the afternoon at the neighborhood as whole classes from elementary to high school walked from their schools to Capetillo to be with the astronaut. It was an unforgettable afternoon of learning, joy, and pride for Puerto Rico, picture taking, and friendship that I will never forget. These kinds of activities make our jobs fun and meaningful and contrast with the quiet research that we do, but which is equally important and relevant.

This report contains research highlights that illustrate the breadth of our program that ranges from novel forests, to migratory avian species, to remote sensing, landscape ecology, and more. In the international realm we hosted a meeting of Caribbean Foresters in the Dominican Republic where we formally established a network of forest research plots that will allow us to understand the long-term behavior of Caribbean forests and how they are different from continental forests outside the hurricane belt. All our State and Private Forestry activities are highlighted, as are other international ones. This work is made possible because of the support of our administrative unit, which operates in anonymity but with effectiveness.

I have a final memory of 2013 that resonates with what we are: it was a press conference at the Botanical Garden in Río Piedras under majestic Guanacaste (*Enterolobium cyclocarpum*) trees. The objective was to announce a new fire danger rating system for Puerto Rico, a system generated by one of our scientists (reported here). But neither our scientist nor the Institute was at the center of the press conference. The star was

the Puerto Rico Fire Chief who announced how significant forest fires were in Puerto Rico (well over half of all island fires are forest fires) and the priority he was giving to this ignored forest disturbance. The head of the National Weather Service was also present and announced that from then on the Weather Service would include fire danger levels in their forecasts. The Secretary of

the Department of Natural Resources and the Environment was there as well, but like us, took a back seat on the occasion. You see, the stewardship of our forests is now in the hands of many, not just the Forest Service or the Department of Natural Resources and the Environment. Partnerships ruled the day and that was memorable to me.



## Vision and Mission

We are a center for excellence where creativity and accomplishments result in timely products and services that anticipate the needs of society as it mitigates and adapts to environmental change.

Our mission is to develop and disseminate scientifically based knowledge that contributes to the conservation of forests, wildlife, and watersheds of the American tropics in the context of environmental change.

## A working Vision for Safety

We actively care for the safety of ourselves, one another, and the public. Success is safely achieving our mission—with all of us returning home every day!



M. Rivera

## The Institute

The International Institute of Tropical Forestry (the Institute) is a tropical forestry research and technology transfer institute. Located in Río Piedras, Puerto Rico, it has a long and productive history. Created in 1939 as the Tropical Forest Experiment Station in cooperation with the University of Puerto Rico, the Institute has been in operation continuously for 73 years. The Institute serves as a focal point for bringing external research and educational resources to bear on issues affecting tropical forests and grasslands.



Because of the high diversity of tropical landscapes and the multicultural and multilingual user base, Institute employees must have specialized knowledge and skills in many fields. Our assets include an exceptional cadre of bilingual and trilingual scientists, natural resources managers, professionals, and technicians; state-of-the-art facilities, including laboratories, experimental research forests, and an excellent tropical forestry library; a long tradition of collaborations; and constituents who are highly supportive of our mission and programs.



## Description of the Institute's Facilities

### Headquarters

The Institute Headquarters has 50,000 square feet of modern, state-of-the-art facilities that are secure, functional, accessible, and that service the scientific community of the Institute and its collaborators. The Headquarters complex is located in Río Piedras, Puerto Rico, and houses:

- The Institute's Headquarters building—a historical building restored and modernized into a high-performance sustainable building.
- A Chemistry Laboratory focusing on analytical chemistry of plant tissues, water, soils, and air. In a typical year, more than 50,000 analyses on samples collected from tropical ecosystems around the world are completed by laboratory personnel.
- A GIS and Remote Sensing Laboratory to study landscape ecology using geographic information systems (GIS), remote sensing, and field studies. This laboratory develops information, methods, and products using spatial data and analyses at multiple scales, which are made available through maps, publications, and training.
- A technology transfer conference center for meetings, trainings, and conferences. This facility has a food serving area and accessible restrooms.
- A multipurpose building that houses a dormitory, a gym, general storage area, office space, and lunch area.
- An area for sample preparation and long-term storage of samples.
- Three back-up generators to ensure that electrical power is available for continuous operation during power blackouts, and 3,400-gallon potable water tank that can provide drinking water during water shortages.

### Sabana Field Research Station

The Sabana Field Research Station has a rich history; it was originally established by the Forest Service in 1938 with the objective of maintaining security and surveillance of all surrounding forest areas. Later, between the 1970s and the 1980s, the station was a saw mill, and finally, after 1989, the station was fully dedicated to research activities.

The Sabana Field Research Station has all the amenities to accommodate individuals and groups interested in completing scientific work in the surrounding or nearby areas located within the Luquillo

Experimental Forest, like the Sabana River and Bisley (experimental watersheds).

The station is located on PR Road 988 km 6.5 in the Sabana neighborhood in the town of Luquillo and offers multiple facilities:

- Dormitory building with restrooms, showers, and kitchen; and
- A multipurpose building with a mycology laboratory, oven room, sample preparation room, laundry room, and storage areas.

## Library

The library at the Institute was founded in 1939 and was a Research Station library until 2007 when the Forest Service integrated existing Station libraries into a more efficient, unified structure thus providing the most cost-effective means of meeting agency information needs and full range of scientific and technical information to all FS employees. Since 2007, the Institute's Library is part of the National Forest Service Library (NFSL) Program. It is one of two specialized libraries within the NFSL, the other is located at the Forest Products Laboratory. All other libraries are in the continental U.S. The scope of the library at the Institute is in tropical forestry and tropical forests around the world, but specializes in the New World Tropics. The Library is considered unique and furthermore an important resource on tropical forestry in the world. Our technical information resources are fundamental for studies conducted by international scientists, local Institute scientists, and post-doctoral students from local, national and international universities, as well as land managers and other professionals in the natural resources fields.

The library is open for "walk in" visitors and the general public on Monday, Wednesday and Friday from 11:00 am to 4 p.m. and Tuesdays and Thursdays from 8:00 am to 1:00 pm. An appointment isn't necessary, but it is recommended to enhance user experience when needing in-depth service on research topics.

The library has books, theses, journals in both hardcopy and electronic format and databases in tropical forestry and related natural resources fields. As part of the NFSL program the library also has access to other forestry resources, not only those that are tropical in nature. It houses a collection of international government and tropical forestry documents organized by country as well as a small map, slide and photographic collection. Most of the collection is accessible for consulting purposes within schedules mentioned above.

This year library staff answered numerous requests for information from Institute staff, other FS units, from onsite visitors and others.

- Delivered 5,198 articles, publications and other materials of which 3,892 were for non-Forest Service individuals or organizations.
- Catalogued 679 items during the year. The bibliographical information was input into the National Forest Service Library online database FS INFO. This brings the total of items catalogued since 2000 to close to 11,000 items.
- Received 571 requests for information, to provide answers to questions and or to provide referral services. Among these, several individuals received counsel on forests in Puerto Rico from our library volunteer, retired forester Dr. Frank H. Wadsworth.
- Produced 101 literature search requests.
- Provided services to 98 walk-in visitors, many of them graduate students.



Working in the library involves providing access to new and older materials through use of diverse technologies.

Providing access to library resources is one of the major aspects of library work. We strive to preserve resources while providing access to our users. Access is provided through continuously organizing and cataloging recently received and older documents and materials; providing online access to needed resources and digitizing and organizing publications and historical photographs, slides and maps. Currently we are working on digitizing a subset of the Institute's publications, in FY14 we will begin the second phase of digitizing historical photographs.

We completed initial digitizing of all available Institute publications from 1970-1999. The next steps will be to look for other sources of hardcopy or electronic versions of publications that haven't been digitized for these years and posting of the better quality ones to Treearch, the full-text, peer-reviewed database of Forest Service R&D publications. Scanning of all remaining Acta Cientifica journal volumes were completed. Several volumes were posted to Treearch, in the near future all of them will be available online. Many recent publications of the Institute, including the Acta Cientifica journal, are available through Treearch while some are still available in hardcopy format. Please contact us for an extensive list of the Institute publications or if you need further assistance.

Treearch link

<http://www.treearch.fs.fed.us/>

You can also locate Treearch publications by geography and/or full text searches using Geotreearch.

<http://www.fs.fed.us/research/products/geotreearch/>

**Institute contact:**

Gisel Reyes, [greyes@fs.fed.us](mailto:greyes@fs.fed.us)

## El Toro Wilderness: Art & Science Collaboration Residency

As part of the celebration of the 50th Anniversary of the Wilderness Act, the Aldo Leopold Wilderness Institute wanted to establish arts and science residencies in six biomes across the US that would represent a variety of ecosystems and partner agencies. El Toro Wilderness in El Yunque National Forest (Luquillo Experimental Forest) is a unique location – representing the first designated wilderness in Puerto Rico and the first designated tropical wilderness in the national forest system, so it seemed like a good option. Grizelle González wrote the proposal to include El Toro as part of the arts and science collaboration with two main goals in mind: 1) to showcase the significance of the research work being performed at the US Forest Service-Institute in Río Piedras, Puerto Rico and, 2) providing the opportunity to local Puerto Rico artists to collaborate with visiting artists (from mainland US and Europe) and scientists while living and working in a relatively remote environment. In collaboration with the Museum of Contemporary Art (MAC) local artists were integrated into the residency and the future exhibit.

### Meet the Residency Artists

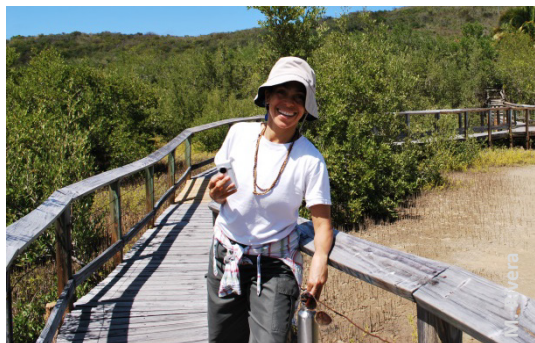
Three artists were selected by the Colorado Art Ranch as designated by the Aldo Leopold Wilderness Institute. Aline Veillat lives in Switzerland and has an Master of Arts degree (MA) and Doctor of Philosophy degree (PhD) degrees in Aesthetics, Sciences and Technologies of Arts from Paris 8 University; Jonathan Cohrs a virtual artist based in Brooklyn, NY that has taught at Parsons The New School for Design; and Grisha Coleman also from NY an Assistant Professor of Movement, Computation and Digital Media at the School of Arts, Media and Engineering.



Aline Veillat



Jonathan Cohrs



Grisha Coleman

From Puerto Rico, the artists Elizabeth Robles, a professor with a Bachelor of Arts degree (BA) in History of Art from the University of Puerto Rico and a MA in Media and Contemporary Culture from Universidad del Sagrado Corazón; Dhara Rivera, faculty member of the Escuela de Artes Plásticas of Puerto Rico with a BA in Human Studies and Visual Art from the Pratt Institute in New York and a MA from Hunter College; Jaime y Javier Suárez Berrocal, who have BA's in plastic arts from the University of Puerto Rico and a MA's in artistic production from the Universidad Politécnica of Valencia and work under a production manifest designated as VientreCompartido (Shared Womb); and Noemí Segarra with a Bachelor of Fine Arts (BFA) from Hunter College and an Master of Fine Arts (MFA) from Temple University, currently working on her research project Piso Proyecto.



Dhara Rivera



Elizabeth Robles



Javier Suárez y Jaime Suárez



Noemí Segarra

## Our Scientists and Field Technicians

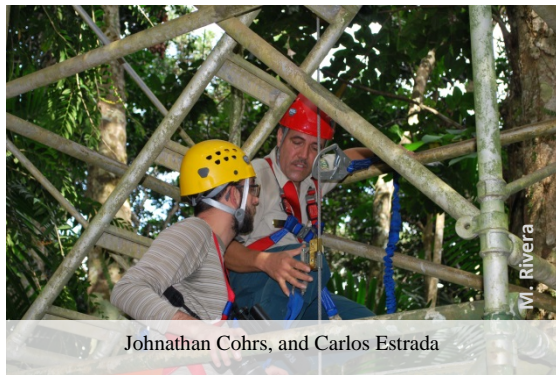
From the Institute Tamara Heartsill-Scalley, Research Ecologists ([www.fs.fed.us/research/people/profile.php?alias=theartsill](http://www.fs.fed.us/research/people/profile.php?alias=theartsill)); María M. Rivera, General Biologist Specialist; Samuel Moya, General Biologist; Humberto Robles, Biological Science Technician; Carlos Estrada, Hydrology Technician; William A. Gould, Research Ecologist ([www.fs.fed.us/research/people/profile.php?alias=wgould](http://www.fs.fed.us/research/people/profile.php?alias=wgould)); and Grizelle González, Research Ecologist and Project Leader ([www.fs.fed.us/research/people/profile.php?alias=ggonzalez](http://www.fs.fed.us/research/people/profile.php?alias=ggonzalez)).



Tamara Heartsill-Scalley, Johnathan Cohrs, Grant Pound, Javier Suárez, and Jaime Suárez



Humberto Robles, Elizabeth Robles, and Wilberto Ortiz



Johnathan Cohrs, and Carlos Estrada



Johnathan Cohrs, and Samuel Moya



María M. Rivera

## Support and administration

Our Business Operations staff continues to provide critical support to the Institute’s Research, International Cooperation and State and Private Programs. Our staff engages in providing technical and administrative support in the areas of budget, engineering and facilities maintenance, contracting and procurement, facilities and property management, mail services, grants and agreements and reception.

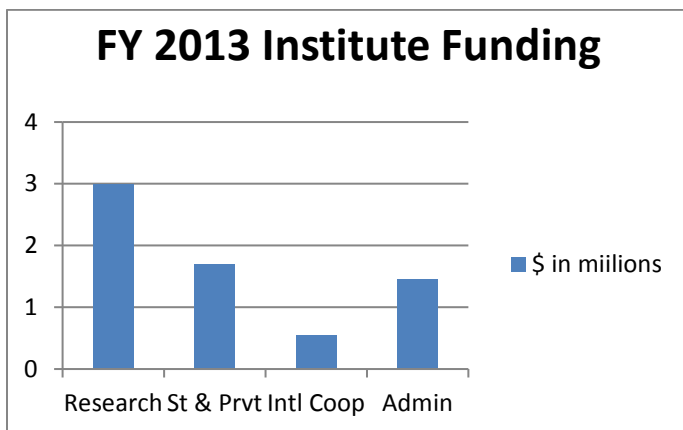
## Finances and Workforce

The budget allocation for the Institute supports the workforce, Business Operations, and programs. Due to budget reductions, in FY 2013 we saw a decrease in the number of our temporary and or part time work force again. This reflects a reduction from last year’s 12 temporary/part time employees to today’s 4 - a reduction of over 60%.

