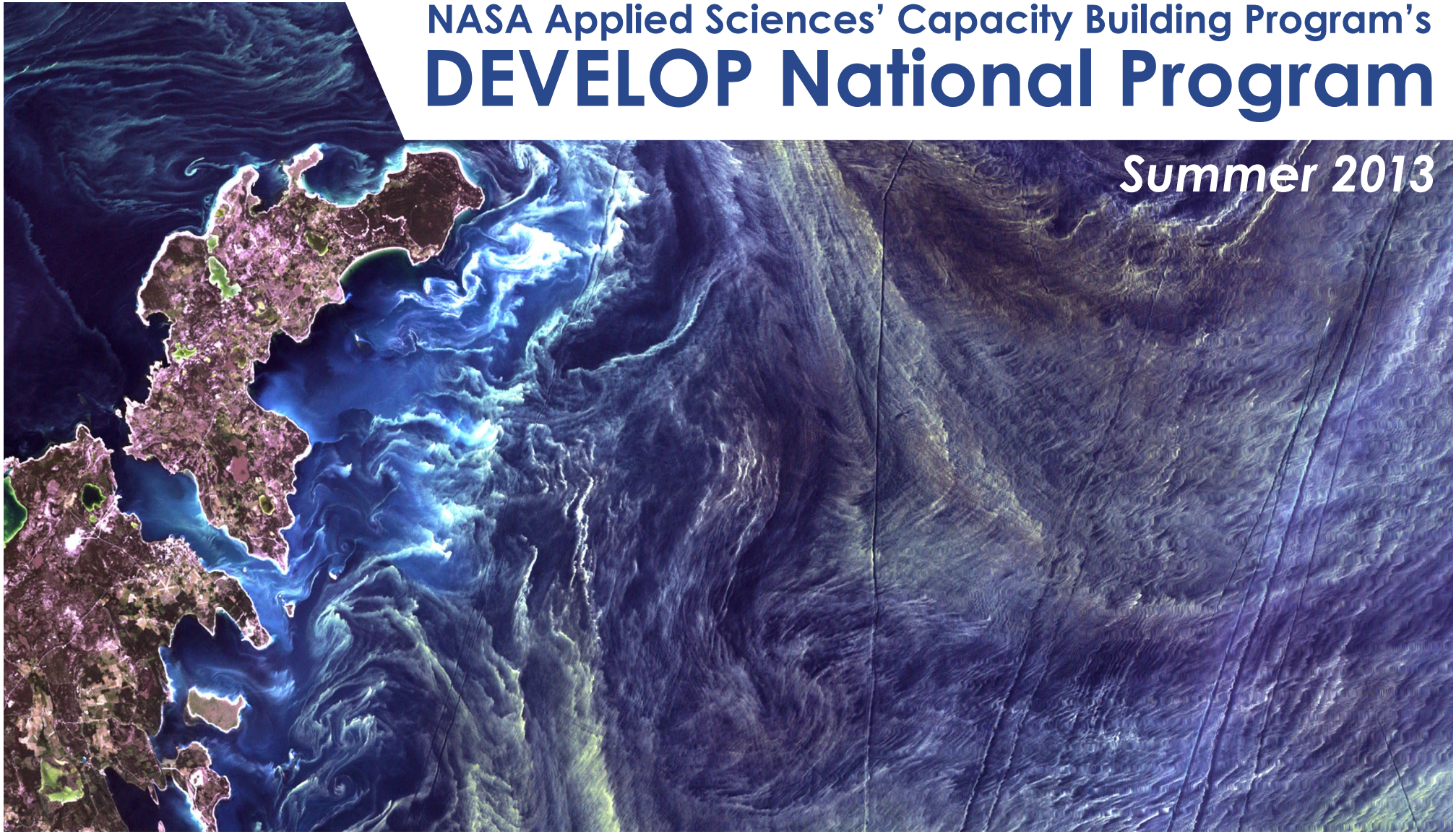
National Aeronautics and Space Administration

NASA Applied Sciences' Capacity Building Program's

DEVELOP National Program

Summer 2013



www.nasa.gov

NASA Center Locations

1. Ames Research Center
2. Goddard Space Flight Center
3. Jet Propulsion Laboratory
4. Langley Research Center
5. NSSTC at Marshall Space Flight Center
6. Stennis Space Center

Regional Locations

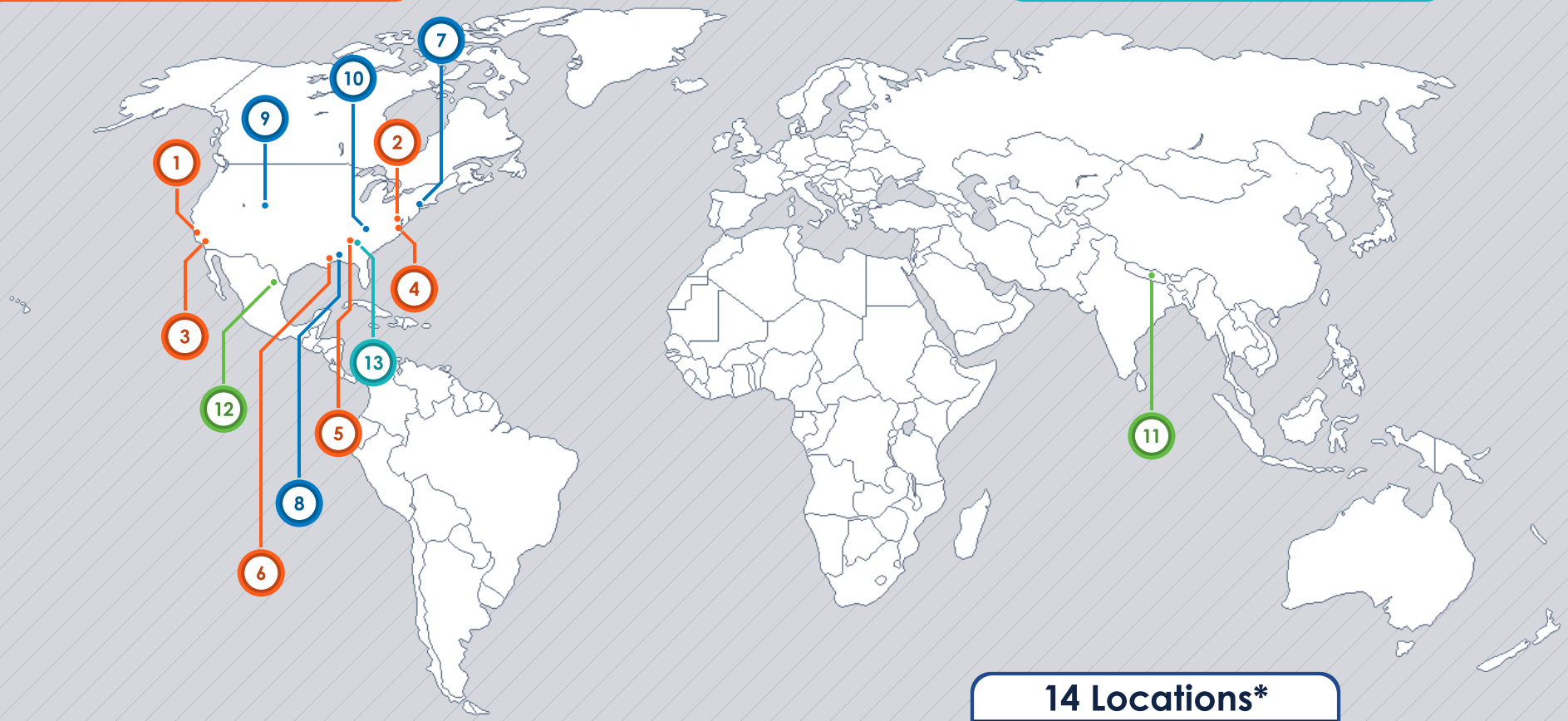
7. International Research Institute for Climate and Society
8. Mobile County Health Department
9. North Central Climate Science Center
10. Wise County and City of Norton Clerk of Court's Office

International Locations

11. International Centre for Integrated Mountain Development
12. Tecnológico de Monterrey Campus Saltillo

Leveraged Academic Locations

13. University of Georgia



14 Locations*

- 12 Domestic*
- 2 International

*includes project activity in Richmond, VA

141 Participants

- 14 High School
- 37 Undergrad
- 37 Grad
- 4 PhD Candidates
- 49 Recent Grads
- 83 alma maters represented
- 30 US states represented
- 10 countries represented
- 51% Male/49% Female

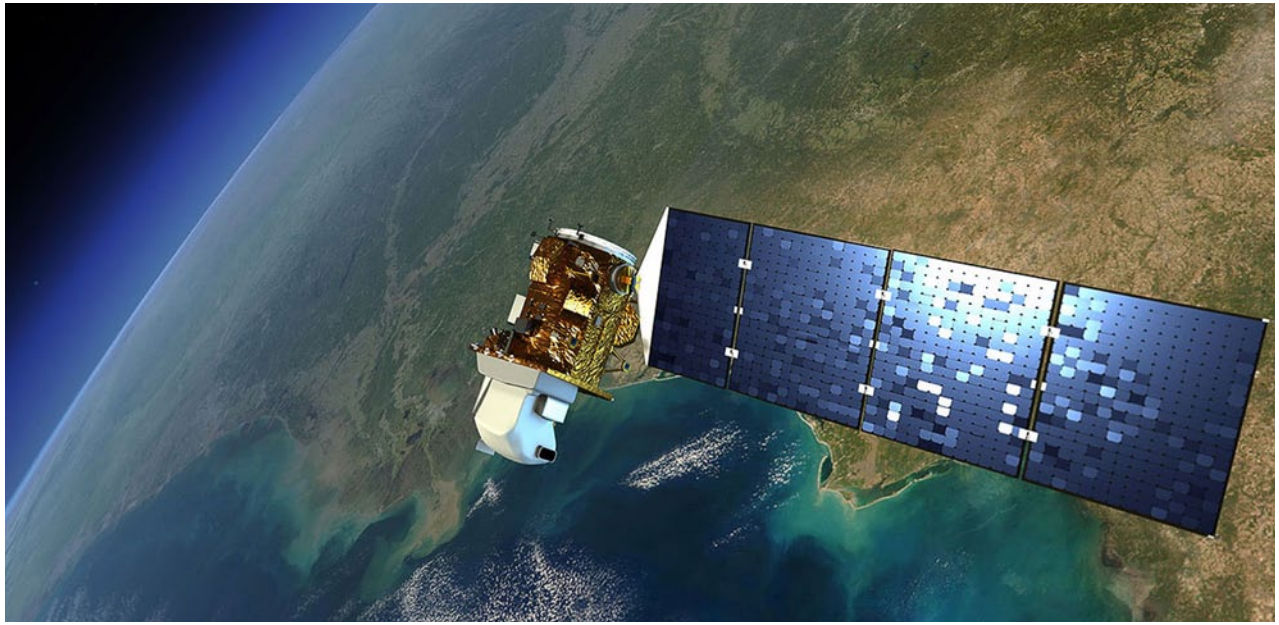
31 Projects

- 9 Ecological Forecasting
- 4 Water Resources
- 3 Disasters
- 4 Health & Air Quality
- 5 Agriculture
- 2 Energy
- 2 Oceans
- 1 Climate
- 1 Cross-Cutting

68 Partners

- 3 Local
- 14 State
- 22 Federal
- 6 NGOs
- 6 Academic
- 17 International

About DEVELOP



DEVELOP addresses environmental management and public policy issues through interdisciplinary research projects that apply the lens of NASA Earth observations to community concerns around the globe. Part of NASA's Applied Sciences Program, DEVELOP bridges the gap between NASA Earth science and society, building capacity in both participants and partner organizations to better prepare them to handle the challenges that face our society and future generations.

Teams of DEVELOP participants partner with decision makers to conduct rapid feasibility projects that highlight fresh applications of NASA's suite of Earth observing sensors, cultivate advanced skills, and increase understanding of NASA Earth science data and technology. These teams analyze societal and scientific dilemmas and discover ways in which prediction, monitoring, or mitigation of these issues can be enhanced through the application of NASA Earth observations. Local involvement is fostered by working closely with community partners directly associated with project study areas and establishing dual-capacity relationships and rapport.

What began as an enterprise to establish mutual relationships between concerned citizens and the scientific community has turned into a global initiative for societal benefit. To promote progress of such an initiative, DEVELOP competitively selects participants of interdisciplinary academic backgrounds to come together as a team, during one of three 10-week terms each year. Participants deliver project results and decision support tools to leaders in industry, academia, and local, state, and federal government.

Combining a mission for societal benefit, a vision to expand the use of scientific research, and a commitment to the values of innovation, passion, professionalism, and collaboration, DEVELOP participants gain experience that fosters personal strengths and service to others, promoting a balance of leadership and teamwork in order to successfully address community needs. Beginning in 1998 with just three students, and then formally established at Langley Research Center in 1999, DEVELOP has provided 2,840 internship opportunities, expanded and maintained a broad network of locations, and conducted over 400 application projects to date that have expanded the user base benefiting from the use of NASA Earth observations.

A recent survey of DEVELOP alumni found that 65% are currently employed in a STEM field, 35% are working with NASA Earth observations, and in the area of professional development, DEVELOP alumni cited presentation preparation, communication, and professional etiquette as the top three areas where DEVELOP has helped in their career. With the competitive nature and growing societal role of science and technology in today's global community, DEVELOP fosters collaboration and advances environmental understanding for participants and end-user organizations, promoting the ability to recognize, understand, and address environmental issues facing the Earth.

About Projects

DEVELOP serves as a project incubator that fosters applications of NASA Earth observations for practical societal benefit. DEVELOP achieves this by conducting approximately 70 feasibility projects each year that explore novel partnerships, utilize new satellites and sensors, and apply innovative methods to extend the benefits of NASA Earth science further. These projects stem from both scientific directives (NASA program managers, science advisors, national science objectives, strategic planning directives, and science conferences) and community directives (local community needs and concerns, decision makers, policy makers, partner organizations, and policy conferences). Ideas are vetted through a competitive proposal process and approved by NASA Headquarters program managers, then executed at the various DEVELOP locations.

Under the guidance of NASA and partner science advisors, DEVELOP project teams work in alignment with local, regional, national, and international partner organizations to identify real-world applications for NASA data to address diverse environmental community concerns. Teams of interns, including students, recent graduates, and young professionals from diverse academic backgrounds extend NASA Earth science to the public through partnerships with public and private organizations that can benefit from integrating Earth observations into their decision making processes. At the completion of each project, results and methodologies are handed off to end-users and often presented at science and policy forums. These projects feed not only innovation in decision making across diverse management and policy sectors, but also drive ideas for future research, like that in NASA's Research Opportunities in Space and Earth Sciences (ROSES) grant solicitations.

At the core, each of these projects share the same characteristics: highlights the capabilities of NASA Earth observations, addresses community concerns relating to environmental issues, aligns with at least one of the nine NASA Applied Sciences' Application Areas of National Priority, partners with an end-user organization who can benefit from enhanced decision making, and culminates in a set of deliverables (technical report, poster, presentation, and video). These projects afford the participants with valuable experience - technological expertise, communication, leadership, and personal and professional development. Simultaneously, partner organizations are introduced to NASA's suite of satellites and airborne mission data that can be utilized for enhanced decision and policy making - leading to potential cost and time savings.

Summer 2013 Portfolio

- *IRI Uruguay Agriculture*
- *LaRC Great Plains Agriculture*
- *LaRC/PHB Virginia Agriculture*
- *LaRC/WC Rwanda Agriculture*
- *MCHD Southeast Agriculture/Disasters*

- *SSC American Climate*

- *JPL California Disasters*
- *JPL California-Mississippi Disasters*
- *WC/MX Coahuila Disasters*

- *ARC Klamath Ecological Forecasting*
- *NCCSC Colorado Ecological Forecasting*
- *GSFC East Africa Ecological Forecasting*
- *ICIMOD/MSFC Chittagong Ecological Forecasting*
- *LaRC Dismal Swamp Ecological Forecasting*
- *LaRC Myanmar Ecological Forecasting*
- *UGA Brazil Ecological Forecasting*
- *UGA Georgia Ecological Forecasting*
- *UGA/MSFC Great Smoky Mountains Ecological Forecasting*

- *LaRC Mid-Atlantic Energy*
- *LaRC/WC Rwanda Energy*

- *IRI Sahel Health & Air Quality*
- *IRI Sudan Health & Air Quality*
- *UGA/MSFC Southeast Health & Air Quality*
- *WC Virginia Health & Air Quality*

- *LaRC South Pacific Oceans*
- *SSC Gulf of Mexico Oceans*

- *ARC Sierra Nevada Water Resources*
- *ARC Yosemite Water Resources*
- *NCCSC Colorado Water Resources*
- *LaRC New England Water Resources*

- *LaRC DEVELOP VIEW*

About Partners

DEVELOP projects partner with a wide variety of end-users. Partnerships often occur with local, state, regional, federal, international, academic, and non-governmental organizations. By collaborating with DEVELOP, partners are introduced to NASA and its Applied Sciences Program, Capacity Building elements, and Earth observation resources. End-users gain insight into satellite and airborne Earth observation capabilities, and how they can augment and enhance their current decision making practices and provide potential cost and time savings. An added benefit is being introduced to and meeting the next generation to enter the workforce.

DEVELOP aims to involve communities through raising awareness of environmental needs, issues, and solutions by innovatively engaging with a broader audience of citizens. Local involvement is fostered by working closely with community partners directly associated with project study areas. These relationships are commonly sparked by boundary organizations that interact with communities of practice in specific disciplines, like the USGS North Central Climate Science Center and the Great Lakes and St. Lawrence Cities Initiative.

DEVELOP actively seeks out interested organizations at local community forums, scientific and policy conferences, NASA events and meetings, as well as through policy makers, boundary organizations, and other partner organizations. For more information on how to get your organization involved with DEVELOP, visit the DEVELOP website at http://develop.larc.nasa.gov/.

Summer 2013 Partners List

- *African Conservation Centre*
- *AfriPop Project*
- *Alabama Forestry Commission*
- *Amboseli Conservation Program*
- *American Electric Power*
- *Bangladesh Centre for Advanced Studies (BCAS)*
- *Bangladesh Ministry of Environment and Forests*
- *California Department of Water Resources (CADWR)*
- *California Earthquake Clearinghouse*
- *Coalition to Restore Coastal Louisiana*
- *Colorado Forest Restoration Institute*
- *Colorado Natural Heritage Program*
- *Colorado State University, Natural Resource Ecology Laboratory*
- *Department of Energy, Clean Energy*
- *Department of Homeland Security*
- *Doctors Without Borders*
- *Dominion Power*
- *Drake University, Iowa*
- *EPA Office of Air Quality Planning & Standards, Air Quality Assessment and Policy Division*
- *EthoCebus Project Team*
- *Florida Forest Service*
- *Forest Research Institute*
- *Georgia Department of Natural Resources*
- *GNS Science (New Zealand)*
- *International Centre for Integrated Mountain Development*
- *Jefferson County Department of Health*
- *Klamath Bird Observatory (KBO)*
- *Lake Champlain Basin Program*
- *Lake Champlain Committee*
- *Louisiana Department of Wildlife and Fisheries*
- *Maryland Energy Administration*
- *MERIT Initiative*
- *Mexico Centro Nacional de Prevención de Desastres (CENAPRED)*
- *Mexico Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT)*
- *Mississippi Forestry Commission*
- *Myanmar Ministry of Environment, Conservation, and Forestry*
- *NASA CALIPSO Science Team*
- *National Park Service, Great Smoky Mountain National Park*
- *National Park Service, Yosemite National Park*
- *NOAA National Coastal Data Development Center*
- *Rwanda Ministry of Agriculture and Animal Resources*
- *Smithsonian Conservation Biology Institute (SCBI)*
- *Sudan Ministry of Health*
- *Public Laboratory for Open Technology and Science (PLOTS)*
- *University of Maryland, Eastern Shore*
- *University of Sao Paulo*
- *Uruguay Instituto Nacional de Investigación Agropecuaria (INIA)*
- *US Army Corps of Engineers (USACE)*
- *US Department of Agriculture (USDA), Agricultural Research Service (ARS) Rangeland Resources Research Unit (RRRU)*
- *US Fish and Wildlife Service, Great Dismal Swamp Wildlife Refuge*
- *US Fish and Wildlife Service, Strategic Habitat Conservation Team*
- *US Forest Service, Southern Research Station*
- *US Forest Service, Fort Collins*
- *US Forest Service, Fraser Experimental Forest Station*
- *US Forest Service, Pacific Southwest Region*
- *US Forest Service, Remote Sensing Applications Center*
- *US Forest Service, RMRS Region 2*
- *US Forest Service, Rocky Mountain Research Station*
- *US Geological Survey, Astrogeology Research Center*
- *US Geological Survey, Fort Collins Science Center*
- *US Geological Survey, North Central Climate Science Center*
- *Virginia Department of Agriculture and Forestry*
- *Virginia Department of Conservation and Recreation, Division of Natural Heritage, Back Bay Nature Preserve*
- *Virginia Department of Environmental Quality Air Division*
- *Virginia Tech Agriculture Research & Extension Center*
- *Woods Hole Research Center*
- *World Bank, Open Data Initiative*
- *World Health Organization*

DEVELOP Timeline

October

- **10/1-5**
  63rd International Astronautical Congress (IAC) 2012 - *Naples, Italy*
- **10/2-3**
  New Energy Economy Conference at Colorado State University - *Fort Collins, CO*
- **10/3-5**
  21st Annual Groundwater Resources Association Conference - *Rohnert Park, CA*
- **10/5**
  University of Texas at San Antonio 2012 Research Conference - *San Antonio, TX*
- **10/6-11**
  National Weather Association Annual Meeting - *Madison, WI*
- **10/11-13**
  2012 AAG Great Plains/Rocky Mountain Region Meeting - *Park City, UT*
- **10/15-19**
  SERVIR Summit - *Huntsville, AL*
- **10/16-18**
  SMAP/GRACE Workshop - *Reston, VA*
- **10/29-11/1**
  ASPRS/MAAPS Specialty Conference - *Tampa, FL*

November

- **11/1**
  IRI node established - *Palisades, NY*
- **11/8-9**
  GEO Huntsville Conference - *Hunstville, AL*
- **11/8-11**
  Western Society of Naturalists Meeting - *Seaside, CA*
- **11/11-15**
  61st ASTMH Annual Meeting - *Atlanta, GA*
- **11/14**
  Worldwide GIS Day
- **11/14-15**
  2012 Bays and Bayous Symposium - *Biloxi, MS*
- **11/16**
  2012 Fall Term ends
- **11/27**
  ***Earthzine* Fall 2012 Virtual Poster Session Launch**
- **11/30-12/3**
  Council of State Governments Annual Meeting - *Austin, TX*

December

- **12/6-10**
  AGU Fall Meeting - *San Francisco, CA*

January

- **1/6-10**
  AMS Annual Meeting - *Austin, TX*
- **1/7-11**
  DEVELOP National Strategic Planning & Leadership Retreat - *Hampton, VA*
- **1/21-23**
  Gulf of Mexico Oil Spill & Ecosystem Science Conference - *New Orleans, LA*
- **1/23**
  NASA Day at the Capitol - *Jackson, MS*
- **1/24**
  ***Women@NASA Blog:* Ande Ehlen**
- **1/28**
  Spring 2013 term begins
- **1/28**
  IRI Node began hosting DEVELOPers and conducting projects

February

- **2/1**
  ***The Earth Observer* article: "NASA DEVELOP Students Use NASA Satellite Data to Study Louisiana Coastal Swamp Forests"**
- **2/4**
  ***Women@NASA Blog:* Yanina Colberg**
- **2/6-7**
  Virginia Aerospace Days - *Richmond, VA*

March

- **3/15**
  DEVELOP National Program Office Strategic Planning Retreat - *Hampton, VA*
- **3/24-28**
  ASPRS Annual Conference - *Baltimore, MD*

2012 - 2013

April

- **4/3** *Earthzine* Spring 2013 Virtual Poster Session Launch
- **4/5** Spring 2013 term ends
- **4/9** *Directions Magazine* Sacramento Disasters
- **4/9-13** Association of American Geographers (AAG) Annual Meeting - *Los Angeles, CA*
- **4/15-17** CalGIS: 19th Annual California GIS Conference - *Long Beach, CA*
- **4/16** *Directions Magazine* Colombia Disasters
- **4/30** *Directions Magazine* Appalachian Health/AQ

May

- **5/7** *Directions Magazine* Coahuila Disasters
- **5/16** UGA node opens
- **5/20** Peer-Reviewed Publication - "Nonpoint Source Pollution Risk Mapping for Alabama's Big Creek Lake" *The Geographical Bulletin (Vol. 54, No. 1, pp. 1-23).*
- **5/23** *Women@NASA Blog:* Katrina Laygo and Melissa Oguamanam
- **5/28** DEVELOP collaborates with the Commonwealth of Virginia, which hosts an office for the summer

June

- **6/3** Summer 2013 term begins
- **6/11-12** VISualize 2013: Global Change & Environmental Monitoring - *Washington DC*
- **6/24** Peer-Reviewed Publication - "Estuarine sediment deposition during wetland restoration: A GIS and remote sensing modeling approach." *Geocarto International*

July

- **7/27-31** CSG 67th Southern Legislative Conference Annual Meeting - *Mobile, AL*

August

- **8/1** DEVELOP Annual Applications Showcase at NASA Headquarters
- **8/6** *Earthzine* Summer 2013 Virtual Poster Session Launch
- **8/9** Summer 2013 term ends

September

- **9/9** Fall 2013 term begins

FY 2013 Overview

The past year has been an exciting one for DEVELOP. The program conducted a record breaking 75 projects, with its highest number of participants and partners to date. 354 internship opportunities were awarded in the 2013 fiscal year, compared to 337 in 2012 and 259 in 2011.

During the annual DEVELOP Strategic Planning and Leadership Retreat in January 2013, DEVELOPers from around the country gathered to discuss current and future plans for the program. This three day meeting resulted in strategic directives that further refined the *DEVELOP National Program Strategy 2012-2022*, a living document created in January 2012.

DEVELOP's Young Professional Class, a cadre of recent graduates, was expanded with 15 participants over the year. The YP Class contributed to the program by leading many of the initiatives defined in the program's strategy and supported the National Program Office, as well as their respective nodes. Thank you to the FY13 Young Professional Class participants:

Aaron Brooks, Beth Brumbaugh, Kirstin Cooksey, Ande Ehlen, Quinten Geddes, Evan Johnson, Jason Jones, Austin Madson, Nate Makar, Chris McKeel, Brandie Mitchell, Melissa Oguamanam, Kelsey Rooks, Christina Welch, and Nathan Weller.

The program had nine publications in venues, such as *The Earth Observer, Directions Magazine* and *Women@ NASA Blog*, as well as two peer-reviewed publications in *Geocarto International* and *The Geographical Bulletin*. DEVELOP held three virtual poster sessions (VPS) in partnership with *IEEE's Earthzine*, demonstrating to a global audience the important contributions of NASA's Earth observations to improving decision making around the world.

DEVELOP's Summer Virtual Poster Session:

August 6th to September 5th

www.earthzine.org/nasa-develop-summer-2013-vps/

Prior to travel restrictions driven by the recent sequestration, DEVELOP actively participated in 24 conferences. DEVELOP coordinated a session on Capacity Building at the American Geophysical Union's 2012 Fall Meeting, as well co-chaired a session at the American Meteorological Society's 2013 Annual Conference.

- **Space Generation Congress** - *Naples, Italy (9/27-10/1)*
- **International Astronautical Congress** - *Naples, Italy (10/1-5)*
- **New Energy Economy Conference at Colorado State University** - *Fort Collins, CO (10/2-3)*
- **21st Annual Groundwater Resources Association Conference & Meeting** - *Rohnert Park, CA (10/3-5)*
- **National Weather Association Fall Meeting** - *Madison, WI (10/6-11)*
- **2012 Association of American Geographers (AAG Great Plains/Rocky Mountain Region Meeting** - *Park City, UT (10/11-13)*
- **SERVIR Summit** - *Huntsville, AL (10/15-19)*
- **SMAP/GRACE Workshop** - *Reston, VA (10/16-18)*
- **ASPRS/MAAPS Specialty Conference: Emerging Technologies Supporting Geospatial Application** - *Tampa, FL (10/29-11/1)*
- **GEO Huntsville Conference** - *Hunstville, AL (11/8-9)*
- **Western Society of Naturalists Meeting** - *Seaside, CA (11/8-11)*
- **American Society of Tropical Medicine and Hygiene (ASTMH) 61st Annual Meeting** - *Atlanta, GA (11/11-15)*
- **Bays & Bayous Symposium 2012** - *Biloxi, MS (11/14-15)*
- **Council of State Governments Annual Meeting** - *Austin, TX (11/30-12/3)*
- **AGU Fall Meeting** - *San Francisco, CA (12/3-7)*
- **AMS Annual Meeting** - *Austin, TX (1/6-10)*
- **Gulf of Mexico Oil Spill & Ecosystem Science Conference** - *New Orleans, LA (1/21-23)*
- **NASA Day at the Capitol** - *Jackson, MS (1/23)*
- **Virginia Aerospace Days** - *Richmond, VA (2/6-7)*
- **ASPRS Annual Conference** - *Baltimore, MD (3/24-28)*
- **Association of American Geographers (AAG) Annual Meeting** - *Los Angeles, CA (4/9-13)*
- **CalGIS: 19th Annual California GIS Conference** - *Long Beach, CA (4/15-17)*
- **VISualize 2013: Global Change & Environmental Monitoring** - *Washington DC (6/11-12)*
- **CSG 67th Southern Legislative Conference Annual Meeting** - *Mobile, AL (7/27-31)*

The program saw the opening of multiple new nodes, including those at the International Centre for Integrated Mountain Development (ICIMOD) in the fall of 2012, International Research Institute for Climate and Society (IRI) in spring 2013, and University of Georgia (UGA) in the summer of 2013. DEVELOP's Langley Research Center node also began a collaboration with the Commonwealth of Virginia, which hosted project activity in Richmond's Patrick Henry Building during summer 2013.

Alumni Survey

Building off the success of the past fifteen years of DEVELOP, the program launched an assessment of its participants through a survey led by the Wise County's Clerk of Court's Office cooperative agreement. From the responses, DEVELOP was given a better understanding of the benefits and impacts of the program on its alumni.

Since 1998, over 1,200 individuals have participated in the DEVELOP Program. Of those individuals, DEVELOP had 978 email address on file; of the 978 email addresses, 217 email addresses were no longer being used ("bounced backs"), leaving 761 valid email addresses. Of the 761 valid email addresses, DEVELOP received 313 responses, a 41% response rate. The goal of the survey was to determine the impact of the DEVELOP Program to the participants and the participants continued use of NASA EOS resources. Here is what we found:

- 65% of respondents are currently working in a STEM field,
- 49% of respondents positively indicated that they still work with, or have exposure to, remote sensing (Figure 1), and
- 35% of respondents work directly with NASA Earth observations (Figure 2).

The program prides itself on building capacity in its participants. From a professional development element of the program, communication, presentation preparation, and professional etiquette ranked in the top three for areas where DEVELOP helped respondents in their career (Figure 3). Of the 313 responses, over 98% of the participants said that DEVELOP helped them with their professional skills in their respective careers.

Success Story: Ande Ehlen

We are proud to feature Ande Ehlen, who served as the Center Lead for the Great Lakes and St. Lawrence Cities Initiative DEVELOP node and participated in the DEVELOP Young Professionals class. Ms. Ehlen served in these capacities from fall 2011 term through fall 2012 term.

If you could, provide a brief introduction to your current job and maybe how you got there?