The numbers that follow are for fiscal year 2013: October 1<sup>st</sup>, 2012, to September 30<sup>th</sup>, 2013

### Incoming funding

- Research appropriations: \$2.98 million
- State and Private : \$1.7 million
- International Cooperation: \$550,000
- Construction and related funds: \$73,000
- Administration: \$1.46 million
- Total funding: \$6.75



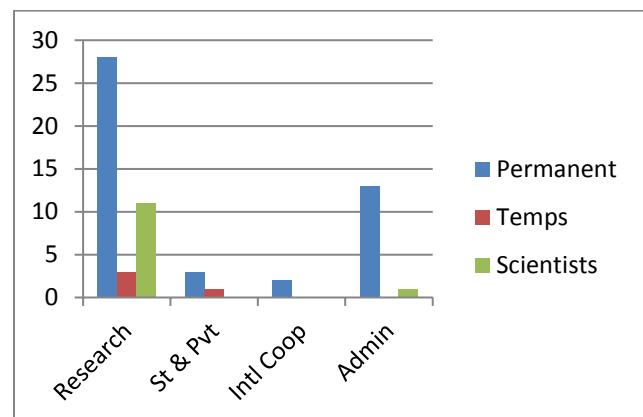
### Distribution of Funds\*

- Employee cost: \$3.9 million (58%)
- Support and Operations: \$.440 million (6%)
- Distributed to cooperators: \$1.41 million (21%)

### Workforce statistics

- Total Institute workforce:
- Permanent workforce: 46
- Of the permanent workforce, 10 employees (22%) are scientists.
- Temporary workforce: 4

### Institute employees by type



## Funding partners for FY 2013

### **Cooperators who received funding from the Institute**

#### **Nongovernmental Organizations:**

Centro Para La Conservación del Paisaje  
Consejo Asesor para la Forestación Urbana y de Comunidades de Puerto Rico, Inc.  
Ciudadanos del Karso  
El Atlantic Resource Conservation & Development  
International Society of Tropical Foresters  
Paso Pacifico  
Fundación Puertorriqueña de Conservación  
Puerto Rico Conservation Trust Foundation  
Southern Group of State Foresters  
The Natural History Society of Puerto Rico  
University of Georgia Research Foundation Inc.  
\*Virgin Islands Resource Conservation & Development Council, Inc.

#### **Private Industry and Individuals:**

The Greenleaf Group, Inc.  
Dr. James Grogan  
St Croix environmental Association

#### **Universities:**

Colorado State University  
Universidad Metropolitana  
University of Missouri  
University of Puerto Rico – Agricultural Extension Service  
University of Puerto Rico – Research Division  
University of North Carolina  
University of Georgia

### **State Government:**

Puerto Rico Department of Natural & Environmental Resources  
\*Puerto Rico Department of Transportation and Public Works  
\*Cuerpo De Bomberos de Puerto Rico

U.S. Virgin Islands Department of Agriculture  
Virgin Islands Fire Service

\*These partners received ARRA Funds.

### **Clients who provided funds to the Institute**

Puerto Rico Department of Natural & Environmental Resources

U.S. Fish & Wildlife  
U.S. Geological Survey



## Research & Development

Project Leader: Grizelle González, [ggonzalez@fs.fed.us](mailto:ggonzalez@fs.fed.us)

Research has been the cornerstone of the Institute's program since its inception. Early research focused on reforestation, plantation forestry, tropical species identification, forest inventory methods, endangered species, and carbon sequestration. Currently, the Institute's research programs are focused on forest ecology, disturbance ecology, ecosystem functions and services, urban ecology, watershed dynamics, migratory species, climate change, and policy science to better understand the effects of natural and human-induced pressures on tropical forests and the landscapes in which they are found.



Standing left to right Institute's scientists: Eileen Helmer, Joseph M. Wunderle; William A. Gould; Michael M. Keller. Sitting left to right scientists: Kathleen McGinley, Tischa Muñoz-Erickson, Tamara Heartsill-Scalley, Project Leader Grizelle González and Director Ariel E. Lugo.

Research will continue to focus on the Luquillo Experimental Forest (LEF) and its Bisley Experimental Watershed Long-Term Ecological Research (LTER) work, the San Juan Urban Long-Term Research Area, the Guánica Biosphere Reserve, various novel secondary forests, and other ecosystems in Puerto Rico, the Estate Thomas Experimental Forest in St. Croix, U.S. Virgin Islands, the Brazilian Amazon, and throughout the Western Hemisphere in collaboration with partners in the region.

The Institute has one work unit: IITF-4151. Its mission is to develop and disseminate scientifically based knowledge that contributes to the conservation of forests, wildlife, and watersheds of the American tropics in the context of environmental change. The work unit envisions that creativity and accomplishments result in timely products and services that anticipate the needs of society as it mitigates and adapts to environmental change. The Institute accomplishes its mission by developing and disseminating knowledge of scientifically sound practices that contribute to sustainable management of forest resources including water and wildlife, the conservation of primary forests, and the rehabilitation of degraded lands



## Scientist Profiles

### Ecosystem Ecology

Ariel E. Lugo - Director

Research interests:

Assembly and functioning of novel ecosystems vulnerability, and functioning of urban ecosystems; response of tropical forests to environmental change.



### Soil Ecology

Grizelle González - Project Leader

Research interests:

Soil ecology and biology, ecosystem ecology, tropical ecology, earthworm ecology.



### Social Science

Kathleen McGinley - Research Social Scientist

Research interests:

Natural resource and forest policies, institutions, and governance approaches, primarily in Latin America and the Caribbean, to determine their effects on tropical landscapes, forests and other natural resources, and associated human dimensions.



Tischa Muñoz-Erickson - Research Social Scientist

Research interests:

Governance (adaptive and sustainable); science-policy interactions and knowledge networks for sustainability; collaborative natural resource management; resilience and adaptive capacity of urban socio-ecological systems.



## Plant Physiology

Ernesto Medina - Adjunct Scientist

Research interests:

Physiological ecology of plants in stressful environments (wetlands, calcareous substrates) with emphasis on carbon balance, water stress, and nutrient relations.



## Wildlife Ecology

Wayne J. Arendt - Wildlife Biologist

Research interests:

Disturbance ecology, climate change, conservation and management of neotropical resident and migratory bird communities and invasive species, with an emphasis on distribution, population dynamics, avian ectoparasites and life-history strategies.



Joseph M. Wunderle - Wildlife Biologist

Research interests:

Conservation biology of birds, especially neotropical-nearctic migrants and their response to human and natural disturbances with objective of devising management practices to ameliorate adverse effects.



## Silviculture

Frank H. Wadsworth - Emeritus Scientist

Research interests:

Scientific and technical basis for the management and sustainable use of forests and fiber-based products—silviculture and production.



## Biogeochemistry

Tana E. Wood - Adjunct Scientist

Research interests:

Effects of climate and land-use change on soil and ecosystem-level processes, with an approach ranging from field studies that evaluate landscape-scale responses, to variability in climate to laboratory experiments that elucidate linkages between microbes and the soil environment.



Michael Keller - Research Physical Scientist

Research interests:

Ecology and biogeochemistry of tropical forests, tropical deforestation and forest degradation, and the effects of changing tropical land uses on regional and global atmospheric composition. Use a wide variety of tools including remote sensing, forest inventory, biogeochemical experimental manipulations, and ecosystem modeling.



Whendee Silver - Adjunct Scientist

Ecosystem ecology and biogeochemistry with a focus on the causes, consequences, and solutions to climate change. Recent research topics include how climate, biodiversity, and soil characteristics drive tropical forest carbon and nutrient cycling, and the effects of human and natural disturbance events on tropical forest dynamics.



## Watersheds

Tamara Heartsill-Scalley - Research Ecologist

Research interests:

Ecosystem services of riparian zones and streams; riparian vegetation and stream dynamics in headwater catchments; ecosystem responses to disturbance; long-term plots in Caribbean forests; knowledge and perceptions of riparian zones and wetlands by adjacent communities and stakeholders.



## Landscape Ecology

Eileen Helmer - Research Ecologist

Research interests:

Relationships between tropical forest disturbance and dynamics from stand to landscape scales; monitoring forest disturbance, species composition, structure and phenology with satellite imagery; socioeconomic controls on tropical forest disturbance and recovery.



William A. Gould - Research Ecologist

Research interests:

Conservation science, biodiversity, ecology, land cover mapping, modeling future scenarios for conservation planning, field education and outreach.



Sebastián Martinuzzi - Adjunct Scientist

Research interests:

Remote sensing, biodiversity conservation and environmental change.



## Modeling

Azad Henareh - Postdoctoral Scientist

Research interests:

Global effects of climate change, large-scale vegetation and ecosystem change, disturbances and their interactions on landscape structure and ecosystem functions at large scales, and changes in their dynamics through time.



Ashley Van Beusekom - Postdoctoral Scientist

Research interests:

Hydrological modeling, statistical analysis, and climate change.



## Research & Development FY 2013 Key Accomplishments

### Gap Formation and Carbon Cycling in the Brazilian Amazon

Developing knowledge about tree mortality is critical to monitoring forest health and productivity and for quantifying the role of forest vegetation in the global carbon cycle. Mortality rates are mainly estimated by labor-intensive field forest inventories. In remote tropical regions, repeated inventories needed to establish good mortality statistics are difficult to maintain. To overcome such difficulties, we used high spatial resolution (<1 m) passive optical remote sensing for estimation of natural disturbance rates in tropical moist forests at a landscape scale in the Brazilian Amazon region. We determined that shadows from tall trees prevented reliable quantification of gap formation using spectral filtering methods. We also determined, based on field work and comparison to image data, that gap formation only accounted for about one-third of the committed carbon emissions based on tree mortality. This suggests that observations of the canopy outer surface alone are insufficient for mortality estimates. Most trees die without leaving a clear trace in the outer canopy. Therefore, active remote sensing methods (e.g., radar and lidar) that penetrate the outer canopy will be needed for improvement of tree mortality estimates using remotely-sensed data.

**Institute Contact:** Michael Keller, [mkeller.co2@gmail.com](mailto:mkeller.co2@gmail.com)

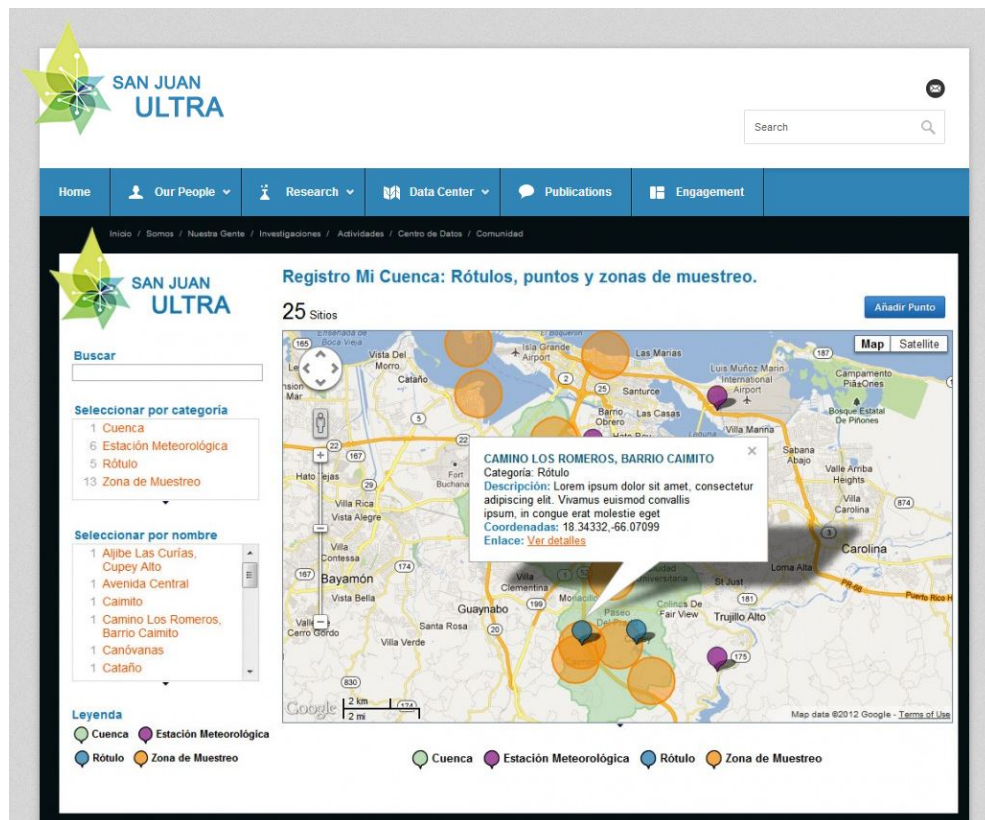
### Extensive increases in nutrient availability found across a tropical landscape recovering from deforestation

Fallen leaf chemistry provides a window into the various and often complex factors affecting the availability of nutrients to trees. Institute collaborators and scientists analyzed 11 elements in forest floor (fallen) leaves and additional litter components from 143 Forest Inventory and Analysis (FIA) plots systematically located across Puerto Rico, a tropical landscape recovering from large-scale forest clearing. Across several scales, fallen leaf N concentration was positively related to the basal area of putatively N-fixing tree legumes, which were concentrated in lower topographic positions, providing for the first time a biological explanation for the high N concentrations of fallen leaves in these landscape positions that can be linked to land-use patterns. Phosphorus concentrations in fallen leaves by forest assemblages were also correlated with the basal area of N-fixing legumes and decreased with mean age of assemblage, as did fallen leaf N concentrations. The findings suggest that N and P availability may currently be greater on the island than before deforestation when older and presumably native forests dominated the landscape, because the island forests are now dominated by younger, novel forests. We also found that three existing landscape classifications (Holdridge Life Zones, Forest Types, and forest assemblage) can be used to identify and map unique differences in fallen leaf chemistry.

**Institute Contact:** Eileen Helmer, [ehelmer@fs.fed.us](mailto:ehelmer@fs.fed.us)

## Advancing science communication, education, and community outreach in the city of San Juan

We are advancing science communication, technology transfer, education, and community outreach in the city of San Juan. Eighty university students were trained in interdisciplinary approaches to socio-ecological systems. The project links with members of the public of all ages, facilitating activities in local schools, field trips throughout the Río Piedras River Watershed (RPRW), workshops and oral history documentations with the elderly, GIS trainings, and local environmental fairs. We have also created a web-based data infrastructure that can be accessed by the public and visualized using Google Earth maps (<http://sanjuanultra.org/wp-content/shares/sjutra/catalogo.html>). To connect people on the ground with the science we have developed, we developed a network of educational signposts throughout the RPRW, allowing the public to access data, information and activities using smartphones, tablets or similar devices (<http://sanjuanultra.org/recurso/registro-mi-cuenca/>). The overall number of people engaged through these activities in 2013 was 902 (140 school students, 190 elderly, 572 general public). This does not include the thousands of people that we reached out through our participation in other events coordinated by our partners in the city.



Institute contact: Tischa Muñoz-Erickson, [tamunozerickson@fs.fed.us](mailto:tamunozerickson@fs.fed.us)



## Ecosystem resilience despite large-scale altered hydroclimatic conditions

The Institute collaborated with USDA Agricultural Research Services (ARS) and others on research that found a common range of water-use efficiency values across timescales and locations. The research found that the increases in dry years this century are not yet compromising the ability to lower water-use efficiency in response to wetter years. The collaborative research describes the response of plant communities (in a global sample of ecosystems) to drought stress as a measure of ecosystem resilience, comparing data from the early twenty-first century with the late twentieth century. This work will help provide an understanding of how vegetation production will respond to the altered hydroclimatic conditions predicted with climate change, which is important when making decisions about food production and resource management.

[http://www.fs.fed.us/rm/pubs\\_other/rmrs\\_2013\\_campos\\_g001.pdf](http://www.fs.fed.us/rm/pubs_other/rmrs_2013_campos_g001.pdf)

**Institute contact:** Tamara Heartsill-Scalley, [theartsill@fs.fed.us](mailto:theartsill@fs.fed.us)

## Tropical forests in a warmer world

The Institute is leading an effort to establish the first tropical forest field warming experiment in Puerto Rico. Temperature is expected to increase significantly across all terrestrial land surfaces, and tropical forests are likely to experience warmer temperatures within the next two decades. Given the large amounts of carbon cycled in tropical forests, it is important to understand how these changes can affect the global carbon cycle and future climate. The Forest Service Research and Development Washington Office allocated funds towards this exciting research endeavor in spring 2013. All the necessary contracts to upgrade the energy infrastructure of the Sabana Field Research Station have been established, the research plots have been identified and pre-treatment data collection has begun. We expect warming will begin FY 2014.