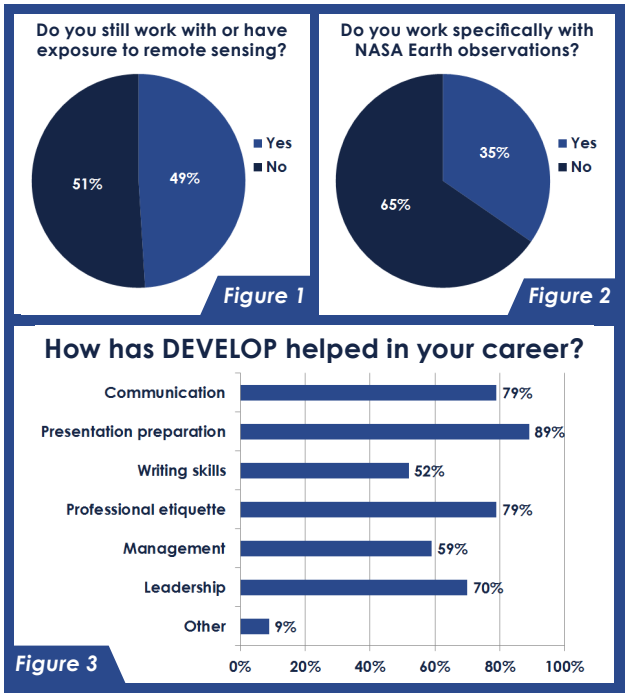
I work for the Virginia Marine Resources Commission (VMRC) as a Fisheries Management Technician, where my main responsibility is to collect and record harvest data from commercial fisherman. These data are important for monitoring species and their numbers in order to ensure they will be around for present and future generations. I began working for VMRC in January of this year after applying to a job posting I found through the Commonwealth of Virginia's webpage.

How has DEVELOP help prepare you for your current job?

Before I even secured the job as a Fisheries Management Technician, DEVELOP had helped me immensely. The interview was very detailed, but I was prepared for it thanks to the experience and professional training I had received through the DEVELOP Program. I feel that right from the start that set me ahead of other applicants and gave me an extra boost of confidence.

The underlying goals of the DEVELOP Program in addressing community concerns, policy issues, and helping to monitor environmental impact coincide with the goals of VMRC. Because I was familiar with key environmental topics from the several projects I had worked on with DEVELOP, I was well prepared for working for this agency.

One of my other responsibilities with VMRC is working on the agency newsletter. All of the deliverables we completed in DEVELOP helped to strengthen my writing skills, attention to detail, and professionalism. These skills are key items for everyday use, and I have come to greatly appreciate them.



And finally, what advice would you give DEVELOP participants who are transitioning into the workforce?

My advice to those transitioning into the workforce would be to not give up. You most likely won't hear from many of the jobs that you apply for, but that just means that wasn't the job for you. When you finally do get the call for an interview, remember all that DEVELOP taught you and go in there with 110%. Professionalism and first impressions are very important, and your experience with the DEVELOP Program has already given you a taste of that. Once you land a job, remember what you love about science and what you are working towards. And as always, expect the unexpected!

Ecological Forecasting

Georgia Ecological Forecasting

Remote Estimation of Salt Marsh Biophysical Parameters in the Georgia Coast to Improve Monitoring and Restoration Efforts by the Georgia Department of Natural Resources

Team: Joseph A. White (Bethune-Cookman University), Shuvankar Gosh (University of Georgia), Steve Padgett-Vasquez (University of Georgia), Auryn Baruch (University of Georgia), Ning Chen (University of Georgia), and Jeremy Mote (University of Georgia)

Advisor: Dr. Deepak Mishra (University of Georgia)

Partner: Georgia Department of Natural Resources

NASA Earth Observations: Terra/Aqua MODIS

Software Utilized: ArcGIS, ERDAS IMAGINE

A third of all the salt marsh in the eastern seaboard can be found in Georgia. Salt marshes are highly productive ecosystems that provide habitat and nutrition to wildlife, offer protection from flooding and storm surges, and help filter polluted runoff from upland areas. This study demonstrated the ability to identify 'hotspots' of early stages of marsh degradation which can only be delineated by evaluating marsh biophysical characteristics including distribution of chlorophyll content (Chl), leaf area index (LAI) (a ratio of green foliage area vs. ground area), and green vegetation fraction (VF) (percent green canopy cover). These biophysical characteristics are primary indicators of photosynthetic capacity, nitrogen content, and physiological status of vegetation. Through use of NASA's Moderate Resolution Imaging Spectroradiometer (MODIS) sensor we retrieved the above described biophysical characteristics in GA salt marshes. This work is significant because it allowed for the first time to use NASA satellite data to study the biophysical characteristics of salt marshes in the GA coast. Our results show an efficient and non-destructive biophysical mapping protocol for emergent wetlands to be used in restoration decision-making by the Georgia Department of Natural Resources.

Klamath Ecological Forecasting

Bird Conservation through Assessment of Oak Habitats in the Klamath Basin

Team: Ryan Anderson (University of Wyoming), Thomas Mathis (University of California, Davis), Adam Chlus (University of Connecticut), Erika Edgar (University of Alaska, Fairbanks), Tanvi Gambhir (Salinas High School)

Advisors: Cindy Schmidt (Bay Area Environmental Research Institute; DEVELOP National Program), Nicole Athearn (US Fish and Wildlife Service)

Partners: US Fish and Wildlife Service, Strategic Habitat Conservation Team; US Fish and Wildlife Service (USFWS) Strategic Habitat Conservation Team

NASA Earth Observations: Landsat 5 & 8

Software Utilized: ArcGIS, ERDAS IMAGINE, ENVI, R, FRAGSTATS, Orfeo Toolbox

Oak habitats in the Pacific Northwest have decreased significantly under past land management practices. In the Klamath Basin, oak habitats are critical for over 200 vertebrate species, including resident and migratory birds of conservation concern. Agricultural and urban development, invasive species encroachment, fire suppression, and timber production have decreased oak extent and threaten primary habitat for numerous bird species. To identify past and present bird habitat and elucidate the relationship between oak habitat and specific bird species, this project utilized NASA Earth observations, in situ canopy cover, and bird count data. Oak land cover maps were produced using image segmentation and machine learning algorithms. These methods utilize field observations along with spectral, climatic, and topographic data to segment oak habitats from alternate cover types. Second, changes in annual Landsat 5 imagery were detected within the Klamath Basin from 1990 to 2011. The results of the change detection analysis, along with the annual land cover maps, were used to classify sources of disturbance in oak habitat distribution. Third, habitat characteristics important for bird species, such as patch size and edge availability, were identified from various landscape metrics. This information was used to develop a network connectivity analysis between oak habitats. Project results will be used by the U.S. Fish and Wildlife Service (USFWS) and the Klamath Bird Observatory (KBO) to meet conservation objectives.

Colorado Ecological Forecasting

Applying Geospatial Modeling Strategies using NASA Earth Observing System for Detection of Mountain Pine Beetle Mortality in the Central Rocky Mountains

Team: Anthony Vorster (Colorado State University), Aaron Sidder (Colorado State University), Kelli Groy (Colorado State University), William Zawacki (Colorado State University)

Advisors: Dr. Paul Evangelista (CSU, Natural Resource Ecology Lab) & Dr. Jeff Morisette (USGS, North Central Climate Science Center)

Partners: USGS, North Central Climate Science Center; US Forest Service, Rocky Mountain Research Station; USGS, Fort Collins Science Center; Colorado Forest Restoration Institute

NASA Earth Observations: Landsat 5, 7 & 8

Software Utilized: ENVI, ArcGIS, R, SAHM Model System

Mountain pine beetle (Dendroctonus ponderosae) has infected 3.4 million acres of forest in Colorado, USA, since 1996 and continues to spread throughout the forests of western North America. To better understand the impacts of the mountain pine beetle outbreak on Colorado's forests, it is important to identify the spread of the pine beetle over time and the resulting extent of tree mortality. This project used vegetation indices derived from pre- and post-beetle satellite imagery to assess the spatial extent and severity of pine mortality from the outbreak in Fraser Experimental Forest (FEF). Using satellite imagery from the Landsat 5 and Landsat 8 sensors, spectral vegetation indices, image differencing techniques, and a boosted regression tree model, we created an accurate assessment of the beetle's spatial impact. The methodology from this project can be scaled up to assess mountain pine beetle impacts at a regional scale. Results can aid in local management decisions, restoration efforts, and future research.

Dismal Swamp Ecological Forecasting

Utilizing NASA Earth Observations to Aid in Predicting and Managing the Effects of Phragmites Australis in the Great Dismal Swamp National Wildlife Refuge

Team: Lauren Makely (Old Dominion University, Project Lead), Jessica Mitchum (George Mason University, Assistant Lead), April Volke (Johns Hopkins University), Valerie Linsinbigler (Christopher Newport University)

Advisor: Dr. Kenton Ross (NASA, Langley Research Center)

Partners: US Fish and Wildlife Service; Great Dismal Swamp National Wildlife Refuge

NASA Earth Observations: Landsat 5, 7 & 8

Software Utilized: ArcGIS, ENVI

Following the 2011 Lateral West Fire in the Great Dismal Swamp National Wildlife Refuge (GDSNWR), an outbreak of the invasive species Phragmites australis was identified within the primary regrowth. Phragmites australis is an invasive plant species known for driving out native species that are natural food sources or shelter for wildlife within the swamps. Because Phragmites grows so quickly, biodiversity is greatly reduced in areas of Phragmites australis growth. Other coastal areas such as the Back Bay Nature Preserve of Virginia have experienced similar invasions of Phragmites australis in recent years and have been using similar treatment methods as the Great Dismal Swamp National Wildlife Refuge, such as pesticide sprays and prescribed burning. Using the NAIP ortho 1 meter high resolution imagery and the Enhanced Thematic Mapper Plus sensor on board the Landsat satellites classification maps were created to quantify the area of Phragmites australis before and after the 2011 Lateral West Fire.

Myanmar Ecological Forecasting

Mapping Mangrove Deforestation in the Ayeyarwady Delta

Team: Christopher Ferraro (Clark University), Carlos Disla (University of Maryland), Daniel Jensen (California State University, Long Beach)

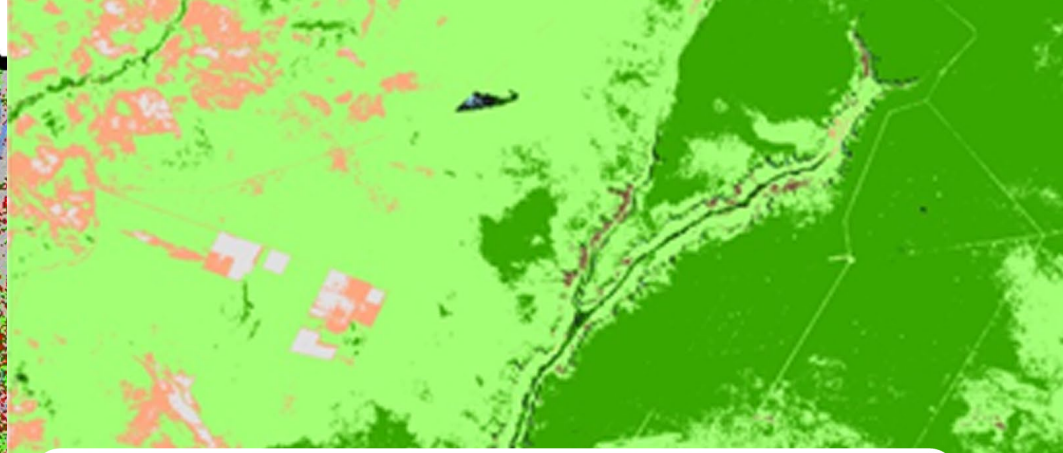
Advisors: Dr. Kenton Ross (NASA, Langley Research Center), Dr. Peter Leimgruber (Smithsonian Conservation Biology Institute)

Partners: Smithsonian Conservation Biology Institute; Myanmar Ministry of Environment, Conservation, and Forestry

NASA Earth Observations: Landsat 7 & 8, Terra ASTER

Software Utilized: ArcGIS, R, IDRISI

Mangrove ecosystems offer several significant services including providing habitat and spawning grounds for a diverse range of species, protecting coastal communities from storms and other natural disasters, and contributing resources and income for local residents. Currently, Myanmar is undergoing a period of rapid economic development which has led to increased pressure on the extensive mangrove habitat in this region. In this study, we examined changes to mangrove extent between 2000 and 2013 using Landsat 7 and 8 imagery in combination with a Digital Elevation Model (DEM) generated from ASTER stereoscopic imagery. Classification accuracy was evaluated using higher resolution ASTER imagery and local expertise on mangrove distribution. The data provided by this assessment was subsequently used to forecast potential vulnerability and changes to mangrove habitat up to 2030. A Random Forests Model was used for land-cover classification and a multi-layered perceptron was used to model transition potentials for vulnerability forecasting. Forest managers in Myanmar will be able to use the mangrove change maps and forecasts to evaluate current policies and focus future ones to maximize effectiveness. Data and methodology resulting from this project will be useful for future mangrove and land-cover mapping projects in this region.



Brazil Ecological Forecasting

Utilizing NASA Earth Observations for Conservation Management of the Bearded Capuchin Monkey (Sapajus libidinosus) in Northeastern Brazil

Team: Andrea Presotto (University of Georgia), Caren Remillard (University of Georgia), Steve Padgett-Vasquez (University of Georgia)

Advisors: Dr. Thomas Jordan (University of Georgia, Center for Geospatial Research), Dr. Marguerite Madden (University of Georgia, Center for Geospatial Research)

Partners: Unversity of Sao Paolo; EthoCebus Project Team

NASA Earth Observations: Landsat 5, 7 & 8

Software Utilized: ArcGIS, ENVI, ERDAS IMAGINE

The bearded capuchin monkey (Sapajus libidinosus) has been documented using hammer stones and anvils to crack open nuts in the wild. Percussive tool-use had previously only been attributed to chimpanzees and humans. As a result, the bearded capuchin monkey has become of particular importance in the paleoarcheological record of early humans (e.g., Roux & Bril, 2005). Although a substantial amount of behavioral data has been collected and analyzed, the landscape and natural habitat of this species remains understudied. In Northeast Brazil, capuchins, and many other wild animals, face rapid loss of their natural habitats due to drought and increase in agriculture, particularly biofuels and soy production. By understanding changes in the biologically diverse Cerrado landscape, we can provide a suitable model of the effects from human activities on the landscape inhabited by capuchin monkeys that will steer future resource management, along with ecological and behavioral studies. The remotely sensed imagery and geospatial analyses we performed were integrated with earlier field work conducted in our study area. Project results and methodologies will provide our partners with accurate, quantitative information that will strengthen their animal behavior research and assist in policy/management decisions for Brazilian ecological forecasting. Utilizing Landsat imagery acquired for 1987, 2000, and 2013 that overlap with the capuchins' home range, vegetation and land use/land cover was characterized. A complete temporal land change analysis allowed the team to assess trends in land use/land cover and predict the future landscape if no action is taken within the study area. These regional predictions will guide future exploration and lead to further behavioral studies of variability in tool use across geographic areas. It will increase understanding of the impact of land use change and desertification on capuchin monkey habitats, otherwise conducive to percussive tool use behavior. There is a risk that as the Cerrado landscape diminishes, the tool use behavior will cease along with it. This project's findings support efforts to increase ecological management and conservation of this valuable area.