**Institute contact:** Tana Wood, [tanawood@fs.fed.us](mailto:tanawood@fs.fed.us)

## The response of tropical forests to a changing precipitation regime

Recent model analyses suggest that tropical regions are likely to experience more frequent and intense droughts. Given that tropical forests cycle more carbon and energy with the atmosphere than any other terrestrial ecosystem, understanding how these systems will respond to these changes is of major importance. Institute scientists and collaborators are authors of two publications that resulted from a small throughfall exclusion experiment that was established in the Bisley Experimental Watersheds in the LEF. The study found significant relationships between soil moisture and temperature and the rate of soil carbon dioxide emissions. This study also revealed the ability of tropical microbial communities to rapidly adapt to short-term reductions in soil moisture availability, which has implications for management of soil carbon in tropical forested ecosystems.

**Institute contact:** Tana Wood, [tanawood@fs.fed.us](mailto:tanawood@fs.fed.us)

## NEON field observations: designing scale, standardized sampling

An Institute scientist and collaborators published a manuscript describing the National Ecological Observatory Network (NEON) terrestrial sampling, which targets organisms across a range of generation and turnover times, and a hierarchy of measurable biological states. Measurements encompass species diversity, abundance, phenology, demography, infectious disease, eco-hydrology, and biogeochemistry. NEON will provide users with the data necessary to address large-scale questions, challenge current ecological paradigms, and forecast ecological change.

**Institute contact:** Michael Keller, [mkeller.co2@gmail.com](mailto:mkeller.co2@gmail.com)



NEON website <http://www.neoninc.org/>

## FY 2013 Research Highlights

### I. Water, Air, and Soil

#### 1. Bryophyte species in novel *Spathodea campanulata* forests

The introduced African tulip tree, *Spathodea campanulata* is considered an invasive species by some yet has become the most common tree species in the forests of Puerto Rico. This study shows that novel *S. campanulata* forests provide adequate habitat and substrates for the colonization of native bryophyte species. The scientists found higher bryophyte abundance and species richness in relatively young and old *S. campanulata* forests, respectively, showing that early colonization is dominated by a few species and that dispersal and establishment continue as these forests age.



Studying tree stems covered in bryophytes.

**Collaborating Institutions:** University of Puerto Rico in Río Piedras and Mayagüez.

**Institute Contact:** Ariel E. Lugo, [alugo@fs.fed.us](mailto:alugo@fs.fed.us).

## 2. **Development of a Water Budget for El Yunque National Forest**

In collaboration with Drs. Jason Christian (University of Georgia Engineering Department) and Kyle McKay (US Army Corps of Engineers), good progress was made on developing an updated water budget for El Yunque National Forest (EYNF). After evaluating past approaches and information used to create water budgets for EYNF, the scientist decided to focus on developing an improved water budget that is more data-driven and transparent in derivation and that includes the lower watersheds outside EYNF. While a 1994 water budget showed that, on a typical day, 54% of water draining EYNF was diverted for Municipal use (Naumann 1994), a 2004 water budget (Crook, Scatena & Pringle 2007) found that water diversions had increased to 70%, with only 30% reaching the ocean, as compared to 46% ten years prior. We predict that once the 2013 water budget is completed, even more water will be withdrawn from rivers draining EYNF, with less than 25% reaching the ocean. A simple water budget in 2014 is expected to be completed in 2014, and we are in the process of developing an improved and expanded water budget that will evaluate water withdrawals from streams draining the mountains of EYNF to the ocean. Spatial data for EYNF was collected and organized, and Puerto Rico in general, in a GIS model of the island, collected and incorporated elevation and land use rasters and located USGS flow gage and National Climatic Data Center (NCDC) precipitation gage sites. Watersheds draining EYNF from headwaters to the coast were delineated and have incorporated data layers showing roads, rivers/channels, and population centers.

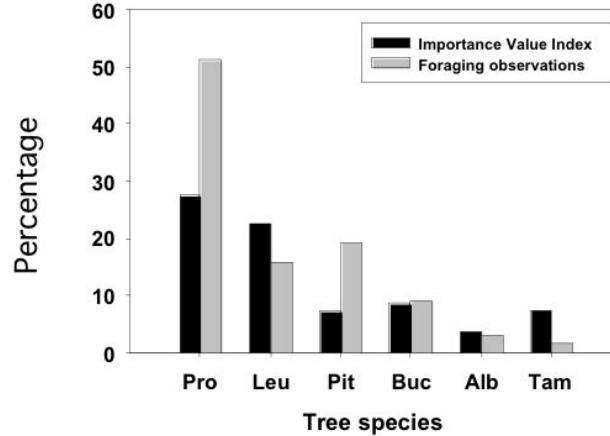
**Collaborating Institutions:** University of Georgia

**Contact:** Catherine Pringle (Cooperator from the University of Georgia), [cpringle@uga.edu](mailto:cpringle@uga.edu)

## II. **Wildlife**

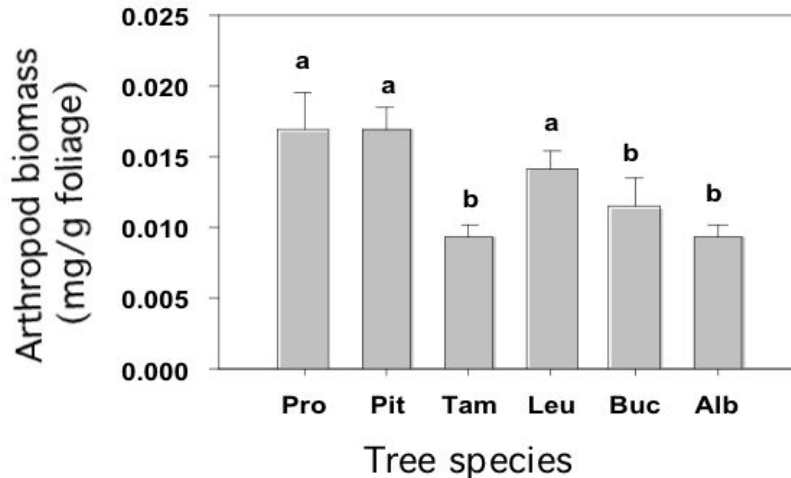
### 1. **Tree Species preferences for foraging by insectivorous birds in a novel *Prosopis-Leucaena* woodland in Puerto Rico and the role of foliage palatability**

William Beltrán and Joseph Wunderle studied tree species preferences for foraging by insectivorous birds in a novel *Prosopis-Leucaena* woodland in Puerto Rico to test the role of foliage palatability as a factor in tree species preference. The foliage palatability hypothesis posits that tree species preferences for foraging by avian insectivores are based on the abundance of their arthropod prey, which is associated with foliage nutrition and palatability. This hypothesis was tested in five introduced and one native tree species in dry secondary woodland, dominated by introduced tree species, by relating foraging preferences to foliage arthropod biomass and leaf chemistry. The most frequently preferred tree species for foraging were the introduced *Prosopis julifera* (preferred by five bird species) and the introduced *Pithecellobium dulce* (preferred by four bird species).



Percentage of total foraging observations and Importance Value Index for six tree species based on 13 vegetation transects in a novel *Prosopis-Leucaena* woodlands, southwestern Puerto Rico. Foraging was observed from September through April and the percentage calculation based on 1,630 observations from five bird species, including Adelaide's Warbler, Caribbean Elaenia, Northern Parula, Prairie Warbler, and Puerto Rican Flycatcher. Importance Value Index values were based on 20 tree species and the index includes the sum of densities, frequencies of occurrence, and basal areas for individuals of each tree species. Tree species codes are Pro = *Prosopis juliflora*; Pit = *Pithecellobium dulce*; Tam = *Tamarindus indica*; Leu = *Leucaena leucocephala*; Buc = *Bucida buceras*; and Alb = *Albizia lebbek*.

Both tree species had high foliage arthropod biomass and, as expected, both had high N content, low lignin/N ratios, and low hemicellulose content. In contrast, the introduced *Tamarindus indica* foliage had low N, high lignin and hemicellulose content, and low arthropod biomass and was avoided by all bird species. The native *Buccida buceras* had tough leaves with low N content, low arthropod biomass, and was avoided by four bird species. Compounds, previously known to affect herbivorous insect responses to *Albizia lebbek* and *Leucaena leucocephala*, likely contributed to the low arthropod biomass despite high N content in *Albizia* and avoidance of *Leucaena* by four bird species despite its high arthropod biomass. Herbivorous insects were deterred by high hemicellulose content in leaves as evident in a negative correlation between hemicellulose content and herbivorous arthropod biomass. The foliage palatability hypothesis applied to introduced tree species in this novel woodland where some introduced tree species had highly palatable foliage with high arthropod biomass and hence were preferred by avian insectivores. Thus, high foliage palatability of some introduced tree species may weaken the effect of enemy release (i.e., occurs when introduction of a plant species allows the plant to “escape” its specialized enemies from its homeland and prosper in its new environment where its specialized enemies are absent) in some novel plant communities.



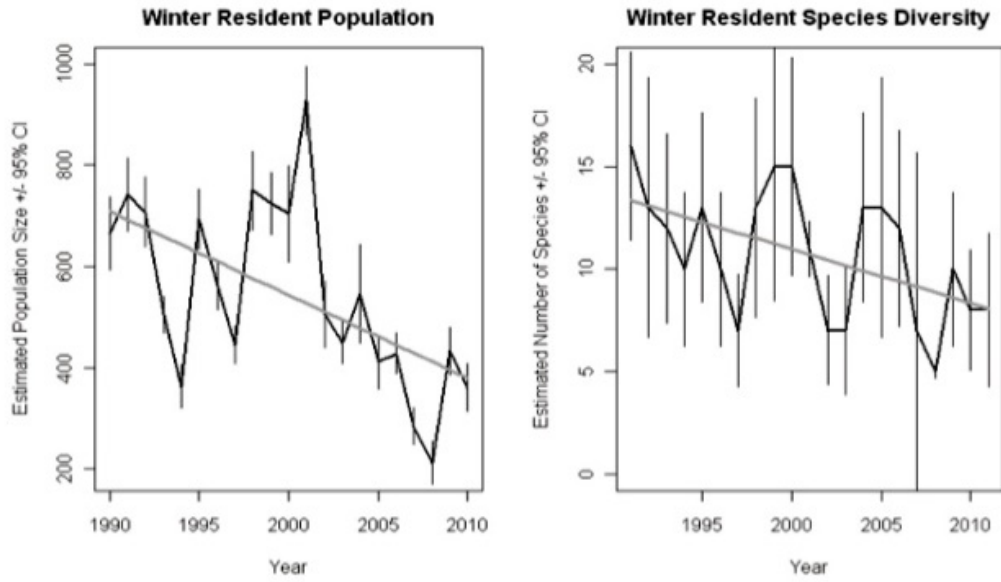
Mean ( $\pm$  SE) arthropod biomass (mg/ g foliage) found on six tree species during September–April from 2007 to 2010 in a novel *Prosopis-Leucaena* woodland in southwestern Puerto Rico. Tree species codes are Pro = *Prosopis juliflora*; Pit = *Pithecellobium dulce*; Tam = *Tamarindus indica*; Leu = *Leucaena leucocephala*; Buc = *Bucida buceras*; and Alb = *Albizia lebbek*. Different letters above each bar denote means that are statistically different ( $P < 0.05$ ).

**Collaborating Institution:** University of Puerto Rico

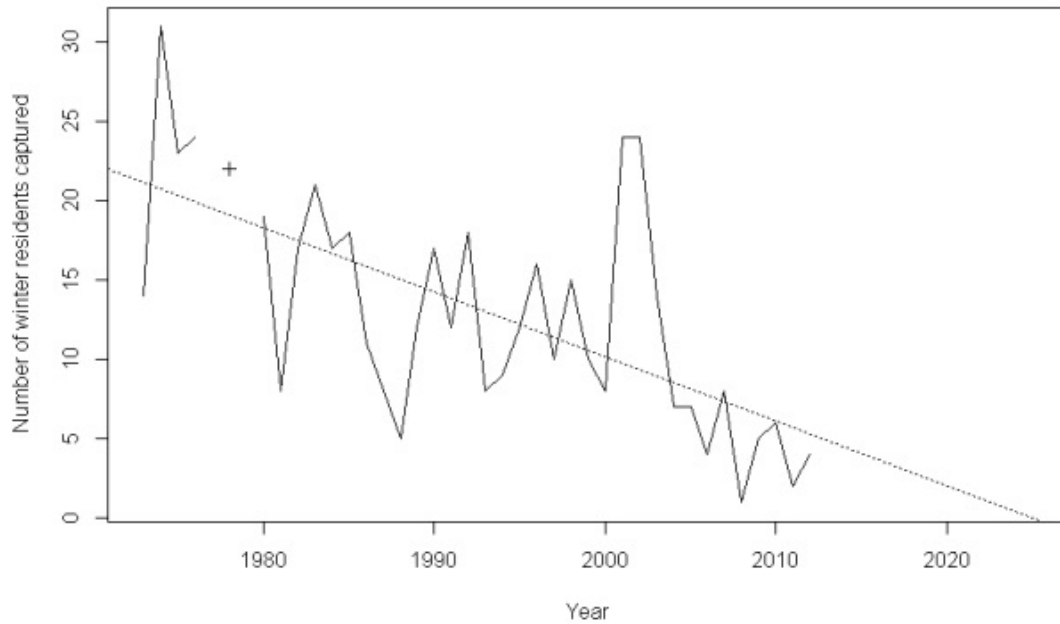
**Institute Contact:** Joseph M. Wunderle, [jwunderlejr@fs.fed.us](mailto:jwunderlejr@fs.fed.us)

## 2. Long-term collapse of a winter resident bird community in Guánica, Puerto Rico

Population declines of Nearctic-Neotropical migratory birds may first become apparent on their wintering grounds where they spend up to nine months of their annual cycle. The long-term study, which began in 1973 using constant-effort mist netting in dry forest in southwestern Puerto Rico, shows a collapse in both the abundance and diversity of wintering birds over the past 40 years (Fig. 1), but especially during the past decade (Faaborg et al. 2012). Whereas the estimated abundance of all winter residents combined fluctuated around a common mean from 1990 to 2001, migrant numbers declined dramatically beginning in 2002 (Fig. 2). When a set of constant, linear trend, and piecewise regression models was compared, a negative linear decline was strongly supported (AIC<sub>c</sub> weight 0.85; 95% CI for trend [-27.37, -5.60]), with local extirpation of the winter resident community predicted in 2025 (Fig. 2). Environmental factors play a key role in the population dynamics of Guánica’s birds (Toms et al. 2012). Regional hurricanes, with their recent increase in occurrence and intensity, have devastating impacts on the entire avian community. However, understanding population regulation in long-distant migrants is difficult. If the declines on the wintering grounds shown in our study are widespread, the baseline for current research is greatly changed and the populations they may study are already much reduced.



Forecast model suggests no winter-residents, i.e., no captures of Nearctic-Neotropical migrant birds, by 2025.



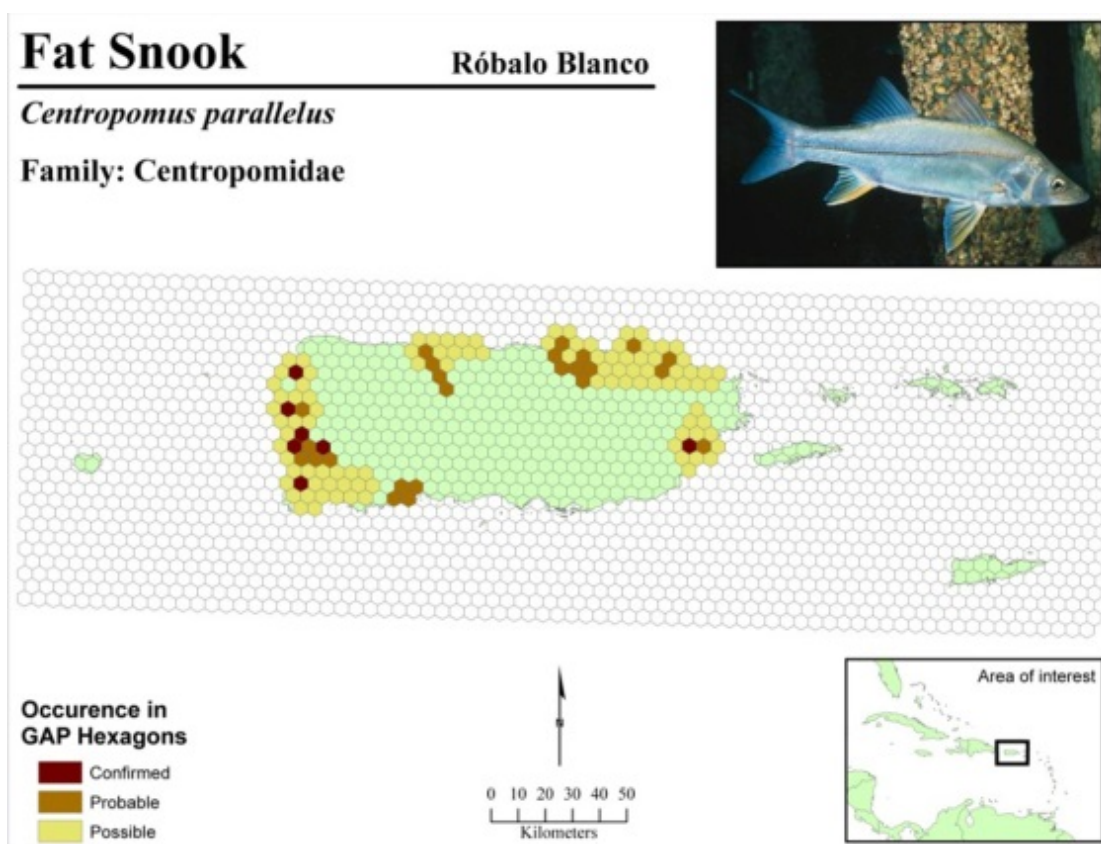
Guánica dry forest winter-resident bird numbers and species have declined sharply over the past two decades, plummeting in recent years.

**Collaborating Institutions:** University of Missouri-Columbia, University of Nebraska-Omaha, Eco-Logic Consulting, and Department of Natural Resources

**Institute Contact:** Wayne J. Arendt, [warendt@fs.fed.us](mailto:warendt@fs.fed.us)

### 3. Documenting freshwater and marine species occurrences for geospatial modeling

Forest Service scientists completed two large project reports including The US Virgin Islands Terrestrial Gap Analysis Project delivered to the USGS National Gap Program and Sportfish Gap: Conservation of Puerto Rico's Freshwater and Marine Recreational Fisheries Resources delivered to the Puerto Rico Department of Natural and Environmental Resources. The former includes modeled distributions of 150 bird, reptile, and amphibian species occurring in the US Virgin Islands, and the latter includes habitat description and mapping, species distributions and conservation status, protected areas and conservation priorities, and analyses of gaps in species conservation protection for a number of commercial and recreational fish species for Puerto Rico and the US Virgin Islands. A database with geo-referenced and documented occurrences of 535 aquatic species including sea turtles, birds, corals and mammals was developed. The number of occurrences for these species ascended up to 109,122 records and the information is used for modeling and mapping species distributions.



Occurrence records for *Centropomus parallelus* in streams and estuaries of Puerto Rico and the US Virgin Islands.

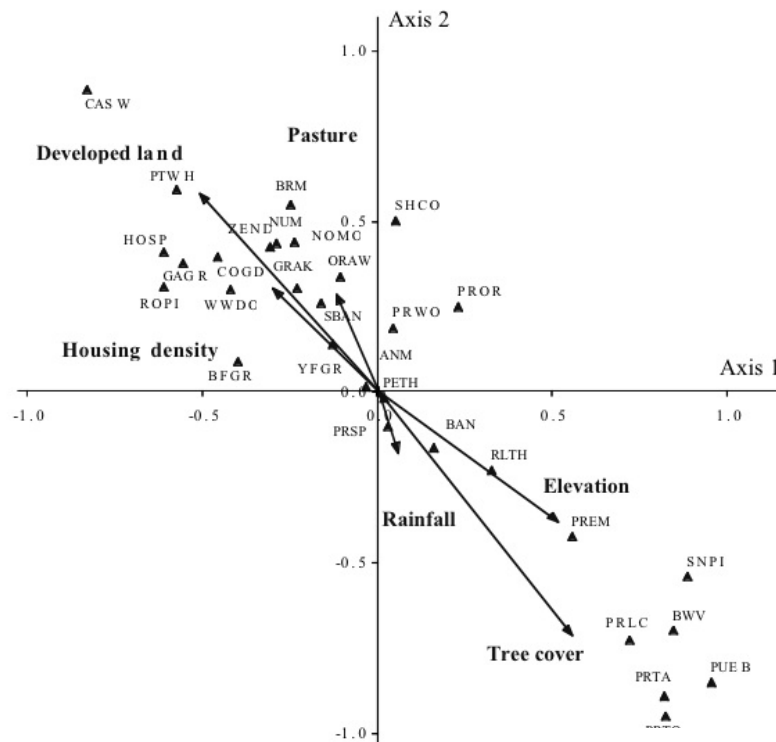
**Collaborating Institutions:** US Geological Service, Commonwealth of Puerto Rico, and University of Puerto Rico

**Institute Contact:** William A. Gould, [wgould@fs.fed.us](mailto:wgould@fs.fed.us)

### 4. Avian distribution along a gradient of urbanization in Puerto Rico



Given the increasing urbanization trend throughout the world, including in Puerto Rico, ecologists and conservation biologists have begun to study the effects of urbanization on wildlife. Their research often focuses on questions such as which species benefit from urbanization?, which species are threatened by urbanization and how might urban areas be better designed or managed to minimize biodiversity losses? Edgar Vázquez answered some of these questions in his Ph.D. dissertation by studying the distribution of birds along a gradient in human development (Vázquez and Wunderle 2013). This gradient ranged from natural forest habitat in the LEF through exurban (rural), suburban, and urban habitats in northeastern Puerto Rico. He found that mean avian abundance and species richness sampled at 181 point count sites actually increased with urbanization and was associated with measures of developed habitat, pasture, and elevation. However, endemic species were sensitive to urbanization as shown by their positive association with forest cover, negative association with an urbanization index, and their rarity in urban areas in contrast to their abundance and species richness in the LEF. In contrast, introduced or non-native species showed a positive association with an urbanization index and highest abundance and species richness in suburban/urban habitats and their absence from the LEF. The native resident species (non-endemic) were found throughout the gradient and showed a positive association with the urbanization index and their abundance and species richness increased with urbanization. The increased species richness and abundance of birds in the urban habitats was attributed to introduced seedeaters (finches) and omnivores and resident insectivores, seedeaters, and omnivores (Fig. 1). Observations made during the study suggest that the availability of nearby undeveloped habitats may be critical for maintaining avian abundance and species richness in Puerto Rico’s urban areas.



For legend see Appendix I

**Collaborating Institution:** University of Puerto Rico

**Institute Contact:** Joseph M. Wunderle, [jwunderlejr@fs.fed.us](mailto:jwunderlejr@fs.fed.us)

### III. Resource Management and Use

#### 1. Advancing understanding of Caribbean forest dynamics and creating long-term regional network, the 16th Caribbean Foresters Meeting.

Caribbean Foresters Meetings bring together foresters, researchers, natural resources specialists, and others that work in the Caribbean region in forest and land management at the national level. The 16<sup>th</sup> Caribbean Foresters Meeting, held August 4-9, 2013 in the Dominican Republic, had the greatest number of participants from over 20 countries representing the broader Caribbean region, in addition to participation from USDA-Forest Service International Institute of Tropical Forestry, USAID, USDA Forest Service International Programs, and Food and Agriculture Organization (FAO). The focus of this meeting was to understand the potential effects of climate change on Caribbean forests based on empirical, permanent forest plot data.

Over the course of the meeting, participants identified over seventy sites in the region with permanent forest plots. Metadata from these plots was shared through [www.CaribbeanForesters.org](http://www.CaribbeanForesters.org), a new online interactive tool/database, part of an international workshop addressing ecological issues of Caribbean forest stand dynamics in light of hurricane disturbances and climate change. The workshop participants identified research sites in the Caribbean and created a database with these sites. The workshop *Assessment of long-term forest dynamics in the Caribbean* aimed to begin analysis at the Caribbean regional level, by facilitating a regional analysis network.



James Daley (Montserrat) and Anthony Simon (St. Vincent) discuss permanent forest plots in Caribbean Dry Forests during the 16th Caribbean Foresters Meeting field trip

A significant outcome of this meeting was the participant-set agenda, defining five working groups for the Caribbean region; 1. [Forestry Training Opportunities and Capacity Building](#), 2. [National Forests Inventories](#), 3. Biomass [and Species Studies across Islands](#), 4. [Mangroves and Dry Forests](#), and 5. [Collaboration and Information Sharing Agreement](#) among Caribbean Foresters. Meeting participants drafted documents on how to move forward the working group agenda, including continuing to identify research that is being conducted in sites across the region, sharing and accessing permanent plot information, participating in regional forums, and validating data through interactive web-based tools. Caribbean Foresters aims to facilitate better regional coordination of fieldwork, and establishment of a Caribbean-wide permanent forest plot research network to increase understanding of climate change on Caribbean forests.



Demonstration of permanent forest plot establishment, 16th Caribbean Foresters Meeting field trip, Punta Cana Foundation Dry Forest, Dominican Republic.



National Forests Inventories Working Group at 16th Caribbean Foresters Meeting

**Collaborating Institution:** Fundación Puertorriqueña de Conservación

**Institute Contact:** Tamara Heartsill-Scalley, [theartsill@fs.fed.us](mailto:theartsill@fs.fed.us)

## 2. Conservation Science and Management – taking the lead in the “all lands” approach

The Institute leads the Caribbean Landscape Conservation Cooperative, a partnership among research and management agencies, organizations and individuals interested in achieving a sustainable future for the Caribbean islands by addressing climate change and other issues that threaten land and marine resources. The Cooperative Steering Committee includes participation from eight federal agencies, local governments, and non-governmental partners.

Accomplishments this year include ratifying a charter for the Cooperative and establishing two pillars on which to develop decision-making tools for conservation planning in light of climate change: modeling future scenarios of climate, urban growth, stream flows, vegetation dynamics, and species distributions, and assessing Ecosystem Governance in the region, who and what controls conservation outcomes among the US Caribbean governmental and non-governmental organizations, and Caribbean-wide.

The Caribbean Landscape Conservation Cooperative website features a teal header with the organization's logo and name, "The Caribbean Landscape Conservation Cooperative Bridging science and action, land and sea". Language options for "English" and "Español" are available. A navigation menu includes "Home", "About", "Community", "Data Center", "Projects", "News and Events", and "Resources". The main content area has a large image of a lizard with the text "LANDSCAPE CONSERVATION requires open dialogue among all sectors of society". Below this is a "welcome to the CARIBBEAN LANDSCAPE CONSERVATION COOPERATIVE" section, followed by a "What we do" section, "Key Roles" (Monitoring), and a "Become A Partner Now!" section with a "Learn More" button and an "Explore Our Data Center!" button.

Caribbean Landscape Conservation Cooperative website (<http://caribbeanlcc.org/>)

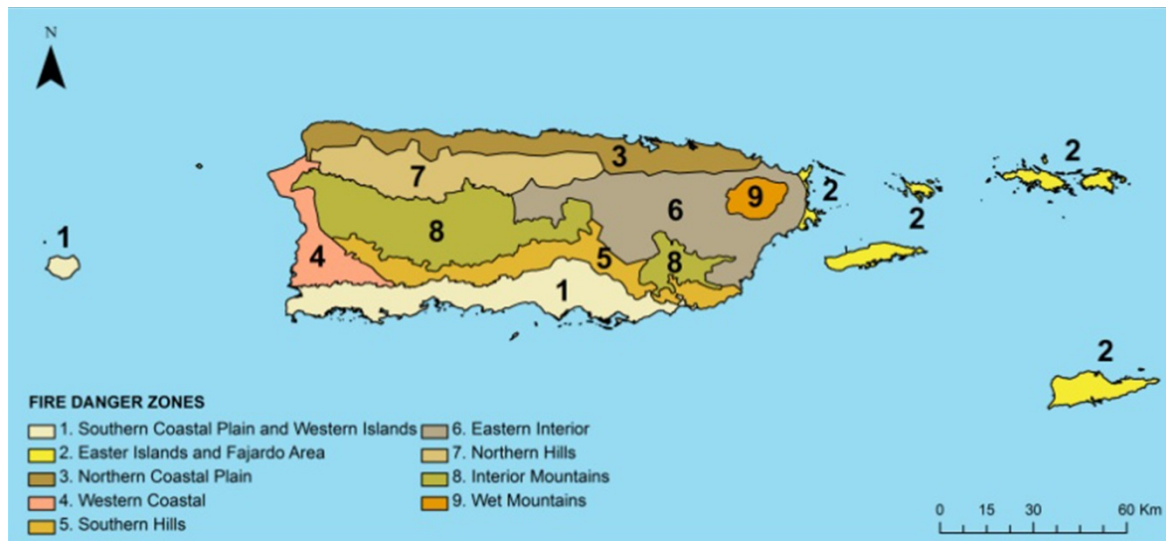
**Collaborating Institutions:** Fish & Wildlife Service, US Geological Service, Environmental Protection Agency, Army Corp of Engineers, The Nature Conservancy, Para la Naturaleza, Commonwealth of Puerto Rico, and Territory of the US Virgin Islands

**Institute Contact:** William A. Gould, [wgould@fs.fed.us](mailto:wgould@fs.fed.us)

#### IV. Climate Change

##### 1. **New fire weather zones and a Fire Danger Rating System for Puerto Rico and the US Virgin Islands**

A Forest Service scientist, in collaboration with the National Weather Service San Juan Office (NWS), developed and initiated a fire danger rating system and fire weather zones that are now used in Puerto Rico and the US Virgin Islands. The Fire Danger Rating System is new for the region. The fire weather zones are used daily in the National Weather Service (NWS) public announcements during fire season, and on the NWS San Juan web site. The Institute is developing a database of fire occurrence to analyze the relationships between those events, fuels, land use, and climate in order to better predict the risk of fire in current and future climate scenarios.