Chittagong Hills Ecological Forecasting

Utilizing NASA Earth Observations and Remote Sensing Techniques to Monitor Possible Threats to the Protected Area for Decision Supporting System in Chittagong Hill Tracts, Bangladesh

Team: Nabin Paudel (Kathmandu University), Kel Markert (University of Alabama in Huntsville), Rukumani Rimal (Tribhuvan University), Shishir Sarker (University of Dhaka), Labiba Farhana (University of Dhaka), Pornampai Narenpitak (University of Wisconsin-Madison)

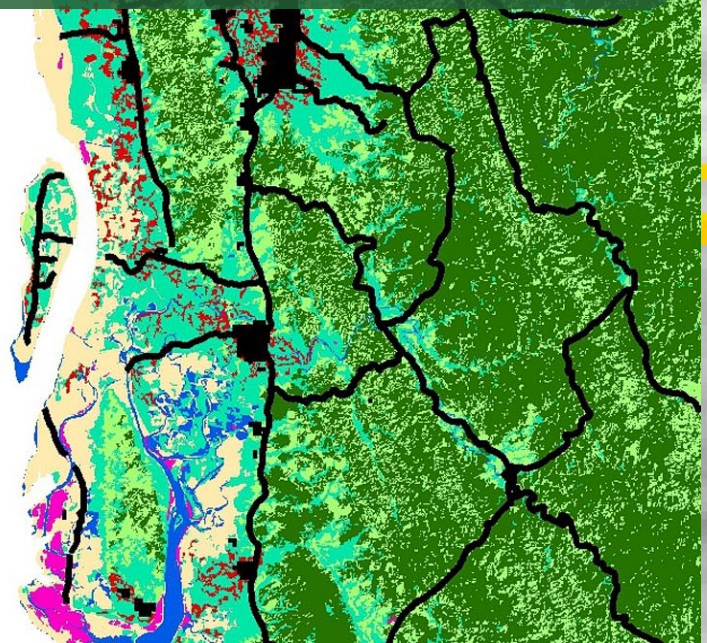
Advisors: Dr. Kent Ross (NASA, Langley Research Center), Sebastian Wesselman (ICIMOD)

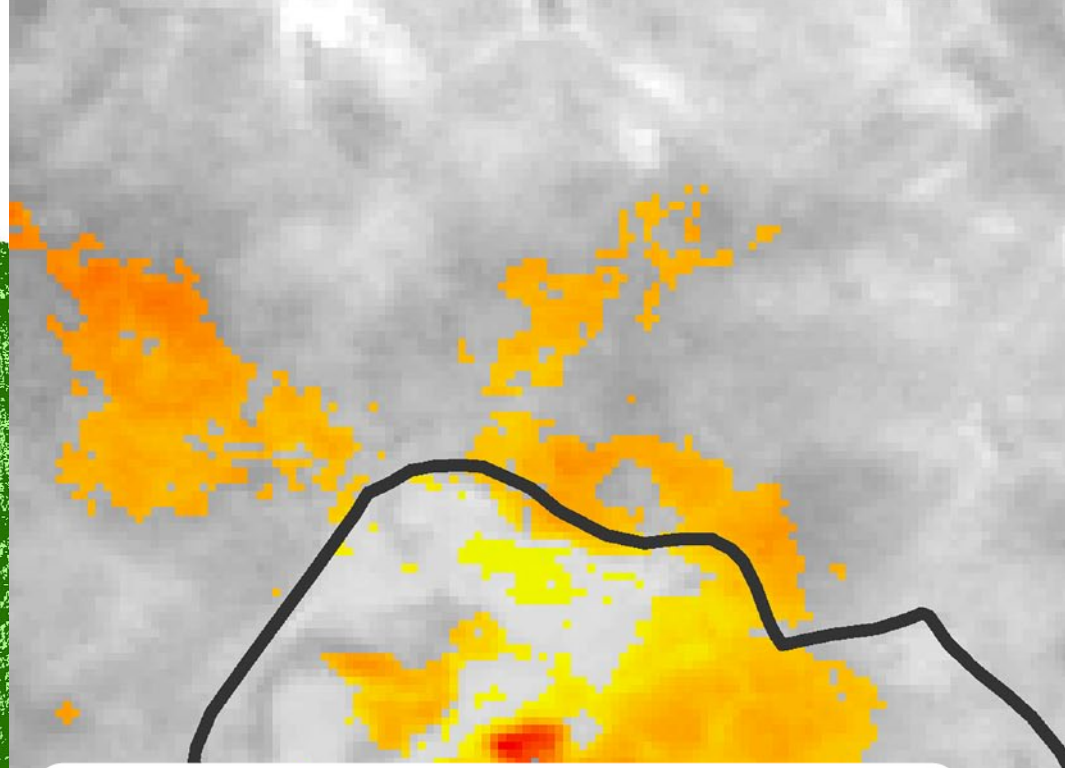
Partners: Bangladesh Centre for Advanced Studies; Bangladesh Ministry of Environment and Forests

NASA Earth Observations: Suomi NPP VIIRS, Terra ASTER, Landsat 5 & 7

Software Utilized: ERDAS IMAGINE, ArcGIS

As deforestation occurred in the Chittagong Hill Tracts Region (CHT), three main aspects of the threats to the forested areas were analyzed. The first threat evaluated was the anthropogenic land use. Satellite data and maps of land use, land cover and population change in the CHT region in 1990, 2000 and 2010 were utilized. The second risk analyzed the threat from forest fire using the thematic maps and graphs of forest fire in the past. Other analysis done composed of quantifying the amount of forest edge in the region to evaluate forest fragmentation. Additionally, the Slope, Land cover, Exclusion, Urbanization, Transportation and Hillshade (SLEUTH) Model was implemented to analyze potential future urban expansion. Determining where human growth can occur would help decision makers prioritize protection due to a number of factors that are affecting the natural CHT environment.





East Africa Ecological Forecasting

Analyzing Phenology and Drought Impact in the Amboseli Basin of Kenya Using MODIS Vegetation Indices

Team: Ryan Williams (Clark University, Project Lead), Quinten Geddes (University of Montana, Project Lead), Oluwakonyinsola Adesoye (Eleanor Roosevelt High School), Anne Baker (Clark University), Michael Gao (Johns Hopkins), Emily Voelker (University of Maryland)

Advisors: Dr. Jeffrey Masek (NASA, Goddard Space Flight Center), Frederick Policelli (NASA, Goddard Space Flight Center), Gerasimos Michalitsianos (SSAI, Goddard Space Flight Center)

Partners: Amboseli Conservation Program, African Conservation Centre

NASA Earth Observations: Terra/Aqua MODIS, TRMM, Landsat 5 & 7

Software Utilized: ENVI, ArcMap, IDL, Python, R, CLOWN/TERRA, Google Earth

The Amboseli National Park (ANP) located in the Kenya-Tanzania borderlands, has been a victim of severe vegetation degradation. Intensive farming, pastoralism, and over-concentrations of wildlife have all contributed to this loss. The Amboseli Conservation Centre (ACC) has gathered extensive ground truth data on this area. However, their they are unable to distinguish between subtle differences in plant types. This prevents them from developing comprehensive solutions for restoring and maintaining the region. This project examines the temporal variations in plant growth as a means to better discern between types of remotely sensed vegetation. Phenological changes were tracked from 2003 to 2012 in each of the eight land cover types. Using MODIS 8 day time steps, we constructed signatures for NDVI parameters, such as minimum, maximum, amplitude, and so on, for each land cover type. In doing this, the project provides the ACC with a refined tool for analyzing land cover, allowing them to better understand their landscape and its needs.

Agriculture

Great Smoky Mountains Ecological Forecasting

Utilizing NASA Earth Observations to Monitor Loss of Hemlock Forest and Advance Mitigation Practices Against the Invasive Hemlock Woolly Adelgid within the Great Smoky Mountains National Park

Team: Austin Stanforth (Indiana University in Indianapolis), Jiaying He (University of Georgia), Lauren Craft (University of Alabama in Huntsville), Xiyu Li (Clark University), Pornampai Narenpitak (University of Wisconsin-Madison)

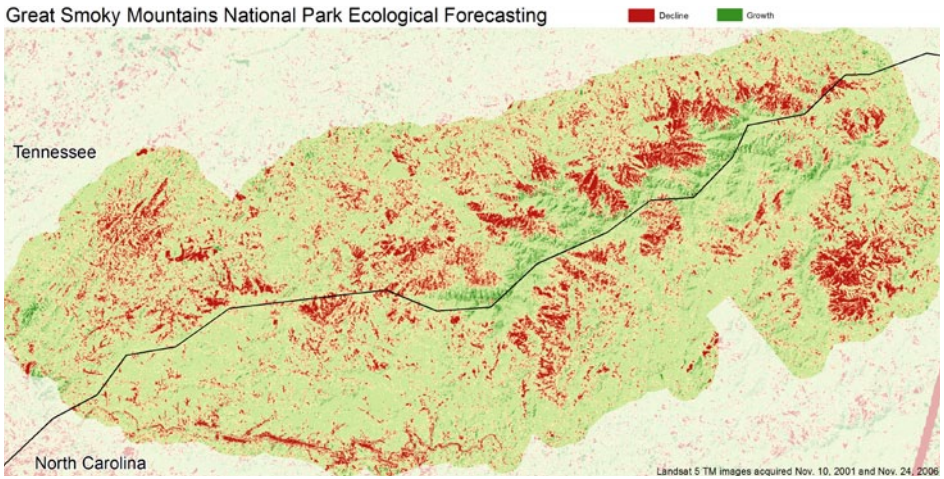
Advisors: Dr. Marguerite Madden (University of Georgia), Dr. Jeff Luvall (NASA, Marshall Space Flight Center)

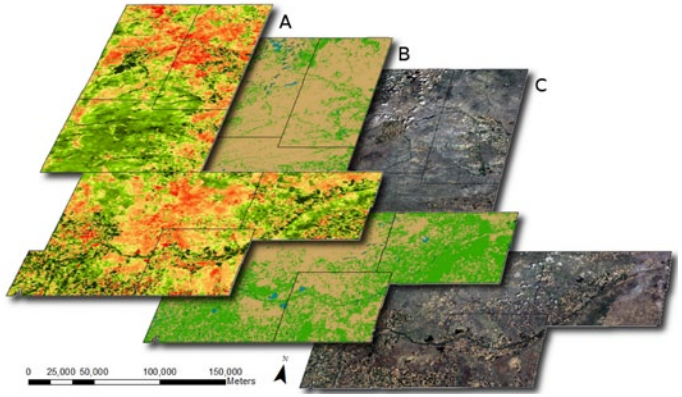
Partners: National Parks Service, Great Smoky Mountains National Park; Environmental Protection Agency, Research Triangle Park

NASA Earth Observations: Landsat 5, Terra/Aqua MODIS, Aura OMI

Software Utilized: ArcMap, ENVI, ERDAS IMAGINE, Matlab, TIMESAT, IDRISI

Eastern hemlocks play an ecologically vital role within the Great Smoky Mountains (GRSM) by providing a unique habitat for many species of flora and fauna, which thrive in shaded and cool aquatic or terrestrial landscapes. The hemlock are currently facing an infestation of the non-native hemlock woolly adelgid (HWA), which feed on and kill the trees. Discovered in the park circa 2002, the HWA has rapidly spread through the forest due to a lack of native predators. This project was designed to map the extent of hemlock defoliation, and investigate its relation to air quality. Landsat 5 TM images acquired during autumn leaf-off conditions were used to create vegetation index maps of the coniferous hemlock, and change detection methods identified defoliation extent across years within those areas. Hemlock decline regions and air quality data, collected from Aura and ground stations within the park, were combined into a regression model to analyze characteristics of spatial discontinuities of defoliation within the GRSM park.





Great Plains Agriculture

Monitoring Rangelands due to Changing Precipitation Regimes for Enhanced Range Management in the Great Plains

Team: Lance Watkins (Mississippi State University), Jerrod Lessel (California State University, Fresno), Alexandra Perillo (University of North Carolina Wilmington)

Advisors: Dr. Kenton Ross (NASA, Langley Research Center), Dr. Justin Derner (USDA, ARS RRRU)

Partners: USDA Agricultural Research Service (ARS) Rangeland Resources Research Unit (RRRU)

NASA Earth Observations: Terra/Aqua MODIS, Landsat 8, Aqua AMSR-E

Software Utilized: ERDAS IMAGINE, ArcGIS, Python

The U.S. Great Plains is primarily used for agriculture, including livestock production. Drought has severely impacted agricultural lands in the Great Plains since 2011. About 80% of agricultural lands were affected by drought conditions in recent years. The USDA Agricultural Research Service (ARS) Rangeland Resources Research Unit (RRRU) provide up-to-date range management research for land managers and ranchers to utilize in management decisions. The purpose of this project was to investigate methods for monitoring drought conditions at a finer resolution than current methodologies used today utilizing a suite of sensors demonstrating interagency collaboration. The sensors included Landsat 8's OLI and TIRS, Aqua/Terra MODIS, Aqua AMSR-E, and NOAA's Multi-sensor Precipitation Estimator (MPE). In order to assess the effectiveness of these new methodologies, this study focused on six counties, three in Colorado and three in Wyoming, within the Great Plains of the United States. The goal of these new methods was to create end products that can be expanded and applied over the entire Great Plains region. The benefits to the project partner include a methodology and a tool of how to utilize and incorporate NASA Earth observations and ancillary data, such as NOAA MPE and Aqua AMSR-E data, into rangeland research and management decisions.

Virginia Agriculture

Utilizing NASA Earth Observations to Identify Suitable Locations for Expansion of Vineyards in Virginia

Team: Taylor Hotchkiss (University of Richmond), Sarah Trimble (Texas A&M University), Sonia Szczesna (Rutgers, The State University of New Jersey), Meredith Johnson (Virginia Polytechnic Institute and State University)

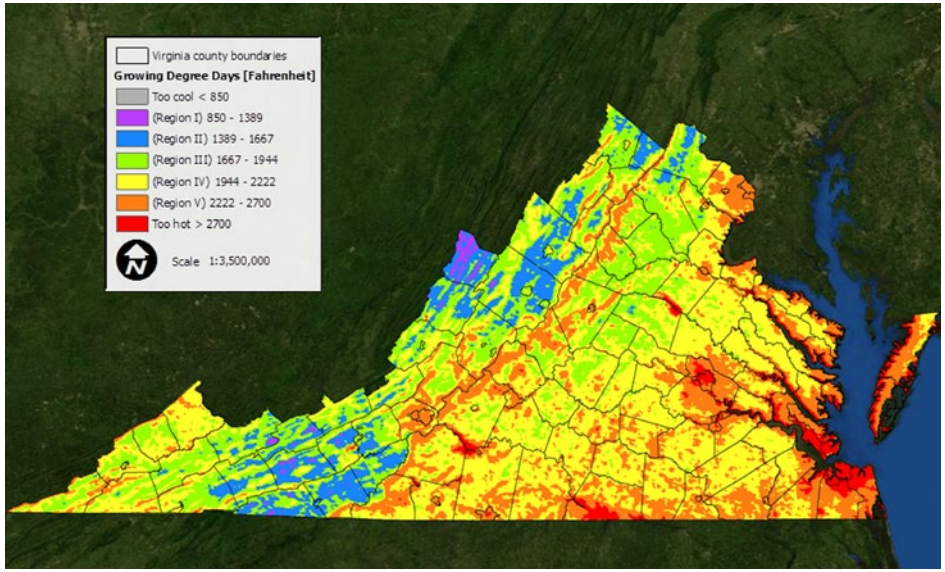
Advisor: Dr. Kenton Ross (NASA, Langley Research Center)

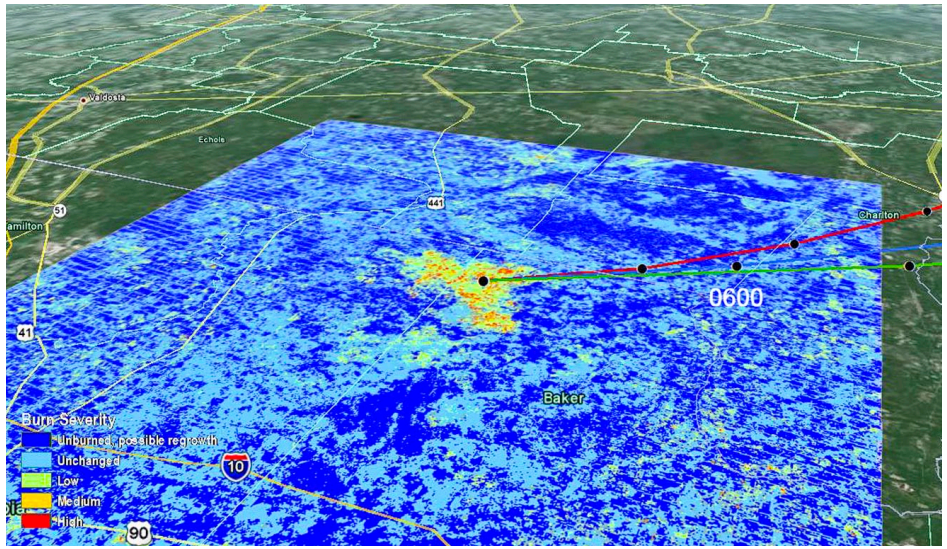
Partners: Virginia Department of Agriculture and Forestry; Virginia Tech's Agriculture Research and Extension Center

NASA Earth Observations: Aqua MODIS

Software Utilized: ArcGIS

Virginia wine is gaining acclaim across the nation and abroad, and increasing grape production in the Commonwealth is vital to keep up with growing consumer demand. A short history of viticulture in Virginia poses a challenge to Virginia viticulturalists in selecting suitable locations for new vineyards and choosing successful grape varietals. As temperature fluctuations are an essential variable in grapevine growth, Land Surface Temperature (LST) data derived from the Moderate Resolution Imaging Spectroradiometer (MODIS) platform aboard NASA's Aqua satellite were used to create maps of spring frost index, winter severity index, and growing degree days across the state of Virginia. Shifting climate regimes may result in changes in distribution of both suitability for a particular grape species and the risks of bacteria, fungi, and other diseases that threaten grape species. Maps were produced for the year 2050 according to changes in temperatures predicted by the Intergovernmental Panel on Climate Change (IPCC). The products created provide Virginia grape growers with a decision-making tool that aims to contribute to higher crop yields, higher quality wine, and increases in vineyard profitability, ultimately resulting in economic success for the state of Virginia.