Fire weather zones for Puerto Rico and the US Virgin Islands

**Collaborating Institution:** National Weather Service

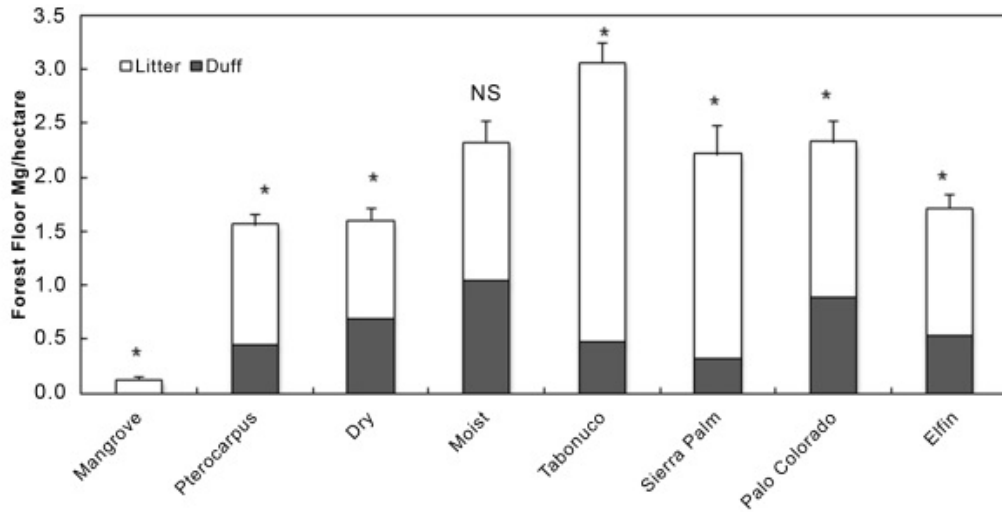
**Institute Contact:** William A. Gould, [wgould@fs.fed.us](mailto:wgould@fs.fed.us)

#### V. Inventory and Monitoring

##### 1. **Woody debris characterization along an elevation gradient in Northeastern Puerto Rico**

We characterized the amounts of woody debris (coarse woody debris, fine woody debris, duff, and litter) for eight different forest types along the elevation gradient in Northeastern Puerto Rico. Data generated by this survey contributes to development and improvement of existing woody debris management plans, addressing increased fire risk in Northeastern Puerto Rico. Factors such as growing population and shifting climate in Puerto Rico have resulted in both increased amounts of urban-wildland interface as well as greater potential for harmful forest fires. Fire frequency is increasing and fires are occurring in humid forests - like these forest

types within the Luquillo Mountains-, for the first time. Fuel loads, or the distribution of woody debris and other carbon sources in forests, is the only key element of the fire behavior triangle that can be effectively managed. This detailed survey of fuel loads within these forest types aids in the development of more effective management practices.



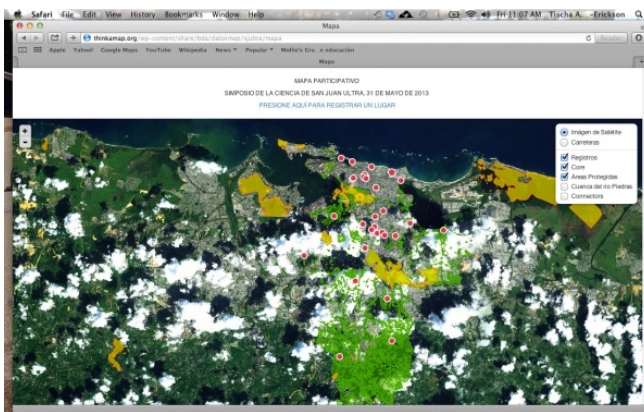
Forest floor litter and duff (Mg ha<sup>-1</sup>) (SE total forest floor; n=81) for eight forest types along elevation gradient in northeastern Puerto Rico. Asterisks indicate significant difference between litter and duff biomass within forest type

**Collaborating Institution:** University of Montana

**Institute Contact:** Grizelle González, [ggonzalez@fs.fed.us](mailto:ggonzalez@fs.fed.us)

## 2. Green areas for the sustainability planning of San Juan

Forest Service scientists and partners of the San Juan Urban-Long Term Research Area (ULTRA) developed an online mapping tool to assist city planners, forest managers, NGOs, community leaders, scientists and residents to identify key green areas for the sustainability



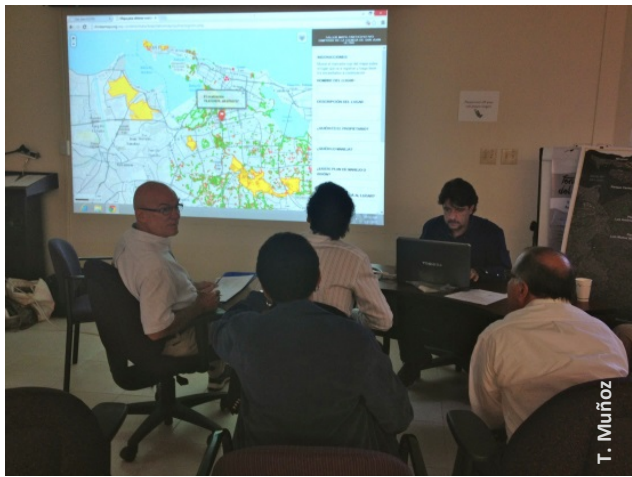
planning of San Juan

(<http://thinkamap.org/wp-content/share/bda/datosmap/sjultra/mapa>).

The tool allows users to register crucial site-specific information in maps about how city green areas are being used, owned, threatened, and managed for potential ecosystem services (e.g., protection of water systems, wildlife habitat, recreation services, etc.). It uses a

Image of the mapping tool as viewed online through the San Juan ULTRA website. Users can enter information directly about city green areas - their use, management, condition and values - through a registration form that also spatially catalogs and saves the points selected.

high-resolution map of land cover developed by Institute GIS Technician, Olga Ramos-González, to assess the connectivity potential of the city's green infrastructure based on innovative methodologies - the Morphological Spatial Pattern Analysis (MSPA).



Participants of the San Juan ULTRA Participatory Mapping Workshop working with Information Manager, Víctor Cuadrado, in selecting and entering data on urban green areas using the web-based mapping tool



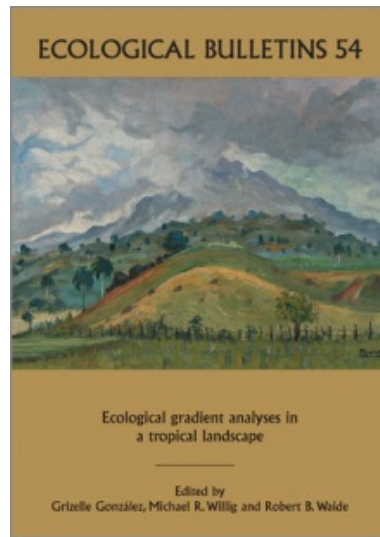
Workshop participants deliberating in small groups to prioritize the value of urban green areas for conservation and watershed management

The tool will also allow multiple stakeholders in the city to deliberate and model multiple scenarios for green connectivity and their utility in addressing various risks, such as flood hazards. The first of a series of planned workshops was held with stakeholders in June of 2013 to identify, characterize, and prioritize important green areas for land use and watershed management in the city. Participants included the Directors of Land Use Planning and Environmental Permits of the Municipality of San Juan, representatives from the Puerto Rico Department of the Environment and Natural Resources, NGO representatives, scientists from the University of Puerto Rico, and residents from various communities in the San Juan area. These stakeholders and community workshops will continue in 2014 to prioritize areas and develop strategies to protect, manage, and connect the city’s green infrastructure.

**Collaborating Institution:** Urban-Long Term Research Area  
**Institute Contact:** Tischa Muñoz, [tamuoz@fs.fed.us](mailto:tamuoz@fs.fed.us)

### 3. Ecological Gradient Analyses in Tropical Ecosystems

An Ecological Bulletins book that contains a comprehensive analysis of ecological gradients in the Luquillo Mountains of Puerto Rico was published. Puerto Rico comprises six ecological life zones and is ideal for studying environmental gradients given dramatic differences in temperature and precipitation that are associated with a rise in elevation from sea level to more than 1000 m over a distance of 10-15 km. Chapters in this volume cover climatic (e.g., precipitation and energy), abiotic (e.g., nutrients, carbon stores soil characteristics and biogeochemistry), and biotic (e.g., microbes, plants, and animal biodiversity) patterns and responses to gradients. These original and synthetic research findings should be of considerable interest to all concerned with understanding the importance of environmental gradients in molding the structure and functioning of ecological systems and to those dedicated to managing or conserving complex tropical ecosystems in light of global change. An Institute scientist is a lead editor of this recently published book.



**Collaborating Institutions:** University of Connecticut, and LTER Network Office and University of New Mexico

**Institute Contact:** Grizelle González, [ggonzalez@fa.fed.us](mailto:ggonzalez@fa.fed.us)



## International Cooperation

Program Manager: Gerald (Jerry), Bauer, [gbauer@fs.fed.us](mailto:gbauer@fs.fed.us)

International Cooperation (IC) had a very active year working mostly in Central America and the Caribbean. Our primary areas of focus again this year were the Dominican Republic and Nicaragua.



Community youth Junior Rangers, standing in front of a conservation mural that they painted, are ready for the annual beach cleanup at the La Flor Wildlife Refuge, San Juan del Sur, Nicaragua. The Institute partners with the NGO Paso Pacifico and local communities to support conservation education programs in less advantaged, minority communities in Nicaragua

### Global Activities

IC participated in the US Forest Service-USAID Disaster Assistance Support Program (DASP), and completed training to qualify in disaster response management, planning, operations, preparedness and prevention.

### Regional Activities

IC conducted the 16th “Caribbean Forester Meeting” held in the Dominican Republic. This meeting was attended by about 75 persons from 27 countries.



The Caribbean Foresters Meeting participants observing field demonstration of forest plot development at the Indigenous Eyes Nature Reserve in Punta Cana Dominican Republic.



Humfredo Marcano (L) and Tamara Heartsill (R) showing forest plot measurement technique to a Caribbean Forester during the Caribbean Foresters Meeting field trip at the Indigenous Eyes Nature Reserve in Punta Cana Dominican Republic



Caribbean Foresters Meeting participants visited the Puntacana Ecological Foundation’s Sustainability Center to learn about sustainable practices being applied in the Dominican Republic

## Nicaragua Activities



Wayne Arendt, Institute wildlife research scientist, is explaining bird monitoring techniques to Julie Martinez, conservation education team leader for Paso Pacifico, Ostional Nicaragua

In coordination with the Institute’s Wildlife Unit, our technical assistance and technology transfer to Nicaragua to support long-term biomonitoring, sustainable tourism development, and sampling for mercury and other of persistent toxic substances (PTS) continued. Our primary partners in Nicaragua were the Ministry of Environment and Non-Governmental Organizations, Paso Pacífico and Fundación Cocibolca. We continued to monitor long-term plots established in agroforestry systems under five land uses (secondary and riparian forest, forest fallow, coffee plantations, and ‘open lands,’ e.g., grass- and pasturelands with scattered trees) in the northern highlands and the same above-cited agroforestry systems, with the exception of coffee plantations, in southern coastal areas within the Paso del Istmo biological corridor.

Significant accomplishment in Nicaragua from IC and our international partners included:

- Non-Governmental Organization Paso Pacífico was invited for fourth consecutive year to participate in the Clinton Global Initiative.
- Bird surveys were conducted using distance-point-count methodology in the Paso del Istmo Biological Corridor and central mountain region - 300 point counts in two regions.
- International Cooperation provided technical assistance to the Universidad de Centro América in Managua and assisted with training biology students at the Santa Mauro Field Research Station.
- Undergraduate Student Training– Provided technical support for 2 students at La Universidad Nacional Autónoma de Nicaragua, Managua (UNAN).

- Graduate Student Training– Provided technical support for 1 student at La Universidad Nacional Autónoma de Nicaragua, Managua (UNAN) from the biology department in cooperation with Fundación Cocibolca and 1 student at Universidad de Managua in Environmental Communications, in cooperation with Deutche Welle Akademie.
- Co-sponsor of the Nicaraguan chapter of the Mesoamerican Society for Biology and Conservation annual meeting. Over 50 participants discussed natural resource management issues in Nicaragua.
- Provided technical assistance for conservation education program led by Non-Governmental Organizations Paso Pacífico. Supported educational programs for more than 150 children from underserved, disadvantaged Hispanic local communities in the Paso del Istmo biological corridor.



Paso Pacifico Ranger showing mapping techniques to community youth Junior Rangers near La Flor Wildlife Refuge, San Juan del Sur, Nicaragua. The Institute partners with the Non-Governmental Organization Paso Pacifico and local communities to support conservation education programs in less advantaged, minority communities in Nicaragua.

- Co-sponsored bird watching field trips to mangrove estuaries and dry tropical forests for over 75 youth from rural villages of the San Juan del Sur municipality.
- Social Media – used social media to share conservation and environmental messages to Nicaraguan and US public. 900 followers generated over 1,500 tweets
- Participated in beach clean-up events in the San Juan del Sur municipality- 10 events between October 2012 and September 2013, involving 450 volunteers and collecting 1,000 pounds of garbage.

- Assisted with organizing and conducting “FAM” trips for journalist to cover conservation activities in Nicaragua. A total of 25 journalists participated in these events.
- The Institute partnered with non-governmental organization Paso Pacífico to developed a variety of curricula around bat, jaguar, and bird education for over 200 K-12 children in four communities in the Paso del Istmo. Students participated in workshops to learn wildlife identification and monitoring techniques and took field trips to observe wildlife in their habitat, learning the importance of these animals to the ecosystem and to respect them in their native environments.
- The Institute provided technical assistance to Non-Governmental Organization partner Paso Pacífico to monitor populations of the yellow-naped parrot. Primary activities include monitoring natural nests, managing and maintaining artificial nests, and performing radio telemetry on nests.
- The Institute provided technical assistance to Non-Governmental Organization partner Paso Pacífico “Return to Forest” program. This program is restoring abandoned pasture land with native tree species. Paso Pacífico monitored plant growth and success and collected data on previously reforested areas. In addition, permanent plots have been established and baseline carbon capture measurements have been completed.
- The Institute provided technical assistance to Non-Governmental Organization partner Paso Pacífico to monitor primates in the Paso del Istmo Biological Corridor. Data is being collected in targeted reforestation areas to improve connectivity between forest fragments for spider monkey populations. Plots were monitored in three zones to document tree phenological patterns.

### Dominican Republic Activities

International Cooperation continued to provide leadership, mentorship and technology transfer to Dominican Republic partners in biodiversity conservation and sustainable tourism activities in local, underserved and disadvantaged Hispanic communities and tourism clusters in coordination with the Dominican Consortium for Tourism Development (Consortio Dominicano de Competitividad Turística, CDCT) and tourism clusters in Barahona, La Altagracia, La Romana-Bayahibe, Jarabacoa, Perdernales, Puerto Plata, Samaná, Santo Domingo, and Montecristie.

The primary focus was to assist Dominican Republic tourism clusters with biodiversity conservation and sustainable tourism development through on-the-ground technical assistance and training programs by:

1. Conducting biological assessments for project activities
2. Providing technical training for communities to develop ecotourism activities
3. Providing promotion and marketing assistance
4. Providing information to support environmental education
5. Providing technical support to the Ministry of Environment to with protected area management



International Cooperation Program Manager Jerry Bauer scouting mangrove forest rivers for development of water trails in the Manglares de Bajo Yuna National Park, Samaná, Dominican Republic. The Institute is working with local fisherman cooperatives to develop economic alternatives to fishing in the Samaná Bay. Photo by Bienvenida Nina.

Significant accomplishments in Dominican Republic from IC and our international partners included:

- Continued to provide technical assistance to underserved, disadvantaged Hispanic local communities and Non-Governmental Organizations to foment economic benefits and manage eco-businesses in protected areas and their buffer zones in Laguna Bavaro Wildlife Refuge, Laguna Limón Wildlife Refuge, and local communities in Constanza (Salto Aguas Blancas).
- Provided technical assistance and participated in “October Fest 2013”. Promoted International Migratory Bird Day by sponsoring by the second annual bird watch in the Santo Domingo Colonial Zone and a public presentation on “Biodiversity, Birds and Cultural Integration”.