Southeast Agriculture

Assisting State and Federal Post-Wildfire Assessments through the Application of Earth Observation Data

Team: Walt Clark (University of South Alabama), Rachael Isphording (Embry-Riddle Aeronautical University), Rebecca Lanier (University of Southern Mississippi), Shikher Mishra (University of South Alabama), Skyler Sampson (University of South Alabama)

Advisors: Joe Spruce (CSC, Stennis Space Center), Dr. Kenton Ross (NASA, Langley Research Center)

Partners: Florida Forest Service; Alabama Forestry Commission; Mississippi Forestry Commission; USFS Remote Sensing Applications Center

NASA Earth Observations: Landsat 7 & 8, Terra/Aqua MODIS, Suomi NPP VIIRS

Software Utilized: ArcGIS, ENVI

As the Southeast United States expands in population, the threat of wildfires has caused increasing social, economic, and health concerns. To help end-user organizations assess the effects of wildfires, the MCHD NASA DEVELOP team identified recent, significant wildfires for use as case studies. Relevant data and imagery was downloaded for days before, during, and after each studied fire from the MODIS sensor onboard Terra/Aqua, the VIIRS sensor onboard Suomi NPP, and the TM, ETM+, and OLI sensors of the Landsat Program. Satellite-based total burn extent, greatest burn temperature, and fire radiative power (FRP) for each fire were obtained and analyzed for relationships. The Relative differenced Normalized Burn Ratio (RdNBR) was calculated for each fire using available Landsat, MODIS, and VIIRS data. Cross sensor comparisons of RdNBR were assessed as well as temporal changes in the RdNBR. The project team reviewed an innovative method to estimate biomass burned and fire aerosol contributions to air quality. A qualitative verification of the emissions estimates were made using MODIS and VIIRS aerosol optical depth data and HYSPLIT trajectory models. Results were conveyed to project partners and other stakeholders through a web seminar.

Uruguay Agriculture

Identifying Crops at an Early Stage using a Temporal-Based and Object-Oriented Decision Model

Team: Sunny Ng (Columbia University), Yifang Yang (Columbia University)

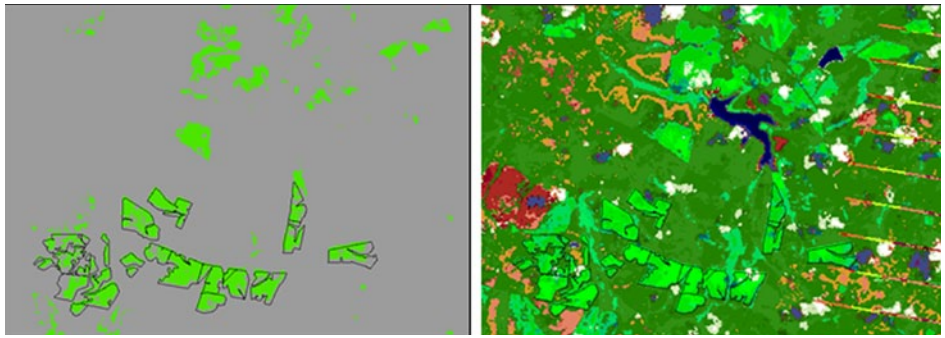
Advisor: Dr. Pietro Ceccato (Columbia University, International Research Institute for Climate and Society)

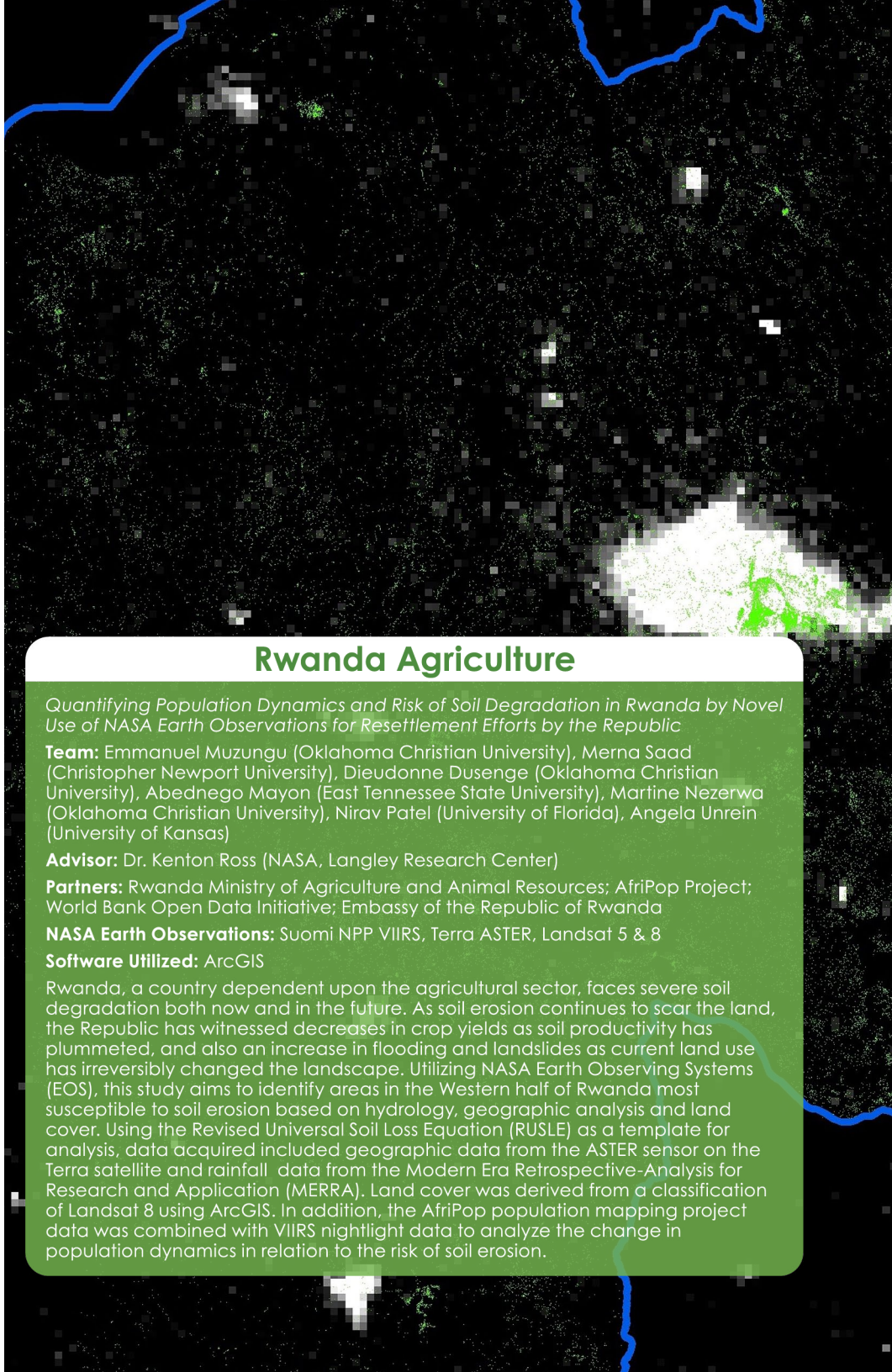
Partners: Uruguay Ministry of Agriculture

NASA Earth Observations: Landsat 7

Software Utilized: ArcGIS, ENVI, SIAM

The Uruguay Ministry of Agriculture wants to detect and forecast crop yields for soybean and maize at early stages of the growing season. In the first phase of the study (Spring 2013), we determined that MODIS imagery at 250 meter resolution is too coarse to identify crop fields and Landsat imagery at 30 meter resolution is more appropriate to identify crop fields. In the current study, we further investigated the possibility of using Landsat imagery to detect crops in Uruguay using prior knowledge of the evolution of spectral properties of crops over time and also using an object-oriented approach to identify crop fields. Using the satellite image automatic mapper (SIAM) to process Landsat 7 images, we identified crops through the evolution of SIAM spectral categories from barren land to vegetation. We also explored the detection of crops based on geometric properties of crop fields such as minimum area and maximum length-width ratio. The accuracy of this methodology was tested using crop field measurements from INIA.





Rwanda Agriculture

Quantifying Population Dynamics and Risk of Soil Degradation in Rwanda by Novel Use of NASA Earth Observations for Resettlement Efforts by the Republic

Team: Emmanuel Muzungu (Oklahoma Christian University), Merna Saad (Christopher Newport University), Dieudonne Dusenge (Oklahoma Christian University), Abednego Mayon (East Tennessee State University), Martine Nezerwa (Oklahoma Christian University), Nirav Patel (University of Florida), Angela Unrein (University of Kansas)

Advisor: Dr. Kenton Ross (NASA, Langley Research Center)

Partners: Rwanda Ministry of Agriculture and Animal Resources; AfriPop Project; World Bank Open Data Initiative; Embassy of the Republic of Rwanda

NASA Earth Observations: Suomi NPP VIIRS, Terra ASTER, Landsat 5 & 8

Software Utilized: ArcGIS

Rwanda, a country dependent upon the agricultural sector, faces severe soil degradation both now and in the future. As soil erosion continues to scar the land, the Republic has witnessed decreases in crop yields as soil productivity has plummeted, and also an increase in flooding and landslides as current land use has irreversibly changed the landscape. Utilizing NASA Earth Observing Systems (EOS), this study aims to identify areas in the Western half of Rwanda most susceptible to soil erosion based on hydrology, geographic analysis and land cover. Using the Revised Universal Soil Loss Equation (RUSLE) as a template for analysis, data acquired included geographic data from the ASTER sensor on the Terra satellite and rainfall data from the Modern Era Retrospective-Analysis for Research and Application (MERRA). Land cover was derived from a classification of Landsat 8 using ArcGIS. In addition, the AfriPop population mapping project data was combined with VIIRS nightlight data to analyze the change in population dynamics in relation to the risk of soil erosion.

Water Resources

Sierra Nevada Water Resources

Climate Change and Its Impact on Snow Water Equivalent in Relation to Wildfire

Team: Andrew Nguyen (San Jose State University), Chase Mueller (University of Texas at San Antonio), Roy Petrakis (University of Arizona), Spencer Adkins (Brigham Young University), Olivia Kuss (Indiana University-Purdue University of Indianapolis), Monica Kumaran (Harker High School)

Advisors: Marc Meyer (US Forest Service), Cindy Schmidt (Bay Area Environmental Research Institute)

Partners: USDA Forest Service Pacific Southwest Region

NASA Earth Observations: Landsat 5, Terra MODIS

Software Utilized: ArcGIS, ERDAS IMAGINE

High Sierra snow and ice provide the primary water supply for the Sierra Nevada ecosystem. Understanding how climate change affects this high Sierra snowmelt and how these changes impact forest disturbance is important for future forest management. Snow water equivalent (SWE) anomalies were averaged on a monthly basis and overall trends of snowpack availability and timing of snowmelt were examined throughout the Sierra Nevada from 2003-2012. Periods of decreased snowpack were correlated to periods of decreased soil moisture and increased forest wildfires. This project used NASA Earth observations such as the Moderate Resolution Imaging Spectroradiometer (MODIS) (for snow cover) and Landsat 5 (for extent of forest disturbance and vegetative analysis). We also used ancillary and modeled datasets such as temperature, precipitation, surface temperature, and water flow rate to provide a better understand of the relationship between snowpack and soil moisture availability to forest wildfires. Furthermore, a Generalized Additive Model (GAM) was used to make predictions of future forest disturbance patterns as well to analyze the sensitivity of particular variables indicative of wildfire. This information is useful for forest management decisions within the US Forest Service and will assist in the incorporation of climate change impact assessment on forest health.

Yosemite Water Resources

Coupling the NASA-CASA Ecosystem Model with a Hydrologic Routing Algorithm for Improved Water Management Decision Making

Team: Evan Johnson (University of California, Los Angeles), Aimee Teaby (California State University, Monterey Bay), Mark Griffin (Arizona State University), Carlos Carrillo (Santa Clara University), Tejas Kannan (Gunn High School)

Advisors: John Shupe (California State University, Monterey Bay), Jim Roche (National Park Service, Yosemite National Park), Cindy Schmidt (Bay Area Environmental Research Institute)

Partners: National Park Service, Yosemite National Park

NASA Earth Observations: Landsat 5, Terra MODIS

Software Utilized: ArcGIS, ENVI, ERDAS IMAGINE, Python

DEVELOP Program, Bay Area Environmental Research Institute)
Historic trends reveal extreme precipitation variability within the Yosemite National Park (YNP) geographic region. While California obtains greater than half of its annual water supply from the Sierra Nevada snowpack, precipitation and runoff can fluctuate between less than 50% and greater than 200% of climatological averages. Advances in hydrological modeling are crucial to improving water-use efficiency at the local, state, and national levels. The NASA Carnegie Ames Stanford Approach (CASA) model is a global simulation model that combines multi-year satellite, climate, and other land surface databases to estimate biosphere-atmosphere exchange of energy, water, and trace gases from plants and soils. By coupling CASA with a Hydrological Routing Algorithm known as HYDRA, it is possible to calculate current water availability and observe hydrological trends within YNP. Satellite-derived inputs such as surface evapotranspiration, temperature, precipitation, land cover, and elevation were included to create a valuable decision support tool for YNP's water resource managers. Validations of model results were conducted using in situ stream gauge measurements. Additionally, the temporal resolution of the CASA-HYDRA model was adapted for a daily time-step (the previous time-step was monthly) for increased frequency of management decisions. This geospatial assessment provides a standardized method which may be repeated in both national and international water-stressed regions.

Colorado Water Resources

Utilizing Landsat and Statistical Models for Mapping Wetlands in Northern Colorado

Team: Stephen Chignell (Colorado State University), Brenda Kessenich (University of Colorado Boulder), Sky Skach (Colorado State university), Amber Weimer (Colorado State University)

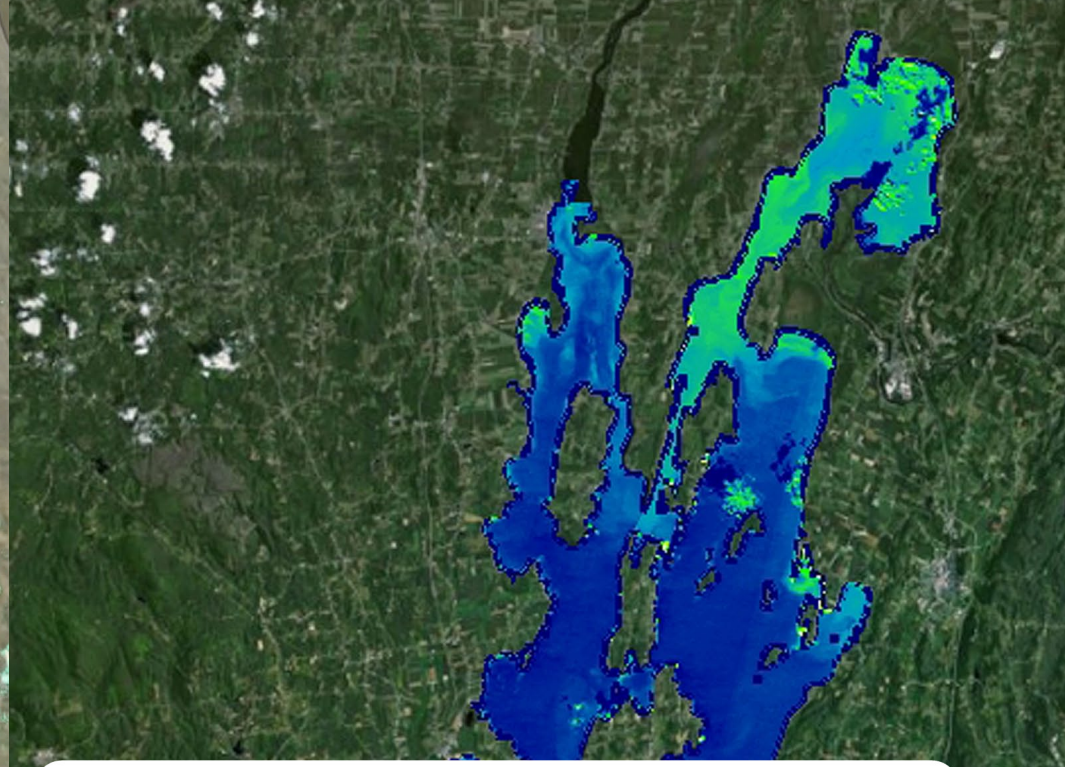
Advisors: Paul Evangelista (CSU, Natural Resource Ecology Lab), Melinda Laituri (CSU, Geospatial Centroid), Jeff Morisette (USGS, North Central Climate Science Center)

Partners: US Forest Service, Fort Collins; Forest Research Institute; Colorado Natural Heritage Program

NASA Earth Observations: Landsat 5 & 8, SRTM

Software Utilized: ArcGIS, ENVI, SAHM Model System, Adobe Suite

The Cache la Poudre watershed is one of the most important headwaters on the Colorado Front Range and provides important ecosystem and economic services to the region before flowing into the South Platte and Missouri Rivers. Wetlands are an important component of watershed health and water quality, but the Poudre wetlands are largely unmapped. Utilizing remote sensing, Geographic Information System (GIS) layers, and boosted regression trees modeling, the watershed team conducted the second stage of a multi-term investigation into riparian, wetland and headwaters modeling within the watershed. The project provided important data for land managers and created a riparian and wetlands modeling framework that can be reproduced throughout the intermountain west region. It also expanded upon the previous baseline model of riparian and wetland areas within the Cache la Poudre watershed and further refined it by modeling within three elevation-based zones.



New England Water Resources

Multispectral Monitoring of New England Freshwater Resources to Assess Turbidity, Algal Blooms and Water Quality for Enhanced Natural Resource Management

Team: Tiffani Orne (Liberty University), Hayley Solak (Clark University), Sam Weber (Virginia Polytechnic Institute and State University)

Advisor: Dr. Kenton Ross (NASA, Langley Research Center)

Partners: Lake Champlain Basin Program; Lake Champlain Committee

NASA Earth Observations: Landsat 7 & 8, Aqua MODIS

Software Utilized: ArcGIS

Centered between New York, Vermont, and Quebec, Lake Champlain is a critical water resource for the surrounding area. More than 180,000 people rely on the lake for drinking water and it is a major stopping point and breeding ground for migrating birds. Development in the Lake Champlain watershed has led to an increase in nutrients in the lake. Algae in the water thrive on the nutrient flux and reproduce exponentially, causing hazards to both human and environmental health. Interested organizations, including the Lake Champlain Basin Program (LCBP) and the Lake Champlain Committee (LCC), mobilize citizen volunteers to collect water samples in various parts of the lake in order to monitor water quality. However, this process requires a large number of volunteers, can be inconsistent, does not account for the quality of the entire lake, and requires the cost of laboratories to test the water samples. Using Aqua Moderate Resolution Imaging Spectroradiometer (MODIS) and Landsat Enhanced Thematic Mapper Plus (ETM+) and Operational Land Imager (OLI) data, this project created a series of maps showing the change in chlorophyll-a, cyanobacteria, phycocyanin, and total suspended sediment (TSS) over time. The methodologies were then handed over to project partners to continue using remote sensing to monitor water quality and the maps were provided as a visual tool to influence public policy.

Oceans

South Pacific Oceans

Predicting the Trajectories of Pumice Rafts for Enhanced Navigational Warnings and Coastal Hazard Management Policies

Team: Michael Bender (Pennsylvania State University), Joshua Kelly (University of Rhode Island), Maureen Kelly (University of Maryland), Corey Walters (Saint Louis University)

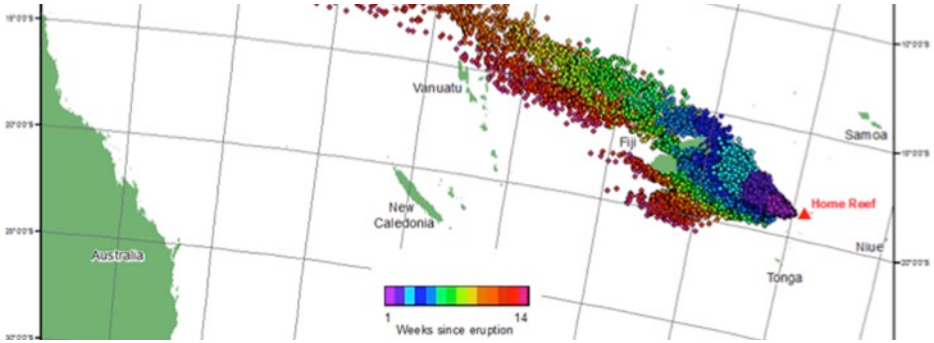
Advisor: Dr. Kenton Ross (NASA, Langley Research Center)

Partners: USGS, GNS Science New Zealand

NASA Earth Observations: Terra/Aqua MODIS, Jason-2, QuikSCAT

Software Utilized: ArcGIS, ENVI, SeaDAS, GNOME Model

Pumice rafts are expansive masses of pumice clasts floating on the ocean surface produced by silicic shallow submarine and subaerial explosive volcanic eruptions. The goal of this project was to enhance knowledge of pumice rafts and develop accessible and practical methodologies for predicting the movement of pumice rafts in the South Pacific region. Two volcanoes in this region have recently erupted and formed pumice rafts: Home Reef volcano (Tonga) in 2006, and Havre Seamount (Kermadec Islands, New Zealand) in 2012. Remote sensing data acquired from NASA Earth Observing System (EOS) satellites QuikSCAT and Jason-2 were used to predict the trajectory of the pumice rafts formed from these eruptions using the General NOAA Operational Modeling Environment (GNOME). Learning more about the processes and transport mechanisms of pumice rafts is significant for a number of ecological and economic reasons. Pumice rafts pose a hazard to marine transportation as individual clasts can block seawater intake valves of large ships and cause hull damage to smaller vessels. Rafts can also be detrimental to fisheries as a large kill of deep-sea fish followed the arrival of pumice rafts during the 1984 Home Reef eruption. Additionally, rafts have the potential to introduce harmful invasive species to pristine areas as they drastically increase dispersal distances for otherwise benthic or relatively sedentary organisms. This novel and easily adaptable methodology can be used by island/coastal nations and fishery managers to forecast when and where a pumice raft will be, drastically enhancing maritime navigational warnings and response times to eventual pumice landfall.



Gulf of Mexico Oceans

Combining Aquarius and MODIS Measurements to Assess Near-shore Salinity Levels in the Northern Gulf of Mexico

Team: Shelby Barrett (William Carey University) (Project Lead), Aaron Brooks (Tulane University), Jamie Thompson (University of Southern Mississippi), Maria Arguelles (University of Miami, Florida)

Advisors: Joe Spruce (CSC, Stennis Space Center), Dr. Kenton Ross (NASA, Langley Research Center)

Partners: Louisiana Department of Wildlife and Fisheries; Coalition to Restore Coastal Louisiana; Coalition to Restore Coastal Louisiana

NASA Earth Observations: Terra/Aqua MODIS, Aquarius

Software Utilized: HDFView, ArcGIS, ERDAS IMAGINE, R

As the Mississippi River flows into the Gulf of Mexico, its freshwater plume carries approximately 550 million metric tons of sediment with it each year. This plume sits atop the Gulf's water column with very little mixing. Monitoring and modeling near-shore sea surface salinity (SSS) along the Gulf Coast region is needed by fisheries managers because the plume-induced changes in the SSS levels can alter habitat suitability. These salinity dynamics affect the vitality of multiple fisheries as well as the formation of hypoxic zones that prohibit many forms of aquatic life. In response, this project was conducted to investigate the potential for improving near shore SSS estimates through combined use of total suspended solid (TSS) data derived from NASA's MODIS sensor with open water SSS measurements from Aquarius. The moderate resolution 250m MODIS data was input into an Arc Toolbox model created by the Fall 2012 Great Lakes Project at Langley Research Center. This model was used to derive TSS values from the MODIS images. The coarse spatial resolution Aquarius data collected over open water were used to derive a linear regression between its salinity estimates and the most temporally and spatially relevant available MODIS data. The resulting linear regression equation was then applied only to MODIS data to derive a more spatially resolute estimate of SSS for coastal waters near the shore. This data was partially validated using in situ salinity measurements acquired from multiple agencies. This technique was applied to multiple image dates to promote a more temporally and spatially robust calibration. The resulting data provided a much higher spatial resolution that extended closer to the shoreline than Aquarius SSS measurements alone. The results of this project provide preliminary information on the technical feasibility of measuring SSS in the near-shore Gulf Coast waters. These methods were communicated to multiple project partners including the Coalition to Restore Coastal Louisiana, a local non-profit organization whose mission is the protections and restoration of a sustainable coastal Louisiana. The project offers a potential method for the coastal zone management community to use in concert with in situ data in the synoptic monitoring of SSS levels in near-shore coastal waters.

Disasters

California Disasters

Detecting Faults in Southern California Using Computer-Vision Techniques and UAVSAR Interferometry

Team: Magali Barba (California State Polytechnic University, Pomona), Christine Rains (California state University, Northridge), Wesley von Dassow (Lafayette College)

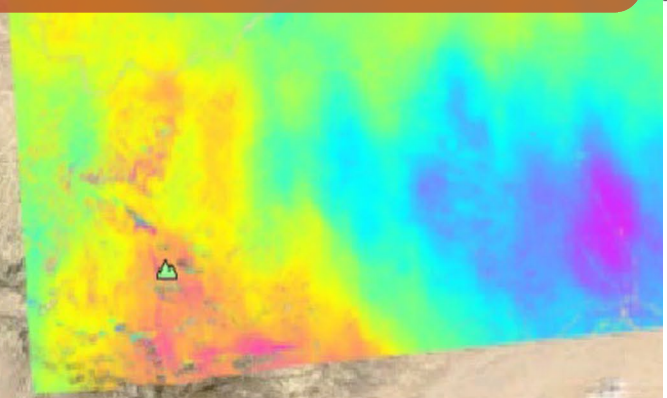
Advisors: Dr. Jay Parker (Jet Propulsion Laboratory), Margaret Glasscoe (Jet Propulsion Laboratory), Benjamin Holt (Jet Propulsion Laboratory)

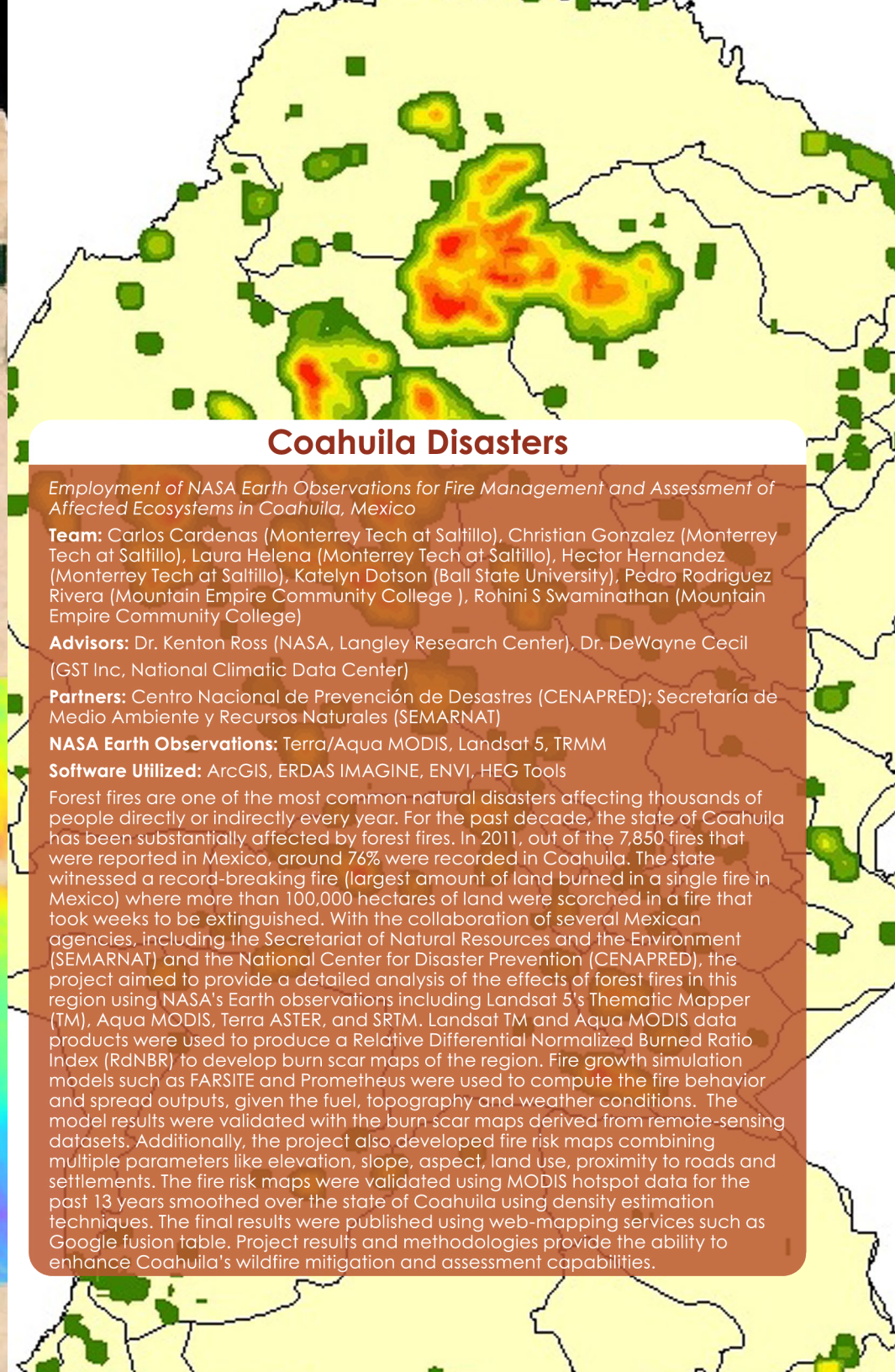
Partners: California Earthquake Clearinghouse; Department of Homeland Security

NASA Earth Observations: UAVSAR

Software Utilized: Python, IDL, ArcGIS

Knowing the location and behavior of active faults is essential to earthquake hazard assessment. Common methods for locating and studying active faults include field mapping and geophysical imaging which are time-consuming, labor-intensive, and potentially environmentally taxing to local ecosystems. This project contributed to the development of a method to expedite fault detection in California utilizing InSAR imagery created from polarimetric L-band data from NASA's Uninhabited Aerial Vehicle Synthetic Aperture Radar (UAVSAR) project. A computer-vision technique known as "edge-detection" was used to automate the fault-identification process, and was tested and refined in alignment with NASA's Earthquake Data Enhanced Cyber Infrastructure for Disaster Evaluation and Response (E-DECIDER) group. To optimize the algorithm, both UAVSAR interferograms and synthetic interferograms generated through Disloc were used. The algorithm detected seismic, aseismic, and co-seismic slip along faults that were identified and compared with databases of known fault systems. This optimization process was the first step toward integration of the edge-detection code into E-DECIDER. Organizations that will use the code include California Earthquake Clearinghouse and the US Department of Homeland Security's Unified Incident Command and Decision Support (UICDS) service. This new methodology will allow researchers, earthquake disaster response teams, and policy-makers to examine the details of ground and fault motions for moderate to large earthquakes. Newly-discovered faults will be integrated into fault databases that will be used to improve future earthquake hazard assessment. As new faults are mapped, they will further understanding of the complex fault systems and earthquake hazards within the seismically dynamic state of California.