**¡ACOMPÁÑANOS! 13 OCTUBRE 2012**  
 • APRENDE SOBRE LAS AVES, BIODIVERSIDAD Y CULTURA EN LA ZONA COLONIAL • DOS EVENTOS EMOCIONANTES •  
 • EN CELEBRACIÓN DEL DÍA INTERNACIONAL DE AVES MIGRATORIAS • IN CELEBRATION OF INTERNATIONAL MIGRATORY •

**OBSERVACIÓN DE AVES EN LA ZONA COLONIAL**

**¿HAY AVES EN LA ZONA COLONIAL?**  
 CLARO QUE SÍ... Y MUCHAS! VEN CON NOSOTROS A UNA OBSERVACIÓN DE AVES Y TOUR CULTURAL ALREDEDOR DE LA ZONA COLONIAL DONDE PODRÁS OBSERVAR AVES RESIDENTES Y MIGRATORIAS EN SITIOS CULTURALES.

• **¿DÓNDE?** ENCUENTRO EN EL PARQUE COLÓN A LAS 7:00 AM EN LA ESTATUA DE COLÓN. CAMINAREMOS HASTA LAS 8:30 AM  
 • **¿CUÁNDO?** SÁBADO 13 DE OCTUBRE 2012  
 • **¿QUÉ DEBE TRAER?** AGUA, BINOCULARES, SOMBRERO, PROTECTOR SOLAR, ZAPATOS CONFORTABLES Y ENTUSIASMO.  
*Guías hablan Inglés y Español*  
*Guides speak English and Spanish*

**Biodiversidad, Aves e Integración Cultural**  
 UNA CHARLA INFORMATIVA

• **¿DÓNDE?** OFICINA DEL CLÚSTER TURÍSTICO DE SANTO DOMINGO  
 • **¿CUÁNDO?** SÁBADO 13 DE OCTUBRE 2012 • HORA: 2:00 HASTA 3:00 PM  
*Esta charla será en Español*  
*This talk will be in Spanish*

**GUIAS/EXPOSITORES**  
 • WAYNE ARENDT UN RECONOCIDO ORNITÓLOGO INTERNACIONAL QUIEN A ESTUDIADO LAS AVES DEL CARIBE POR 40 AÑOS  
 • KATE WALLACE GUÍA TURÍSTICA LOCAL (WWW.TODYTOURS.COM) Y COAUTORA DEL LIBRO RECIENTE PUBLICADO "BIRD FINDING GUIDE TO THE DOMINICAN REPUBLIC"  
 • JERRY BAUER GUÍA DE LA NATURALEZA CERTIFICADO Y LÍDER DEL PROGRAMA DE COOPERACION INTERNACIONAL DEL SERVICIO FORESTAL DE LOS EEUU

The Institute designed an urban bird watching trail in the Santo Domingo Colonial City, and in cooperation with local partners, sponsored the first Migratory Bird Day Urban Trail hike in October 2012.

- Participated in local TV programs in Santo Domingo and Puerto Plata to promote biodiversity conservation and ecotourism. These programs reached an audience in Dominican Republic and the US of about 30,000 persons.
- Provided technical assistance and participated in “Discover POP 2012”. Presented technical talk on “Ecotourism Opportunities for Loma Isabel de Torres Trail and Biodiversity Conservation on the Monumento Natural Loma Isabel del Torres”.
- Provided technical assistance and participated in “FODATUR 2012”. Presented technical talk on “Diversification of Ecotourism Programs: Birdwatching Opportunities and Conservation”.



This trail head sign was developed in cooperation with the Sereno de Montaña Ecotourism complex ([www.serenodelamontana.com](http://www.serenodelamontana.com)). IITF provided technical assistance to train local community members to construction nature trails and to develop interpretive signage. The “Sonidos de Julian” trail is a result of this training

- Provided the technical assistance and participated in “Nature and Adventure Tourism Fair” held at the National Botanical Garden. Gave technical presentations on Birdwatching opportunities in Dominican Republic, and nature trails development in the Dominican Republic.
- Developed interpretive trail and signs to promote conservation, biodiversity and climate change adaption in Montecristie Salt Flats.
- Designed interpretive signs to promote birdwatching and biodiversity conservation at Spirit Mountain Organic Coffee Farm.
- Provided ecotourism and community development training to US Peace Corps Volunteers and their local counterparts.
- Produced technical manual “Construyendo Senderos Sostenibles en Áreas Naturales de la República Dominicana”. Gave a press conference and technical presentation to an audience of 100 persons.
- Completed four technical reports to help provide for conservation of biodiversity in protected areas and buffer zones. These included:
  - 1) Recommendations for Ecotourism and Biodiversity Conservation at Spirit Mountain Organic Coffee Farm”, Jarabacoa, República Dominicana.
  - 2) “Guía de Capacitación en Educación Ambiental y Cambio Climático” Published by CDCT. The Institute provided technical guidance in biodiversity and climate change effects.
  - 3) Development of interpretive signage for Montecristie Salt Flats.
  - 4) Rapid assessment of tourism activities in the Indigenous Eyes Ecological Reserve, Punta Cana Resort, Dominican Republic.





B. Nijna

International Cooperation Program Manager, Jerry Bauer and Dominican Republic Ministry of Tourism, ecotourism team leader Isabela Bonelli discussing conservation strategies for the Jaragua National Park, Dominican Republic.

## State and Private Forestry

**Program Manager:** Constance Carpenter, [conniecarpenter@fs.fed.us](mailto:conniecarpenter@fs.fed.us)

The State and Private Forestry unit (S&PF) at the Institute works hand in hand with scientists and managers in the Institute Research and International Programs to achieve regional and landscape objectives. In all the programs federal resources are leveraged against resources provided by other federal, state, and local government agencies and non-profit organizations. S&PF programs can help owners and land managers to access the technical information on forest management for a wide variety of uses and benefits such as timber and other forest products, fish and wildlife habitat, scenery, recreation, clean air, clean water, and to maintain soil productivity, reduce soil erosion and losses due to wildfire, or insects and disease. State and Private Forestry programs are directed toward the voluntary conservation and management of non-federal land. In Puerto Rico 96% of the forestland is in private or state ownership. In the US Virgin Islands nearly all the land on St. Croix and St. Thomas is in private ownership, but on St. John 29% of the forestland is privately owned.



State and Private Forestry and Library staff members work together to provide land managers the technical information they need to manage their land. From left to right: standing: Constance (Connie) Carpenter S&PF-Program Manager; Evelyn Pagán - Library Technician; Gisel Reyes - Technical Information Specialist; Katie Frerker - Conservation Education Coordinator; Aixa Mojica - Program Support; From left to right seated: Bruce Drapeu - Natural Resources Specialist, Ecosystem Management; Magaly Figueroa - Natural Resources Specialist and Jorge Morales - Technical Information Specialist

## Highlights

### Combining Research and Conservation Education at the Institute—July 2013

During the summer of 2013, State and Private Forestry staff partnered with the Research and Development team at the Institute to combine interests and accomplish mutual goals in a project entitled “Bosque Urbano” or Urban Forest. The opportunity arose when Dr. Ariel Lugo and Dr. Tamara Heartsill proposed using a long-term research project as a way to collaborate with Conservation Education activities at the Institute. The researchers have been monitoring the way trees in the urban forest surrounding the Institute’s office have been changing since 1997. However, the last time the trees on these plots were measured was in 2005. Aware of the interest that many teachers and students have in getting hands-on, ecological field experience, the project was developed to provide volunteers a venue for gaining professional experience while simultaneously contributing to an important, ongoing ecological study.

Beginning in June, Conservation Education Coordinator Katie Frerker organized a series of different volunteer groups to re-measure the 40 plots that researchers have been tracking. The volunteers spent days in the field getting trained by our staff on how to measure tree diameters, use a GPS to navigate to plots, use a compass to delineate and mark trees in a plot, and use a clinometer to estimate tree height.

Our first volunteer group engaged in the project was a pair of visiting university professors looking to diversify their field experience during their summer breaks. One was a professor of Ecology from Barranquitas, PR and the other a visiting professor of Agronomy from the University of San Carlos in Guatemala City, Guatemala. Our second round of volunteers was a group of four Puerto Rican public school teachers enrolled in a Master’s program sponsored by the Center for Science and Math Education Research. As part of this program, teachers complete a series of summer immersion investigations working with different research projects across the island. After spending several summers collecting and analyzing data, they compile and present their results and eventually earn a Master’s degree. We hope to use the data that our volunteer groups collected to publish an article in a scientific research journal.

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### Forest Field Days at Estate Thomas—September 2013

Estate Thomas Experimental Forest is a large tract of subtropical dry forest owned by the US Forest Service. Located on the island of St Croix in the US Virgin Islands, it is used almost exclusively for research purposes. That is, until now. 2013 marks the year where Estate Thomas will begin to function as a conservation education

resource in addition to maintaining its role as a research station. Using funds from the American Recovery and Reinvestment Act of 2009, the Institute worked with local US Virgin Islands partners to use the roughly \$230,000 award to erect a new outdoor pavilion and composting toilet on the property. While researchers will continue with their projects, the pavilion is slated to be a center of activity for new conservation education opportunities. Estate Thomas is a property comprised of inland subtropical dry forest vegetation, an ecosystem that is unfamiliar to many people living on the islands who are more accustomed to encountering coastal wet forests. At the Institute, we are excited to initiate activities on the property that introduce locals to the benefits and wonders of this novel ecosystem.

We're also looking forward to using the new facilities at Estate Thomas as a launchpad for local collaboration with environmental educators. Our first partnered program is slated to begin in March 2014 where we will utilize funds from the Forest Service grant, More Kids in the Woods, to initiate a series

### St. Croix Earth Day Eco Fair April 2013

In April 2013, the Institute was pleased to work with our partners on the US Virgin Islands to present St Croix's 20<sup>th</sup> annual Earth Day EcoFair at the St. George Botanical Garden. The fair was attended by elementary students from all parts of St. Croix. Upon arrival at the fair, the students were divided into groups and passed the day attending the 23 different activity stations,

of Forest Field Days at Estate Thomas. The Field Days will specifically target underserved 4th graders with little or no access to forested areas and will be coordinated by our partner, St. Croix Environmental Association (SEA). At each Field Day event, fourth graders from around the island will rotate through a series of activity stations in the forest to explore different aspects of biological science including food webs, plant identification, insect diversity and forest disturbance. Activities will be led by our partners at the National Park Service, the University of the Virgin Islands Marine Advisory Services, the Department of Planning and Natural Resources (DPNR) Division of Environmental Protection and the University of the Virgin Islands Extension Service.

If you are interested in visiting Estate Thomas and utilizing it in your outdoor education activities, please contact the Institute's State and Private Forestry Program Manager, Connie Carpenter.

**Institute contact:** Magaly Figueroa, [mafigueroa@fs.fed.us](mailto:mafigueroa@fs.fed.us)

each revolving around this year's theme of energy. In total, more than 800 elementary school students attended the two-day event.

In addition to the Forest Service, stations were led by educators from our partnering agencies and organizations including the US Virgin Islands Department of Planning and Natural Resources, the National Park Service, St. Croix East End Marine Park and

St. Croix Environmental Association. Each activity station had displays or games focused on local environmental issues where the children learned about a variety of topics ranging from how to help their families lower the electricity bill through energy saving practices to participating in a relay game to search out alternative forms of energy. There was also a central tent where students gathered throughout the day for environmentally themed sing-a-longs and even had the opportunity to come up with their own “Eco-rap”.

### Green Infrastructure Design in a Puerto Rican Public School



Sabana Llana school

Living green refers to a way of life that is resource and energy efficient, non-polluting, aesthetically pleasing, and as self-sustaining as possible. While living green helps to protect our planet’s natural resources, implementing green infrastructure in our schools can also improve the quality of the educational atmosphere. In fall of 2013, the Institute teamed up with Puerto Rican non-profit Grupos Ambientales Interdisciplinarios Aliados (GAIA) and

At the Institute we are excited to have the opportunity to strengthen our partnerships across the Caribbean while simultaneously promoting conservation education practices throughout the islands. If you are interested in becoming involved with the Institute’s conservation education activities, please contact the Institute’s State and Private Forestry Program Manager, Connie Carpenter.

**Institute contact:** Magaly Figueroa, [mafigueroa@fs.fed.us](mailto:mafigueroa@fs.fed.us)

Worcester Polytechnic Institute (WPI) to help make this vision a reality for one Puerto Rican school. As part of an 8 week-long internship program, the Institute hosted five engineering students from WPI while they came to Puerto Rico to complete a green infrastructure design project. During this time, WPI students were co-lead by the Institute staff and GAIA organizers as they completed a green infrastructure assessment for Sabana Llana junior high school, a San Juan inner city school involved in GAIA’s Urban Oasis school program. The goal of the project was to provide recommendations to create a green infrastructure design that benefitted the Sabana Llana Junior High School, guided the school toward Leadership in Energy and Environmental Design (LEED) certification, and set an example for other Puerto Rican schools.

Throughout the project, students met with qualified experts in green building design and a number of staff at the Institute. They conducted interviews with the faculty of Sabana Llana to better understand issues at the school and gather their ideas for

improvement. They also hosted a drawing activity with the students allowing them to bridge the language barrier and demonstrate through pictures what they wanted implemented on the school grounds. The eight weeks of hard work culminated in a final report and presentation given to the school and the broader community involved in the project. In the report, WPI students gave recommendations for cost-effective ways for Sabana Llana to address recycling

and waste management practices, energy and resource consumption, urban forestry and open spaces and green infrastructure design. Thanks to the work of the WPI interns, the staff and students at Sabana Llana now have a vision for a greener school and a plan for how to achieve it.

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### The Forest Stewardship Program

The USDA Forest Service Forest Stewardship Program provides specialized and high quality technical assistance to landowners. That technical assistance is then translated into forest management plans that promote sustainable management of the forest resources and keeping forest as forests. The program also provides educational opportunities on the different conservation initiatives and practices that are available. The Institute partners with the Puerto Rico Department of Natural and Environmental Resources (DNER), Forest Service Bureau and the US Virgin Islands Department of Agriculture for the implementation of the program. Enrique Santiago is the DNER Forest Service Bureau Forest Stewardship Coordinator and provides guidance to the field Forestry Technicians that are working out of each of the seven regional offices the DNER has in Puerto Rico. Marilyn Chakroff is the Coordinator for the program in the US Virgin Islands Department of Agriculture and oversees program implementation.

Forest Stewardship Program activities are guided by State Action Plans. The Puerto Rico and US Virgin Islands' State Action Plans identified Important Forest Resource Areas (IFRA) that, for purpose of the program, are considered Priority Landscapes. The IFRA are landscapes that are considered to have high program potential or priorities by the State Action Plan. States provided special data that will identify those areas and make them available to the Stewardship Mapping and Reporting Tool (SMART). SMART facilitates the development of Forest Stewardship Management Plans and at the same time collects the information of state accomplishments on all activities related to the implementation of the Forest Stewardship Program. In Puerto Rico 703,967 forested acres occur in Important Forest Resource Areas. Those IFRA include uplands that protect important watersheds that provide drinkable water to most of the population. That number is revised right now to incorporate land that is part of the newly approved Bosque Modelo or Model Forest in English, which provides special conservation considerations to approximately 378,000 acres of forestland. The US Virgin Islands State Action Plan identified 44,508 forested acres as Important Forest Resource Areas. In the Virgin Islands

these areas include forests in riparian and wildlife-urban interface areas, habitat of native and endangered species, and important landscapes.