Coahuila Disasters

Employment of NASA Earth Observations for Fire Management and Assessment of Affected Ecosystems in Coahuila, Mexico

Team: Carlos Cardenas (Monterrey Tech at Saltillo), Christian Gonzalez (Monterrey Tech at Saltillo), Laura Helena (Monterrey Tech at Saltillo), Hector Hernandez (Monterrey Tech at Saltillo), Katelyn Dotson (Ball State University), Pedro Rodriguez Rivera (Mountain Empire Community College), Rohini S Swaminathan (Mountain Empire Community College)

Advisors: Dr. Kenton Ross (NASA, Langley Research Center), Dr. DeWayne Cecil (GST Inc, National Climatic Data Center)

Partners: Centro Nacional de Prevención de Desastres (CENAPRED); Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT)

NASA Earth Observations: Terra/Aqua MODIS, Landsat 5, TRMM

Software Utilized: ArcGIS, ERDAS IMAGINE, ENVI, HEG Tools

Forest fires are one of the most common natural disasters affecting thousands of people directly or indirectly every year. For the past decade, the state of Coahuila has been substantially affected by forest fires. In 2011, out of the 7,850 fires that were reported in Mexico, around 76% were recorded in Coahuila. The state witnessed a record-breaking fire (largest amount of land burned in a single fire in Mexico) where more than 100,000 hectares of land were scorched in a fire that took weeks to be extinguished. With the collaboration of several Mexican agencies, including the Secretariat of Natural Resources and the Environment (SEMARNAT) and the National Center for Disaster Prevention (CENAPRED), the project aimed to provide a detailed analysis of the effects of forest fires in this region using NASA's Earth observations including Landsat 5's Thematic Mapper (TM), Aqua MODIS, Terra ASTER, and SRTM. Landsat TM and Aqua MODIS data products were used to produce a Relative Differential Normalized Burned Ratio Index (RdNBR) to develop burn scar maps of the region. Fire growth simulation models such as FARSITE and Prometheus were used to compute the fire behavior and spread outputs, given the fuel, topography and weather conditions. The model results were validated with the burn scar maps derived from remote-sensing datasets. Additionally, the project also developed fire risk maps combining multiple parameters like elevation, slope, aspect, land use, proximity to roads and settlements. The fire risk maps were validated using MODIS hotspot data for the past 13 years smoothed over the state of Coahuila using density estimation techniques. The final results were published using web-mapping services such as Google fusion table. Project results and methodologies provide the ability to enhance Coahuila's wildfire mitigation and assessment capabilities.

Climate

California-Mississippi Disasters

Utilizing Spaceborne and Airborne SAR Sensors to Assess Aqueduct, Levee, and Road Conditions After Earthquake and Flood Events

Team: Scott Barron (University of California, Los Anagels), Karen An (University of California, Irvine), Kenta Ishii (University of California, Santa Barbara

Advisors: Dr. Cathleen Jones (Jet Propulsion Laboratory), Benjamin Holt (Jet Propulsion Laboratory), Joel Dudas (California Department of Water Resources)

Partners: US Army Corps of Engineers; California Department of Water Resources

NASA Earth Observations: UAVSAR

Software Utilized: ArcGIS, QuakeSim, ENVI, Matlab, Disloc Model

The Sacramento-San Joaquin Delta and Mississippi River Basin levee systems are both vital pieces of water resource infrastructure that are located in areas of high risk for flooding and seismic activity (for the Delta region). The California Department of Water Resources, which manages the Delta, and the U.S. Army Corps of Engineers, which manages the Mississippi region, currently rely on field assessments to manage the health of these levee systems. This methodology is unsustainable for such large and complicated systems (the Delta contains over 1,100 miles of levees), especially as high water events become more common with increasing sea level rise and the effects of climate change on freshwater runoff. The field management of both levee systems can be improved by using satellite and airborne radar data. Using interferometric and polarimetric data from synthetic aperture radar sensors, this study aimed to achieve two goals: 1) predict infrastructure conditions after major earthquakes and flood events in the study regions and 2) create automated support tools to monitor levee leakage and predict earthquake induced infrastructure problems before they happen.

Dallas-Fort Worth

American Climate

Utilizing NASA Earth Observations to Analyze the Relationship Between Climate and Gas Flaring Across North and South America

Team: Amber Jones (William Carey University) (Project Lead), Haley Feather (University of Southern Mississippi), Stephanie McCracken (University of Southern Mississippi), Timothy Sutherlin (University of Southern Mississippi)

Advisor: Joe Spruce (CSC, Stennis Space Center)

Partners: Public Laboratory for Open Technology & Science

NASA Earth Observations: Suomi NPP VIIRS, Aura OMI, Aqua AIRS

Software Utilized: ERDAS IMAGINE, ArcGIS, Python, IDL

Natural gas is a by-product of petroleum extraction, production, and processing. Flaring is a common disposal practice in the petroleum industry when the collecting, storing, and/or transport of natural-gas or gaseous by-products is economically or technically unfeasible. Other reasons for intentional flaring may include elimination of gaseous waste, emergency response, site surveying, and well testing. The purpose of this study was to use a combination of NASA Earth observation systems, mainly Suomi NPP (National Polar-orbiting Partnership), along with ancillary data to assess the interchanging relationships between gas-flaring emissions, air quality, and climate. Flare-free study areas were selected across varying climatic regions in North and South America as well as where dense flare clusters occurred. Air quality data were then examined for correlation with flare intensity and for seasonal variation. As a result of this study, the effect of gas flaring on the atmosphere was assessed and a suitability index was created to suggest when conditions were optimal for reducing environmental impacts from gas-flaring.

Energy

Rwanda Energy

Utilizing NASA Earth Observation to Determine Site Suitability for Green Energy Resources in Rwanda

Team: Faith Mwiza (California Baptist University), Merna Saad (Christopher Newport University), Vincent Mwumvaneza (California Baptist University), Nirav Patel (University of Florida), Gaspard Twagirayeza (Oklahoma Christian University), Angela Unrein (University of Kansas)

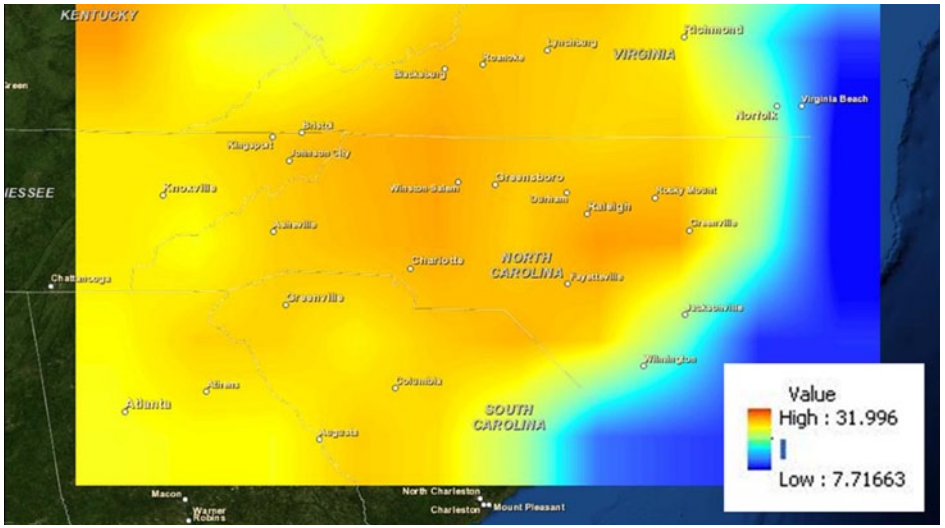
Advisor: Dr. Kenton Ross (NASA, Langley Research Center)

Partners: Rwanda Ministry of Agriculture and Animal Resources; AfriPop Project; World Bank Open Data Initiative; Embassy of the Republic of Rwanda

NASA Earth Observations: Suomi NPP VIIRS, Terra/Aqua MODIS

Software Utilized: ArcGIS, ERDAS IMAGINE

Throughout much of Rwanda, domestic energy is reliant upon woody biomass, hydroelectric power, and imported petroleum products. With only 15% of the population retaining electricity use in their homes, solar power efforts are gaining momentum as a viable source of energy in both urban and rural areas, in effect reducing environmental harm while also increasing energy and economic security. Utilizing NASA's Earth Observing Systems (EOS), areas most suitable for solar power generation were determined given solar radiation, cloud, aspect, and slope characteristics using CERES on the Soumi NPP satellite, as well as the Moderate Resolution Imaging Spectroradiometer (MODIS) and Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) sensors aboard the Terra and Aqua satellites. In combination with population density mapping acquired from the VIIRS sensor on the Suomi NPP platform combined with the AfriPop project data, energy demands based on population distribution throughout Rwanda were determined, and as such, promotes the development of the Rwandan power grid.



Mid-Atlantic Energy

Deriving Solar Energy Production Suitability for the Mid-Atlantic Region from NASA's Earth Observations

Team: Vivek Hebbar (University of California Berkeley), Jacob Hope (University of Virginia), Joanna Furst (Christopher Newport University), Manisha Iruvanti (Tabb High School), John Lingenfelser (Gloucester High School), Radha Venkatesan (Grafton High School), Michael Kane (Poquoson High School), Anthony Pototzky (Old Dominion University)

Advisors: Dr. Kenton Ross (NASA, Langley Research Center), Dr. Paul Stackhouse (NASA, Langley Research Center)

Partners: Maryland Energy Administration

NASA Earth Observations: Terra/Aqua MODIS, Terra CERES, Landsat 7, Suomi NPP CERES & VIIRS, SRTM

Software Utilized: ArcGIS, Solar Prospector, Python

Solar energy has become increasingly prominent in the Mid-Atlantic region of the United States due to a reduction in cost and a rise in demand for renewable production of electricity. Many recent government policies also reflect the rising acceptance of solar energy as one of the most abundant renewable resources. At least 2% of Maryland's electricity is required to be generated from solar energy. Unfortunately, current methods for siting potential solar farms are not as refined as they could be. This project focuses on identifying areas with the most advantageous climate and topography for placing solar panels in order to harness solar energy efficiently. Using NASA's Earth observations, such as Clouds and the Earth's Radiant Energy System (CERES), Visible/Infrared Imager/Radiometer Suite (VIIRS), Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER), and Shuttle Radar Topography Mission (SRTM), a series of suitability maps were created. The "resource availability" factors (affecting an area's solar power capabilities) can then be determined using data obtained from the maps, allowing policy-makers as well as our own partner's to more easily evaluate the potential of an area for efficient solar energy production.

Health & Air Quality

Southeast Health & Air Quality

Infusing NASA Satellite Data to Model Air-Quality for Southeast United States: A Wildfire, Aerosol Transport, and Respiratory Health Case Study

Team: Swatantra Kethireddy (Jackson State University), Binita KC (University of Georgia), Eric Dobbs (University of Alabama in Huntsville), Jennifer Bell (University of Georgia)

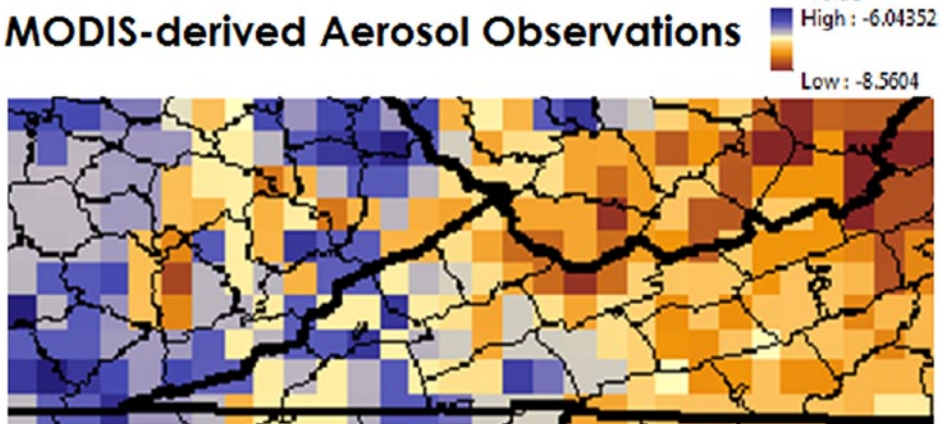
Advisors: Dr. Marshall Shepherd (University of Georgia), Dr. Thomas Mote (University of Georgia), Dr. Jeff Luvall (NASA, Marshall Space Flight Center)

Partners: Jefferson County Department of Health; US Forest Service

NASA Earth Observations: Terra/Aqua MODIS, Landsat 5

Software Utilized: ArcGIS, IDL, Python, ERDAS IMAGINE

Air pollutants from wildfires have adverse impacts on air quality and public health. Fine particulate matter (PM2.5) from smoke has been found to cause respiratory disorders in susceptible populations. The Okefenokee fires from spring to summer of 2007 biased the ambient air quality measurements in Birmingham, AL which ultimately led to the reclassification of the period between May 14 and June 3, 2007 as an "exceptional event". This study aims to estimate PM2.5, its regional transport into Jefferson County, AL, and health impacts on the population. Aerosol Optical Depth (AOD) from the Moderate Resolution Imaging Spectroradiometer (MODIS) aboard NASA's Aqua and Terra satellites helps evaluate air quality in areas lacking PM2.5 monitors. The GOES East Aerosol/Smoke Product was used to analyze and predict smoke flux. The satellite data, ground-based aerosol measurements, and flux analysis represent that respiratory health hazards are a function of extreme aerosol loading events, such as the 2007 Okefenokee fires.



Virginia Health & Air Quality

Monitoring Air Quality in the Southwest Virginia Region for Assessment of Environmental Impacts of Coal Burning Technologies

Team: Taylor Meade (Virginia Tech), Suravi Shrestha (Westminster College), Daria Blach (University of Virginia at Wise), Brittany Barnes (Virginia Tech)

Advisors: Dr. Kenton Ross (NASA, Langley Research Center), Dr. DeWayne Cecil (GST Inc, National Climatic Data Center), Hon. J. Jack Kennedy, Jr. (Wise County & City of Norton Clerk of Court)

Partners: Virginia Department of Environmental Quality Air Division; Dominion Power, Virginia Hybrid Energy Center; American Electric Power, Clinch River Plant

NASA Earth Observations: Aura OMI, Terra/Aqua MODIS

Software Utilized: ArcGIS, Matlab, HYPSLIT Model

The majority of coal-fired power facilities are located in a close proximity to the Appalachian Mountains where traditionally a large percent of the coal produced in America was mined. There are some important advantages for having mining and energy production located within this region. However, the concentration of coal plants can have a number of negative impacts for the region's environment in addition to the health of the local community. Previous phases of this project focused research specifically on the Clinch River Plant (CRP) built in 1957 and compared it to the Virginia City Hybrid Energy Center (VCHEC) which began operations in 2012. Limitations were found due to lack of in situ emissions data each site, close proximity of the power plants, and coarse resolution of the Earth observing satellites. This final phase of the Virginia Air Quality project broadened its focus to a regional rectangle around these two plants and extended the study period to February 2003 to February 2013. This research focused primarily on CRP's emissions, as the VCHEC only came online in the last year of the study period. The broadened time period and study area allows regional monitoring of changes in nitrous oxides and other aerosol particles around the Southwest Virginia region. Utilizing two NASA Earth observing sensors including Ozone Monitoring Instrument (OMI) and Moderate Resolution Imaging Spectroradiometer (MODIS), this project investigated how regulations and environmental laws imposed in the past ten year have affected the air quality of the region. Impacts to public health were also evaluated by using hospital data on asthma and air quality related sicknesses. As the demand for electricity sources that are environmentally friendly will continue to increase, this project exemplifies how NASA's Earth observations can provide decision support tools for policymakers and energy managers around the globe.