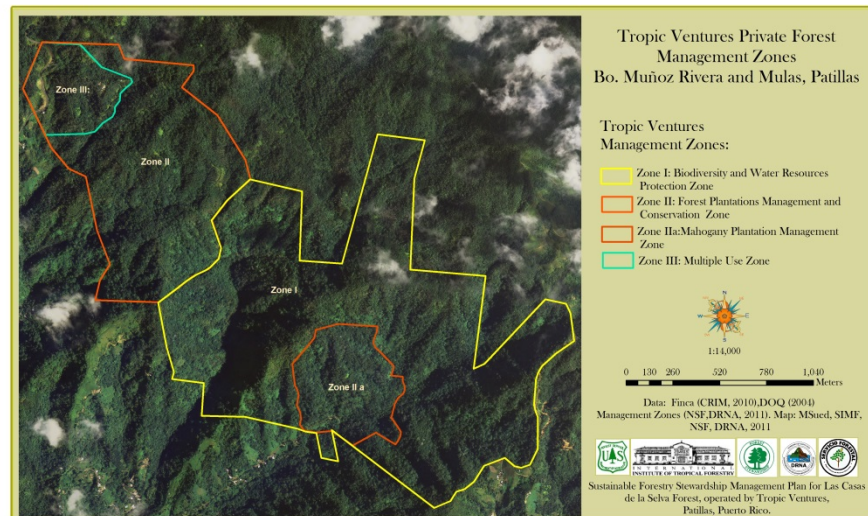
Coffee (*Coffea Arabica*) flower

The Department of Natural and Environmental Resources and Filigrana, Inc., a consulting firm, are working intensively in the Maricao/Guánica Joint Priority Landscape. The area is proposed for the establishment of the third population of the Puerto Rican parrot (*Amazona vittata*). This parrot is the only endemic parrot in Puerto Rico and is listed as an endangered species. Filigrana is visiting landowners within the priority landscape and preparing Forest Stewardship Management Plans for their properties. Six Forest Stewardship Management Plans were produced covering a total of 807 acres. Those plans include habitat restoration for the Puerto Rico Parrot reintroduction and improvement of habitat to benefit several other important endemic bird species such as the Puerto Rican Nightjar, the Puerto Rican Screech Owl, Puerto Rican Lizard Cuckoo, Puerto Rican Bullfinch, Puerto Rican Woodpecker, and the Elfin-woods Warbler. Those actions have the added benefit of assisting in the restoration of an important watershed that serves the Guánica Bay and will be translated in better water quality and less impact in the coral reefs. Agroforestry practices such as shade grown coffee are part of the array of conservation practices that are included in those management plans. Shade grown coffee improves bird habitat, protects the soil from erosion, improves pollination, and produces high quality coffee.

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## Stewardship Plan Development

*Unless we practice conservation, those who come after us will have to pay the price of misery, degradation, and failure for the progress and prosperity of our day.* Gifford Pinchot.



Forest Stewardship Management Plans must meet national standards set by the program, meet landowner objectives, and be approved by the State Forester. The Forest Stewardship Management Plans should address thirteen natural resource elements when they are present and are within landowners' objectives and management goals. Those resource elements are: soil and water; biological diversity; aesthetic quality; recreation; timber; fish and wildlife; threatened and endangered species; forest health; archeological, cultural, and historic sites; wetlands; fire; carbon cycle; and range, agroforestry, and silvopasture. The final result is a management plan that is multi-resource in scope and a comprehensive guide for forest ecosystem management. Landowners and foresters need to develop the plans together. Landowners set the goals and objectives for their land. Once the management plan is delivered, the landowner becomes eligible for other federal programs that can help pay to implement recommended practices and could be eligible for state tax abatement programs. A plan can also be designed to meet the objectives of a variety of programs offered by the Natural Resources Conservation Service, Fish and Wildlife Service, and other federal and state initiatives.





### FY 13 Forest Stewardship Program (FSP) Accomplishments in Puerto Rico and the US Virgin Islands

Performance Measures	Puerto Rico	US Virgin Islands
Non Industrial Private Forests in Important Forest Resource Areas (Acres)	703,967	44,508
New Forest Stewardship Management Plans (number of plans) (FY2013)	7	8
Acres for new FSP Management Plans (FY 2013)	1294	137
Acres in Important Forest Resource Areas (FY 2013)	592	137
Acres Covered by Current Forest Stewardship Plans	10,627	1,146
Acres in Important Forest Resource Areas Covered by Current Stewardship Plans	8,061	1,068
New Environmental Quality Incentives Program (EQIP) Management Plans (number of plans) (FY2013)	0	0
Acres in EQIP Management Plans (FY2013)	0	0

Landowner Assistance	99	38
Landowners Education	284	30

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### Let's get SMART... Part 2

*Conservation is a foresighted utilization, preservation and/or renewal of forest, waters, lands and minerals, for the greatest good of the greatest number for the longest time.* Gifford Pinchot.

The Forest Service launched the Stewardship Mapping and Reporting Tool (SMART) in 2013. This is a national web based data entry and report writing tool designed to support field-going personnel. Landowners' goals for their land are entered into the planning tool. The forest professional then enters information on forest composition, landscape characteristics, conservation needs, maps and other important information that describes the property. The technician enters the array of management and conservation practices that meet the landowners' needs and goals. The end result is a Forest Stewardship Management Plan that can guide the landowner's management for conservation and production over time.

The US Virgin Islands began using SMART since the day it went public. In Puerto Rico, the Department of Natural and Environmental Resources are using SMART for the development of Forest Stewardship Management Plans in the Mariacao/Guánica Joint Priority Landscape. SMART was translated in Spanish and we are waiting for the software developers to open the trial version and make it available to the Forestry Technicians from Department of Natural and Environmental Resources. Once the Spanish version is officially released it will be available to any Spanish speaking technician or forester that needs to provide a Spanish management plan to the landowners they provide service to.

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### Urban and Community Forestry Program

*Someone is sitting in the shade today because someone planted a tree a long time ago.* Warren Buffett

The Urban and Community Forestry Program (UCF) promotes the conservation of our urban forests. The success of the program is possible due to the volunteer work of committed citizens in Puerto Rico and the US Virgin Islands. Through educational and tree planting activities we

promote public participation and provide the tools they need to understand and conserve the multiple environmental services our urban forests provide. Each year the Puerto Department of Natural and Environmental Resources and the Virgin Islands Department of Agriculture provide technical assistance to the communities on the development of urban forest management plans, tree planting activities, workshops and educational talks, and activities with kids. Also, the program provides financial assistance to communities, non-profit organizations, educational institutions, and State government for the development of initiatives for the conservation of green spaces and educates citizens about the importance of the urban forests.



Vegetative material composting site at Laura Mercado Agroecological School at San Germán, Puerto Rico.

The UCF Program is administered in Puerto Rico by the Department of Natural and Environmental Resources (DNER) Forest Service Bureau and the in the Virgin Islands by the Department of Agriculture. Each agency has appointed an Urban and Community Forestry Coordinator that works with local urban and community forestry partners. Marilyn Chakroff is the Coordinator in the Virgin Islands and Rosamaría Quiles in Puerto Rico. Each Coordinator works closely with the Urban and Community Forestry Councils to plan program implementation and develop public policy for the protection and conservation of the urban forests. The Councils assist the Coordinator in the promotion and selection of local urban and community forestry projects that are funded through a portion of the State's program funds.

During Fiscal Year 2013 the Puerto Rico UCF Council and the DNER selected two community projects to receive funds from the program. Forest Service invested \$39,875 and the community groups provided an inkind match of \$681,145. In the Virgin Islands the VI UCF Council and the

Department of Agriculture selected three community projects. In the Virgin Islands the Forest Service provided \$55,694 and the community groups provided an in-kind match of \$103,891.

Urban and Community Forestry Statistics for Puerto Rico and the US Virgin Islands for FY 2013

<b>Urban and Community Forestry Program Accomplishments for Fiscal Year 2013</b>	<b>Puerto Rico</b>	<b>US Virgin Islands</b>
<b>Total Population</b>	<b>3,725,789</b>	<b>106,405</b>
Percent of population living in communities <b>managing</b> programs to plant, protect and maintain their urban and community trees and forests.	24.71	0.00
Percent of population living in communities <b>developing</b> programs and/or activities to plant, protect and maintain their urban and community trees and forests.	0.00	2.78
Number of people living in communities provided educational, technical and/or financial <b>assistance</b> .	704,295	3,017
Number of people living in communities that are <b>developing</b> programs/activities for their urban and community trees and forests.	0	3,017
Number of people living in communities <b>managing</b> their urban and community trees and forests	704,295	0
Number of communities with active urban & community tree and forest <b>management plans</b> developed from professionally-based resource assessments/inventories	32	3
Number of communities that employ or retain through written agreement the services of <b>professional forestry</b> staff who have at least one of these credentials: (1) degree in forestry or related field and (2) ISA certified arborist or equivalent professional certification	225	3
Number of communities that have adopted and can present documentation of local/statewide <b>ordinances or policies</b> that focus on planting, protecting, and maintaining their urban and community trees and forests	259	0
Number of communities with local <b>advocacy/ advisory organizations</b> , such as, active tree boards, commissions, or non-profit organizations that are formalized or chartered to advise and/or advocate for the planting, protection, and maintenance of urban and community trees and forests	26	3
Number of hours of <b>volunteer service</b> logged. (An agency-wide consistent methodology to be developed to track volunteer hours)	1,804	2,670

List of local Urban and Community Forestry Projects funded in Puerto Rico in FY2013

<b>Puerto Rico UCF Projects FY 2013</b>				
<b>Community Group/Location</b>	<b>Project Type</b>	<b>Funding</b>		
		<b>Forest Service</b>	<b>Local</b>	<b>Total</b>
Corporación del Oeste Mayaguez	Tree Planting Demonstration Project	20,000	660,300	680,300
Escuela Ecológica Niños Uniendo al Mundo Caguas	Education and Training	19,875	20,845	40,720
<b>Total funding</b>		39,875	681,145	721,020

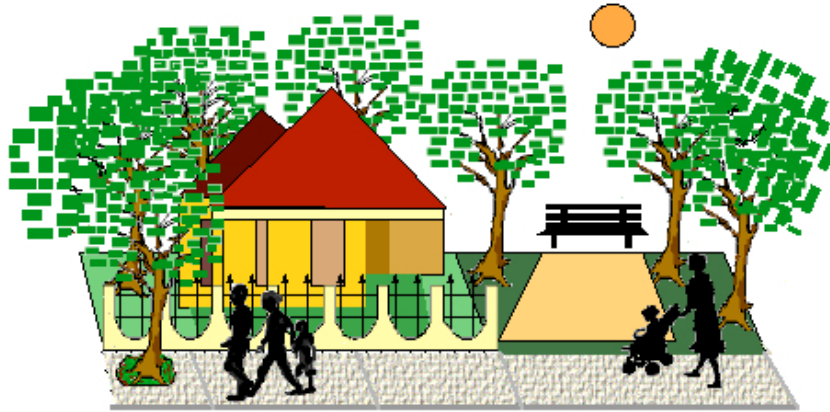
List of local Urban and Community Forestry Projects funded in US Virgin Islands in FY2013

<b>Virgin Islands UCF Projects FY 2013</b>				
<b>Community Group/Location</b>	<b>Project Type</b>	<b>Funding</b>		
		<b>Forest Service</b>	<b>Local</b>	<b>Total</b>
Office of the Administrator St. Thomas/Water Island Charlotte Amalie, St. Thomas	Urban Trees Inventory and Assessment	20,000	31,750	51,750
Spring Garden Homes Association, Inc. #3 Christiansted, St. Croix	Tree Planting Demonstration Project	15,694	15,714	31,408
St. John Community Foundation, Inc. Cruz Bay, St. John	Education and Training	20,000	56,427	76,427
<b>Total funding</b>		55,694	103,891	159,685

## Beyond Beautification: the real value of the urban forest

*I never before knew the full value of trees. Under them I breakfast, dine, write, read, and receive my company.* Thomas Jefferson.

### “Beyond Beautification: The Real Value of Urban Forests”



#### The 14th Caribbean Urban and Community Forestry Conference

The Caribbean Urban and Community Forestry Conference is the venue for members of the urban tree community to share their success stories and stay current in the latest techniques and tools available to them. The Virgin Islands Urban and Community Forestry Council hosted the 14<sup>th</sup> edition of the Conference from October 25 to the 27<sup>th</sup> at the University of the Virgin Islands in St. Thomas. The theme of the Conference was Beyond Beautification: The Real Value of the Urban Forests.

The diverse group that attended the conference, more than 100 attendees, participated in informational sessions that discussed nature and human health, forests in the coastal zone, land use effects, tree inventory methods, tree planting and management protocols, exotic species, cultural and ethno-medicinal uses of trees, urban forests and the community, pest and diseases affecting endangered plants, and economic benefits of urban trees. The audience included attendees and guest speakers from the US Virgin Islands, Puerto Rico, Chicago, Washington DC, and Colombia. Students from the University of the Virgin Islands were special guests to the event. For the first time the Conference was also broadcasted to the University of the Virgin Islands St. Croix Campus via teleconference.



Our keynote speaker, Dr. Frances Kuo, founder of the Human-Environment Research Laboratory at the University of Illinois at Urbana-Champaign, delighted us with two extraordinary presentations. Her first talk discussed the *Nature's Role in a Healthy Human Habitat*. Her second talk presented findings from her latest research *Academic Improvement with Green Space*.

We had the honor of presenting the Caribbean Urban and Community Forestry Conference Awards. The awards are presented for outstanding efforts to plan, plant, conserve or establish urban or community forests in the Caribbean. Awards categories are outstanding citizen-volunteer, outstanding professional, program award, project award, public awareness award, education award, and lifelong service award. The 14<sup>th</sup> Caribbean Urban and Community Forestry Conference Awards recipients were:

- Outstanding Citizen-Volunteer: Jayson Budsan President and founder of Environmental Association of St. Thomas for his commitment and contribution to recycling and reforestation efforts in St. Thomas and St. John, US Virgin Islands
- Outstanding Professional: Olasee Davis, Extension Service Specialist in the natural resources program of the Cooperative Extension Service at the University of the Virgin Islands St. Croix Campus. Olasee is also a columnist for the Virgin Islands Daily News and the St. Croix Avis newspaper. Olasee is a committed environmental educator and offers lectures on topics including eco-tourism, heritage tourism, the environment, marine resources, agriculture, Virgin Islands natural and cultural history, and sustainable life sciences. His activism on environmental issues has ensured the conservation and protection of natural, cultural, and agricultural resources throughout the Caribbean.



Barbara Petersen, Administrator of St. Thomas, US Virgin Islands presents the Outstanding Professional Award to Olasee Davis, Cooperative Extension Service Specialist.

- Program Award: Center for Sustainable Development Studies. Since it was conceived in 2002, the Center for Sustainable Development Studies has successfully developed numerous projects in collaboration with governmental and non-governmental organizations that have directly advanced the knowledge and understanding of urban and community forestry. An important example is its recently published second edition of the educational publication *Infraestructura Verde y Nuestros Parques* (Green Infrastructure and our Parks) developed with a grant from the USDA Forest Service International Institute of Tropical Forestry and the collaboration of the Puerto Rico National Parks Company.
- Project Award: *Parque de la Verde Sombra* (Green Shade Park) at the University of Puerto Rico Cayey Campus. *Parque de la Verde Sombra* is the only urban forest at Cayey, Puerto Rico and neighboring municipalities. It is located at the University of Puerto Rico, Cayey Campus; the project began soon after UPR in Cayey was designated as a regional college in the early 1970s. It was developed for the conservation of flora and fauna species, particularly endemic and endangered species from Puerto Rico and the Caribbean. The Park serves as a center for ecological education for school and



community groups, as well as an undergraduate research laboratory. In addition, the Park has been used as a center for tree care professionals training, arboriculture and as a field laboratory for general biology courses offered at the UPR in Cayey.

- **Public Awareness Award: St. Croix Environmental Association.** The St. Croix Environmental Association (SEA), Inc. has participated in Urban and Community Forestry programs for many years. In the last six years SEA has been given five separate awards for urban and community forestry projects. Among these projects were the following: Dry Forest to Wetland: Teacher Training Seminars; Dry Forest Enrichment at Southgate Coastal Reserve; Dry Forest Enrichment at Southgate Coastal Reserve, Phase II; St. Croix Silk Cotton Tree Protection; and Bethlehem Village and Profit Hills Community Forestry Project. In those projects SEA has included public awareness as one primary goal. Each project has an educational component teaching the public in the importance of urban forests, and promotes the involvement of various public sectors in actual seed collection, seed propagation, planting, and maintenance of trees and other plants. Volunteers from schools, Boy Scout troops, government organizations, and the general public learned by doing and had hands-on experiences with native species.



The St. Croix Environmental Association (SEA), Inc., website: <http://www.stxenvironmental.org/>

- **Education Award: Djabana's Kuumba Educational Campgrounds, Inc.** The Djabana's Kuumba Educational Campgrounds, Inc. is an organization that provides environmental education through lectures, field trips, and hands-on experiences in the natural environment of Mandahl Bay's mangrove forest and the upland dry tropical forest above it. The Campgrounds consists of a total of 11 acres of forested property just above Mandahl Bay on the north shore of the island of St. Thomas in the US Virgin Islands. For several years, the owners and directors of the Campground, Anna Wallace-Francis and Alcedo Francis, worked with volunteers and student campers to create a learning center that is within the forest and surrounded by forest. Student campers learned about native

trees as they planted them on the property. Students and volunteers marked and cleared trails, created terraces, and rain gardens to slow surface water run-off, and planted a garden area with traditional provision crops. Every hands-on activity included education about the activity or the plants that were propagated and planted.

- **Lifelong Service Award: Mario A. Francis.** Mario A. Francis has been a member of the Urban and Community Forestry Council in the US Virgin Islands since its inception in 1993. Over these 19 years, Mr. Francis has demonstrated his commitment to the urban and community forestry. For most of these years, he has been the Chairman of the US Virgin Islands Urban and Community Forestry (U&CF) Council, and was instrumental in moving the U&CF Council from an advisory board to a nonprofit organization and getting the 501(c)3 certification. He represented the Council at many local, regional, and national conferences and meetings. Mario has presented programs at public and private schools, at agricultural fairs and environmental events celebrating Earth Day, on all three main islands of the US Virgin Islands. He has provided hands-on experiences to participants at all of these events. Mario was instrumental in the conception of the campaign *We Plant Native Trees* promoting the use of native plant material on reforestation projects to preserve and conserve trees of cultural, historic, and environmental value. Mario and Ivan Butcher, another Council member, created the Council's newsletter, *The Tree Speaker*, and the Council's new website. In the recent years, Mario has been working with US Virgin Islands Senators by educating them on the importance of the urban and community forests and the need of a tree law for the US Virgin Islands.



Saturday was field trip day! The last day of the conference attendees visited Hassel Islands and had the opportunity to explore the historical and cultural sites on the island and visit the project reforestation and environmental interpretation project that was established with Urban and Community Forestry funds.

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## Caguas Arbor Day Celebration

*Nature... you and I are the same.* José Miguel Hernández Miranda.

The Autonomous Municipality of Caguas and his Mayor William E. Miranda Torres hosted the Arbor Day celebration on April 30, 2013 at the recreational facilities of the Idamaris Garden residential project. Also that day all the attendees celebrated the 5<sup>th</sup> Anniversary of the certification of Caguas as a Tree City USA. Caguas is the only city in Puerto Rico that has that designation. The Secretary of the Puerto Rico Department of Natural and Environmental Resources presented the Tree City USA flag and the Tree City USA Growth Award to the Mayor of Caguas.



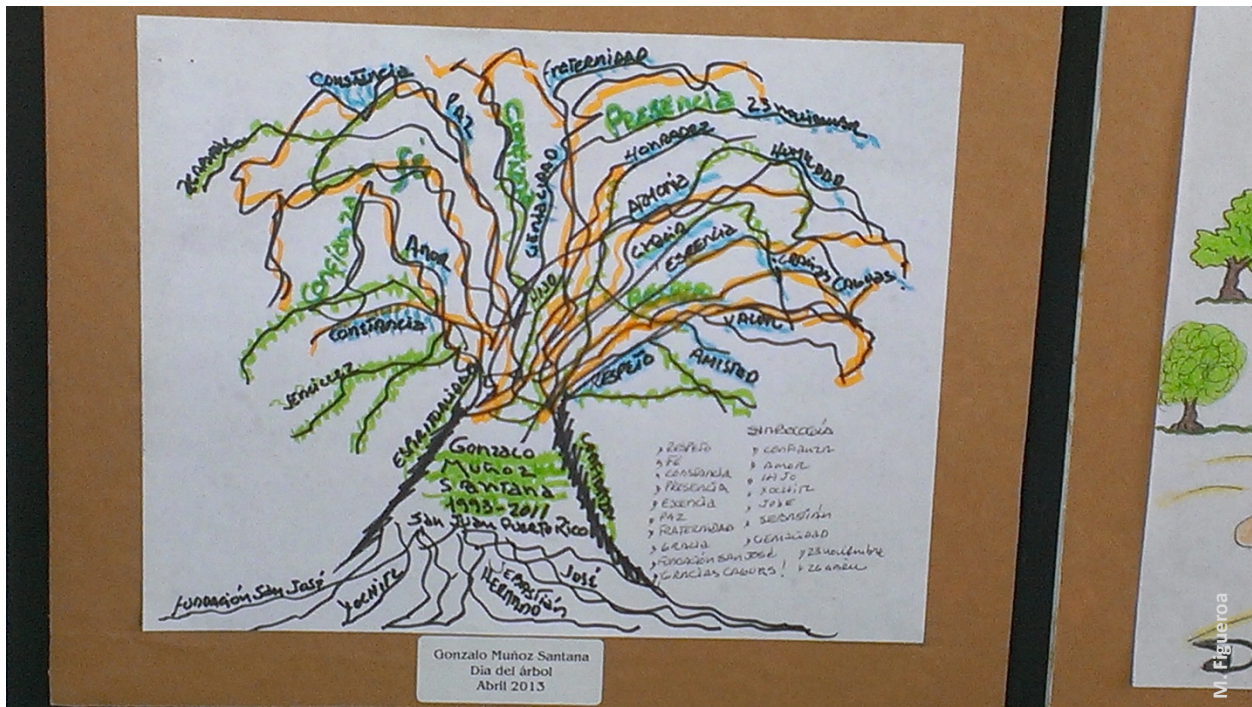
The Mayor of Caguas, William Miranda Torres, presents the manifesto and dedication of the Arbor Day Celebration to María Cristina Miranda Marín founder of Fundación Casa José and the President of the Idamaris Gardens Residents Association.

The activity was dedicated to Fundación Casa José (Casa José Foundation). Casa José is a nonprofit organization that promotes the emotional, spiritual, and physical wellbeing of cancer patients by the interaction with nature. The organization provides services to youth under 21

years old and their families. That day they planted 12 trees. One of those trees was planted to celebrate the 5<sup>th</sup> anniversary of the certification of Caguas as a Tree City USA. The other 11 trees represented 11 families who have children that are cancer patients, including José Miguel Hernández Miranda, cousin of Mayor Miranda Torres.

During his speech the Mayor of Caguas reiterated the engagement of *La Ciudad Criolla* to promote reforestation activities and promote the professionalism, integrity, courage, commitment, and sensibility towards all living beings, including nature. And quoting his cousin José Miguel said “Nature... you and I are the same”.

After his message Mayor Miranda Torres signed the *Proclama* to designate the *roble nativo* (*Tabebuia heterophylla*) as the tree symbol of the city, to declare the last Friday of April of every year as the official Arbor Day, and to promote urban and rural reforestation. Then the Mayor, families of *Fundación Casa José*, and residents of Idamaris Garden concluded the activity with the tree planting ceremony.



Art piece created by Gonzalo Muñoz Santana from Fundación Casa José.

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## Palm Management in the Landscape Workshop

*For in the true nature of things, if we rightly consider, every green tree is far more glorious than if it were made of gold and silver.* Martin Luther King.

The Puerto Rico Urban and Community Forestry Council is committed to offer educational and training opportunities to the tree care professionals and community members from Puerto Rico and the US Virgin Islands. Council members are always looking for new and exciting topics and speakers to offer to this audience.

During December 2012 the Council hosted the two days short course, Palm Management in the Landscape. The course was offered by Tim Broschat and Monica Elliot from the University of Florida, Fort Lauderdale Research and Education Center. Tim Broschat is a Professor of Environment Education and Monica Elliott is the Acting Center Co-Director and Professor on Plant Pathology. The course was attended by 51 persons representing tree care professionals, municipal urban foresters, state government officials, and community members from Puerto Rico and the US Virgin Islands.



Monica Elliot leads the afternoon field trip during the Palm Management in the Landscape workshop

The Research and Education Center is internationally recognized for research on ornamental palms. Research sponsored by the Center includes: 1. Improved landscape practices for palm maintenance; 2. Mineral nutrition of palms; and 3. Insect pests and diseases of palms.

Attendees were very pleased to participate in this course as this was the first time a course on palm management was offered for this audience. The short course covered the following topics:

- Diagnosing palm problems
- Palm anatomy and growth
- Physiological disorders
- Nutrient deficiencies
- Palm insects
- Palm diseases
- Transplant issues
- Pruning palms
- Fertilizer formulations and application techniques



Palm Management in the Landscape workshop field trip

Each day was divided in two parts, morning classroom sessions and field trips in the afternoon. During the field visits the attendees had the opportunity to visit the palms located at the UPR Botanical Garden and actively work diagnosing plant health issues and recommending treatment and management options.

We had an added benefit to the visit of these palm management experts to Puerto Rico. The day before the course they agreed to visit the Caguas Botanical Garden and do some diagnosis on the palms and give management and treatment recommendations. Also, they visited El Yunque National Forest and met with Ecologists and Forest Managers and visited a site where some palms were showing distressed symptoms.

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## Joe Acabá vistis the Capetillo Urban Forest

Astronaut Joe Acabá visited the Capetillo Community Garden, Nursery, and Urban Forest and shared his experiences in space with students from local elementary and junior high schools. Over 150 students, enjoyed a talk given by Astronaut Acabá, viewed a video taken on his second trip to space, and visited the urban forest to learn about the benefits of green spaces and the important role of green infrastructure in our lives. Joe gave to each student an autographed photo of Puerto Rico that he took from space.



Astronaut Joe Acabá, Smokey, and students having a great and exiting time together.



From left to right, Astronaut Joe Acabá, student, Smokey, and Mayor of San Juan, Carmen Yulín

The Mayor of San Juan, Carmen Yulín Cruz, stopped by and said hello to Joe and the kids. Also, Smokey made a surprise visit and the kids had the opportunity to take pictures with him.

The Capetillo project is administered by community members and has the support of the University of Puerto Rico, Río Piedras Campus, the Department of Natural and Environmental Resources, and the Urban and Community Forestry Program. It promotes community governance and provides means to improve the economic and social situation of the neighbors by promoting ecotourism and managing the community garden and native trees nursery.

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### Cooperative Fire Protection Program

The Cooperative Fire Program provides assistance to build capacity in fire prevention, preparedness, and fire suppression in rural areas in the wildland-urban interface.

In Puerto Rico during 2013, the Puerto Rico Fire Department (PRFD) responded to 4,750 wildland forest fires that burned 17,188 acres, the majority of which occurred between January and April in southern Puerto Rico. In order to respond to that volume of fires the Puerto Rico fire Department continues to increase its initial attack capability by cross training. As part of the Cooperative Fire Protection Program a new wildland fire engine was located in Castañer Ward and a second was acquired for Vieques Island. In addition, 27 structural fire trucks at stations within high fire risk zones were equipped with personal protective equipment, tools, and forestry hoses. In the Municipalities of Peñuelas and Coamo, two communities are at high fire risk due to the interactions in the wildland urban interface, hazard mitigation was begun using mechanical equipment, hand tools, and controlled burning. Under the Fire Prevention Education Campaign the PRFD provided educational talks and activities to nearly 176,000 citizens of all ages, by visiting and offering talks at schools, shopping centers, senior centers, to the private industry, and via TV and radio.





The portable water tank, called a “pumpkin tank” by fire fighters is used to provide water for aerial assault of wild fires. The PR Fire Department holds periodic training as safety is key concern for ground and helicopter crews



High pressure spray is effective in fire suppression. The USFS Cooperative Fire Prevention Program provides equipment and training for state of the art fire suppression.

The US Virgin Islands Fire Service responded to 149 fires that burned 517 acres. A majority of the fires occur in sub-tropical dry ecosystems that pose a high risk of wildfire. Therefore the fire prevention program is a key part of their program. Through various events, television and radio

broadcasts, and school activities they estimate they reached over 41,500 people in 2013 which represents nearly 40% of the US Virgin I population.

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### Puerto Rico Fire Chief Ángel Crespo Ortiz wins silver Smokey Bear Award

Puerto Rico Fire Chief Ángel Crespo Ortiz received the silver Smokey Bear Award from US Forest Service Director Dr. Ariel Lugo and Puerto Rico Secretary of the Department of Natural Resources Carmen Guerrero in May 2013. The Smokey Bear Awards are the highest national honor one can receive for outstanding work and significant program impact in wildfire prevention. This merit award has been bestowed on well-deserving groups and individuals annually since 1957. Nominations for the award are judged by representatives from the USDA Forest Service, the National Association of State Foresters and the national Ad Council. Chief Crespo Ortiz was nominated by State Forester Cristina Cabrera and supported by letters from local agencies in Puerto Rico and the US Virgin Islands.



From left to right: David Bernier, State Secretary; Ángel Crespo Ortiz, PR Fire Chief; Ariel E. Lugo, IITF Director; and William Miranda Torres, Mayor of Caguas Municipality

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## Appendix I

<b>Codes</b>	<b>English Name</b>	<b>Status</b>
GMAG	Green mango	Endemic
PREM	Puerto Rican emeral	Endemic
PRFL	Puerto Rican flycatcher	Endemic
PRLC	Puerto Rican lizard-cuckoo	Endemic
PROR	Puerto Rican oriole	Endemic
PRSP	Puerto Rican spindalis	Endemic
PRTA	Puerto Rican tanager	Endemic
PRTO	Puerto Rican tody	Endemic
PRWO	Puerto Rican woodpecker	Endemic
PUEB	Puerto Rican bullfinch	Endemic
BRMA	Bronze mannikin	Exotic
HOSP	House sparrow	Exotic
NUMA	Nutmeg mannikin	Exotic
OCWA	Orange-cheeked waxbill	Exotic
ORAW	Orange-fronted parakeet	Exotic
PTWH	Pin-tailed whydah	Exotic
ROPI	Rock Pigeon	Exotic
WWPA	White-winged parakeet	Exotic
ANEU	Antillean euphonia	Resident
ANMA	Antillean mango	Resident
BANA	Bananaquit	Resident
BFGQ	Black-faced grassquit	Resident
BWVI	Black-whiskered vireo	Resident
CAMA	Caribbean martin	Resident
CASW	Cave swallow	Resident
COGD	Common ground-dove	Resident
GAGR	Greater antillean grackle	Resident
GRAK	Gray kingbird	Resident
GREG	Great egret	Resident
GTCA	Green-throated carib	Resident
LOKI	Loggerhead kingbird	Resident
MACU	Mangrove cuckoo	Resident
NOMO	Northern mockingbird	Resident
PETH	Pearly-eyed thrasher	Resident
RLTH	Red-legged thrush	Resident
RUDQ	Ruddy quail-dove	Resident
SBAN	Smooth-billed ani	Resident
SHCO	Shinny cowbird	Resident
SNPI	Scaly-naped pigeon	Resident
WWDO	White-winged dove	Resident
YFGQ	Yellow-faced grassquit	Resident
ZEND	Zenaida dove	Resident