Sudan Health & Air Quality

Utilizing NASA Earth Observations to Determine the Relationship between Environmental Factors and Leishmaniasis in Sudan

Team: Alex Sweeney (Columbia University), Caitlin Reid (Columbia University)

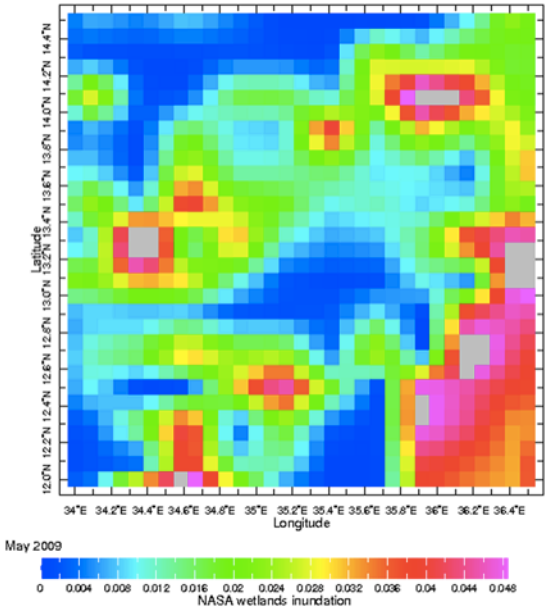
Advisors: Dr. Pietro Ceccato (Columbia University, International Research Institute for Climate and Society), Dr. Madeleine Thomson, (Columbia University, International Research Institute for Climate and Society)

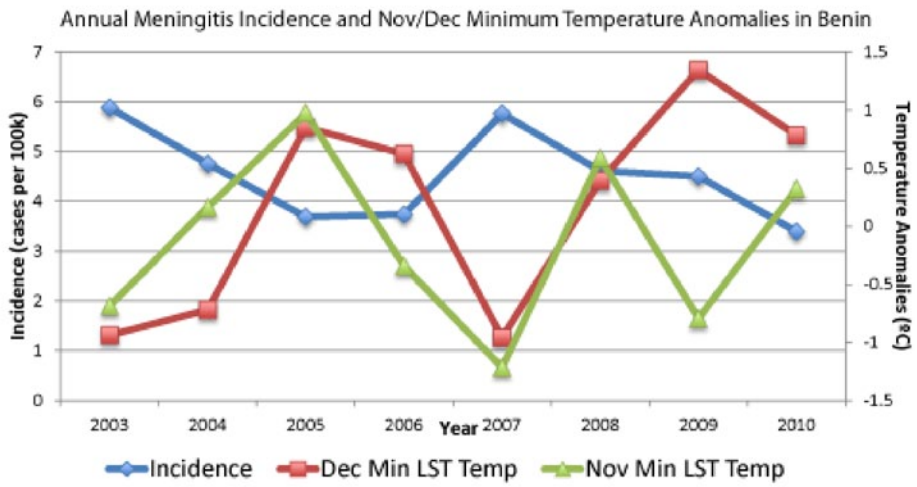
Partners: Sudan Ministry of Health; Doctors Without Borders; University Maryland, Eastern Shore

NASA Earth Observations: Aqua/Terra MODIS, Landsat 5 & 7, TRMM

Software Utilized: R, ArcGIS, ENVI

Visceral Leishmaniasis (VL), also known as kala azar, is a disease caused by the parasitic protozoa, Leishmania donovani. It is transmitted by female sandflies from the Phlebotmos genus in Sudan. Endemic regions exist within Eastern Africa with a geographic hotspot in Gedaref State in eastern Sudan. This area is known to experience seasonal fluctuations in incidence that typically peak from September to February (SONDJF). Recent epidemics have caused hundreds of thousands of deaths. In order to understand transmission, it is necessary to understand the climatic factors associated with VL and its ecological boundaries. However, no one is sure which climate variables are associated with wet or dry years. Results from the study will be used in collaboration with the International Research Institute for Climate and Society (IRI), Doctor's Without Borders (Switzerland), Maryland University (Eastern Shore), Sudan's Federal Ministry of Health, and the University of Khartoum. Outcomes will assist in the creation of a leishmaniasis Early Warning System for the region, which will be housed in the IRI Data Library and made available to decision-makers in Sudan.





Sahel Health & Air Quality

Creating and Validating Climate Suitability Maps for Meningococcal Meningitis Epidemic Outbreaks in the Meningitis Belt

Team: Tam Tran (Columbia University) and Elisabeth Gawthrop (Columbia University)

Advisors: Dr. Pietro Ceccato (Columbia University, International Research Institute for Climate and Society)

Partners: MERIT Initiative

NASA Earth Observations: Terra/Aqua MODIS

Software Utilized: Matlab, IRL/LDEO Climate Data Library

Meningococcal meningitis (MM) is a bacterial cerebrospinal infection and is one of the most feared diseases in sub-Saharan Africa, due to the high incidence rate in Africa and its debilitating effects on society. It has been hypothesized that climate conditions may help convert benign meningitis bacteria into a pathogenic version that compromises the epithelial lining of the nasal cavity. Most outbreaks occur during the dry season, when humidity is low and temperature is high, but the mechanism of how climate affects transmission or the intensity of the disease is not well understood. This project used model data (humidity) and remotely-sensed data (land surface temperature) to determine how these climate factors correlate with MM outbreaks with the hope of being able to use climate data as predictors for areas at high risk of having an epidemic outbreak. Ultimately, this study will help contribute to greater understanding of the disease dynamics and begin the analysis required to create a risk map that the World Health Organization will use in combating the disease and in planning vaccination strategies.

Cross-Cutting

DEVELOP's VIEW

Visually Integrated Earth-observation Wall

Team: Aaron Herbert (Pennsylvania State University), Daniel Winker (University of Virginia), Jonathan Hicks (Christopher Newport University), Zak Edwards (Virginia Polytechnic Institute and State University)

Advisor: Dr. Chip Trepte (NASA, Langley Research Center)

Partners: CALIPSO Science Team

It is often difficult to view various parameters of time-dependent data all at once. The Visually Integrated Earth-observing Wall (VIEW) is a hyperwall system that allows the user to analyze asynchronous datasets extracted from multiple Earth observing sensors, simultaneously, on multiple screens in a time-synchronized manner. Currently, VIEW consists of four computers that functions as clients and an additional computer that functions as the server, although more or less clients can be used if necessary. Any amount of data which can fit in the provided hyperspace, that is the area of the combined screens, can be synchronously displayed in order to more clearly see multiple parameters at once. In the future, additional modifications and improvements will be made to the software to allow for an easier to use interface as well as a smoother and more efficient runtime.

Outreach & Design Team

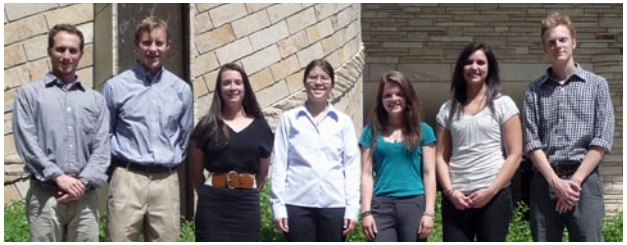
Enhancing DEVELOP's Recognition & Promotion

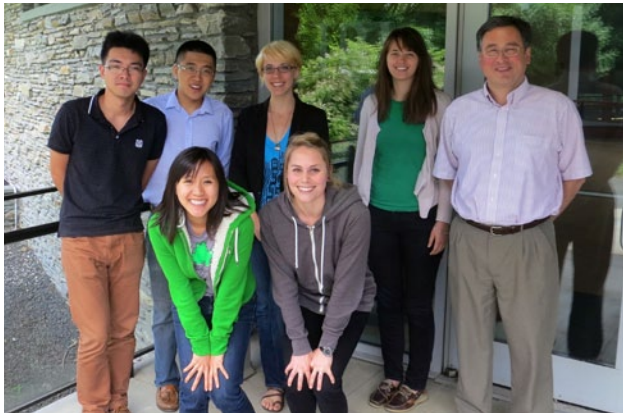
Team: Beth Brumbaugh (Publication Lead), Kirstin Cooksey (Outreach Lead), Chris McKeel (Design Lead) & Joseph Miller (Social Media Lead)

DEVELOP's Outreach Team focused their summer on a variety of outreach activities, including:

- Led publication efforts: writing, editing and overseeing publication of a variety of different print materials (highlight articles, journal submissions, etc.).
- Maintained DEVELOP's social media: Facebook, Twitter, Google+, Pinterest, and LinkedIn.
- Managed the Summer Virtual Poster Session: collected all project materials, edited and coordinated material with IEEE's Earthzine.
- Created new promotional videos: designed and edited new recruiting videos describing the DEVELOP Program and experience.
- Managed the DEVELOP YouTube Channel: oversaw the addition of over 30 videos.
- Led DEVELOP's interactive poster initiative: managed all content for inclusion in the summer posters through QR codes and NFC chips.
- Designed new print materials: brochures, this booklet, event announcements, impact maps, VPS imagery, the DEVELOP timeline, etc.
- Led recruiting activities: oversaw email and social media recruiting campaigns and worked with the National Program Office to initiate the DEVELOP Campus Ambassadors Corps program.

Get Involved





Who is eligible to apply to DEVELOP?

Individuals pursuing to further their experience in the Earth sciences and remote sensing, including currently enrolled students, recent graduates with an undergraduate or graduate degree, transitioning career professionals, and transitioning veterans of U.S. Armed Forces.

General Eligibility Requirements

- At least 18 years of age
- Minimum 3.0 GPA on a 4.0 scale (at current or last institute of higher learning)
- Ability to provide personal transportation to and from the DEVELOP location
- Strong interest in Earth science and remote sensing
- U.S. citizenship is required to apply to DEVELOP locations at NASA Centers

International Applicants

International applicants studying in the United States interested in working with the DEVELOP National Program must be currently enrolled and attending an accredited U.S. school. International applicants are not eligible to apply to NASA Center Locations; however, they are eligible to apply to Regional and Leveraged Academic Locations. There is an exception for the NSSTC (Marshall Space Flight Center) that allows international applicants to apply to that location. Acceptances for international applicants are conditional upon proof of a valid visa, I-20 form, and an approved CPT/OPT that will allow them to legally work within the U.S. Applicants who do not meet these requirements are not eligible to participate in the DEVELOP National Program.

U.S-Based Locations International Students can apply to:

- International Research Institute for Climate & Society - Palisades, NY
- Mobile County Health Department - Mobile, AL
- North Central Climate Science Center - Fort Collins, CO
- NSSTC at Marshall Space Flight Center - Huntsville, AL
- University of Georgia - Athens, GA
- Wise County and City of Norton Clerk of Court's Office - Wise, VA

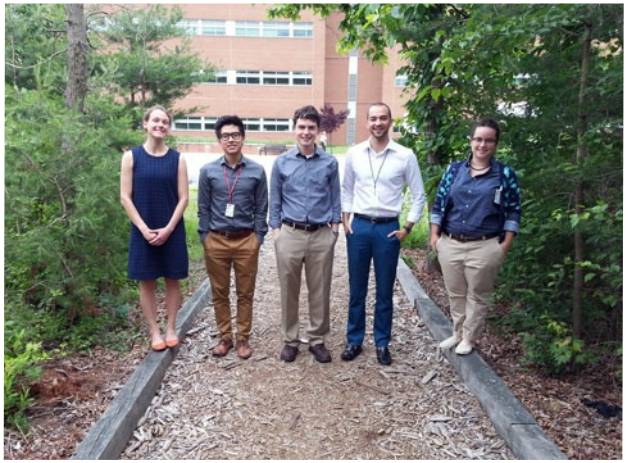
What partners are eligible to collaborate with DEVELOP?

Any organization that is making decisions related to environmental concerns and is interested in incorporating NASA Earth observations into that decision making process. This can include local, state, regional, federal, academic, international and Non-Governmental Organizations (NGOs).

For more information on partnering with DEVELOP, please visit the DEVELOP website - *http://develop.larc.nasa.gov*.

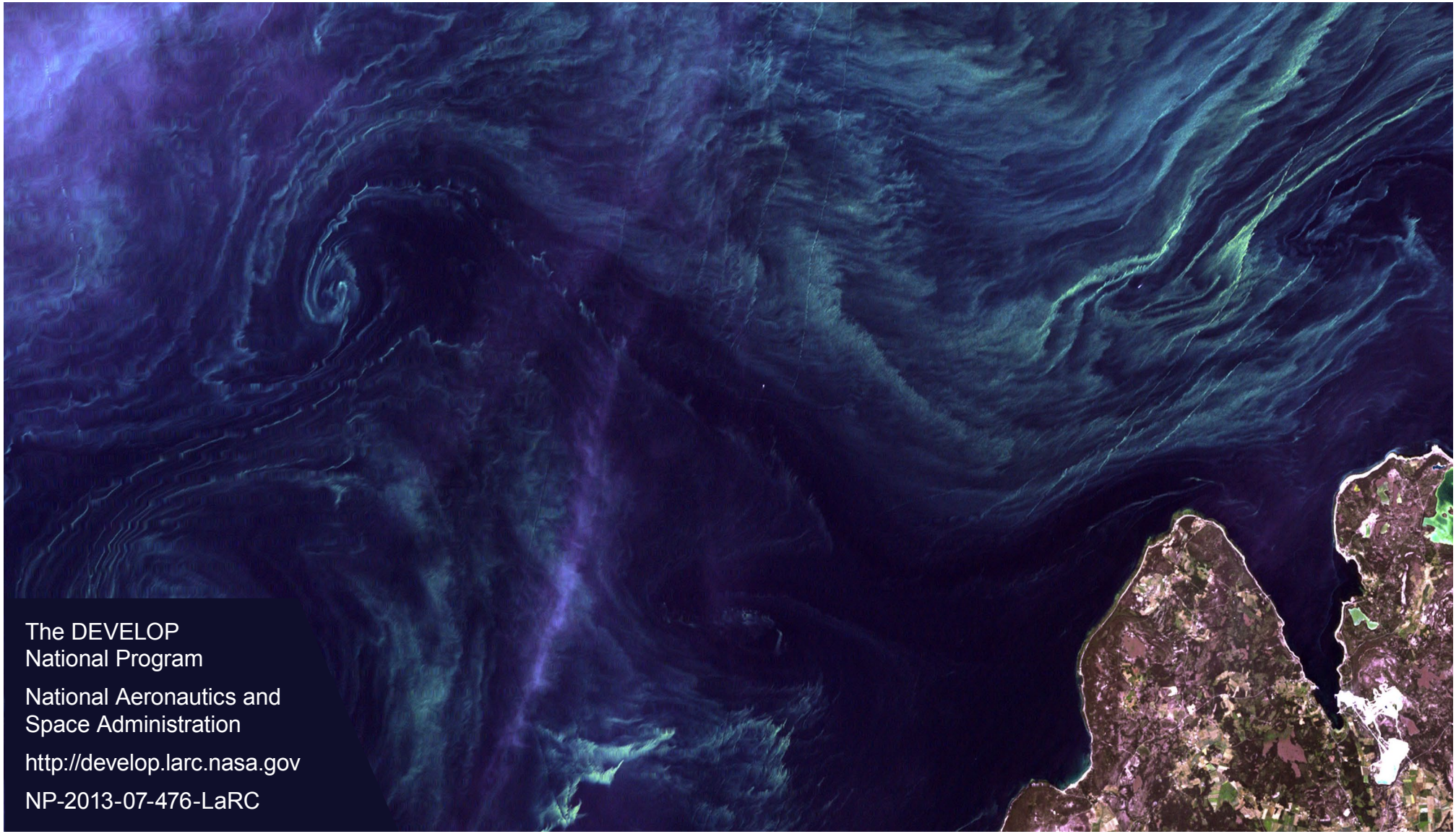
Social Media Links

Facebook: *https://www.facebook.com/developnationalprogram*
Google+: *https://plus.google.com/+NASADEVELOP/posts*
Twitter: *https://twitter.com/#!/NASA_DEVELOP*
YouTube Channel: *http://www.youtube.com/user/NASADEVELOP*
LinkedIn: *http://www.linkedin.com/groups?gid=4343498*
Pinterest: *http://pinterest.com/nasadevelop/*



Contacts: *http://develop.larc.nasa.gov* and *NASA-DL-DEVELOP@mail.nasa.gov*

Dream. Discover. DEVELOP.



The DEVELOP
National Program

National Aeronautics and
Space Administration

http://develop.larc.nasa.gov

NP-2013-07-476-LaRC