NASA Biodiversity & Ecological Forecasting

Understanding biological diversity and its effects on the Earth system to forecast changes and develop resource management strategies

Fall 2018

BIG NEWS

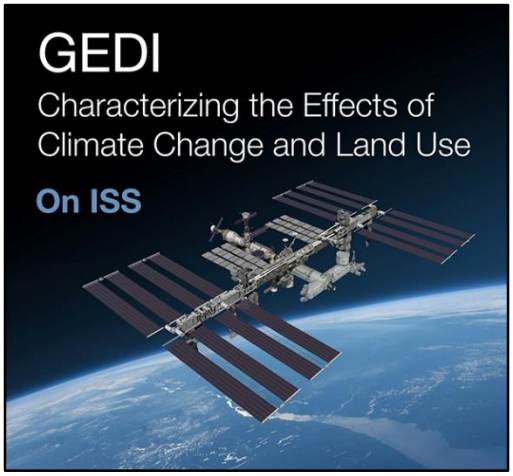
NESSF Becomes FINESST

The popular NASA SMD graduate opportunity known as NESSF has gotten a new name, FINESST (Future Investigators in NASA Earth and Space Science & Technology). These grants support student-designed research projects that contribute to SMD's science and technology goals. Under this new program, the participating graduate student will be a "Future Investigator" (FI). No currently funded NESSF awardees will be impacted by this transition. Existing NESSF awardees must apply for their 2nd or 3rd year of funding via the NESSF19R opportunity. **New students should apply to FINESST.** We ask that you please share this news with your communities.

Updates Reminder

Please send us manuscripts that have been accepted to journals and notify us of awards/recognition for your research that help us advertise our program and PIs to the public, administration, and our research community. Additionally, please note our request for apps and websites highlighted below.

Global Ecosystem Dynamics Investigation Lidar



On December 4th, the long awaited Global Ecosystem Dynamics Investigation Lidar (GEDI) instrument launched to the ISS where it begins a 2 year mission.

The GEDI mission will characterize the effects of changing climate and land use on ecosystem structure and dynamics to enable radically improved quantification and understanding of the Earth's carbon cycle and biodiversity. GEDI uses lidar to provide the first global, high-resolution observations of forest vertical structure. GEDI addresses 3 main science questions:

- What is the aboveground carbon balance of the land surface?
- What role will the land surface play in mitigating atmospheric carbon dioxide in the coming decades?
- How does ecosystem structure affect habitat quality and biodiversity?

Answering these questions is critical for understanding the future path of Earth's biodiversity. This adds to 2018 launches of ECOSTRESS, GRACE-FO, and ICESat-2 which makes it a revolutionary time for remote sensing of biological phenomena and the physical processes that govern them.

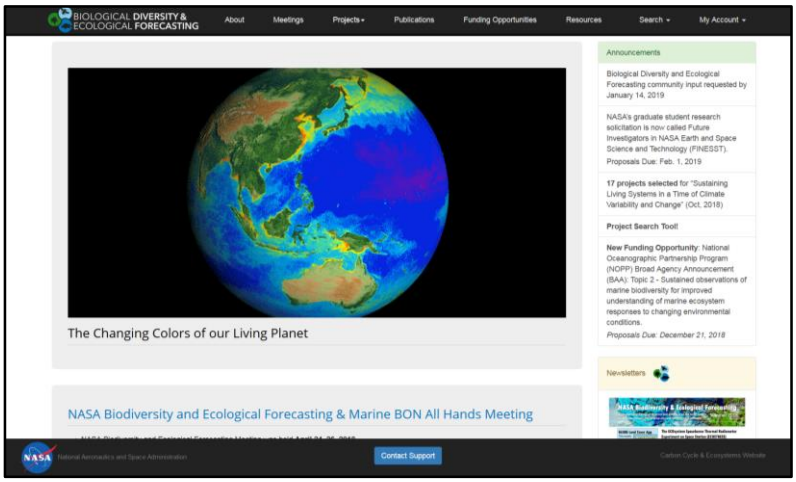
SAVE THE DATE: 2019 Team Meeting

NASA Biological Diversity & Ecological Forecasting Annual Team Meeting

May 21-23, 2019, Washington, DC

Our annual team meeting is confirmed for May 21-23 with the MBON team meeting scheduled for Friday, May 24th. Details on the venue will be forthcoming. Please hold these dates on your calendar.

Updates to the Program Website



Over the last few months, we have revamped our programmatic website to provide a single home for the Biological Diversity and Ecological Forecasting programs. The new website <https://cce.nasa.gov/biodiversity/index.html> has project profiles set up for all projects from 2003 to present. Your online **Project Profile** is a valuable resource to you, the research community, and NASA program managers. Each project has been assigned keywords to describe where and what you are studying. You may view all projects by clicking the **Project** tab at the top of the website and choose to **View** the list of projects by PI last name or **Search** projects using either keywords or a map interface.

All Project Leads have website accounts set up with access to update their publication citations online (instructions below) or you may email support@cce.nasa.gov with the citation, title of project, PI name, solicitation name, and solicitation year (note, you can get this from the list of projects).

Please note that if your project is associated with one or more of the following programs, your publications will display automatically on those websites: NASA Carbon Cycle and Ecosystems, NASA Carbon Monitoring Systems, NASA Terrestrial Ecology, NASA Ocean Biology and Biogeochemisty, NASA Arctic-Boreal Ecosystem Vulnerability Experiment, and North American Carbon Program.

Updating Your Project Publications

We have created a system to automate updating new publications that are listed in our newsletter. Nevertheless, we may miss publications from your project or incorrectly cite your work. We have enabled your accounts with the ability to update or edit the publications associated with your project. To do this, go to the **My Account** tab in the menu and sign in. If you don't know your password, select **Forgot Username or Password** and enter your last name to find your account. Select to Reset your password and an email will be sent to your email address. Follow the instructions to sign in with a temporary password and then enter a new password.

Once signed in you will be presented with your **My Account** page:

- Click **Publication Citations and upload Quad Charts**
- Select the project you want to add the citation to.
- You will be presented with a page to **Add a Publication Citation**.
- To enter a new citation, click **Add a Publication Citation**.
- Please follow the citation instructions and click the **Save** button.
- For any questions, Please contact (support@cce.nasa.gov).

Send Us Your Apps

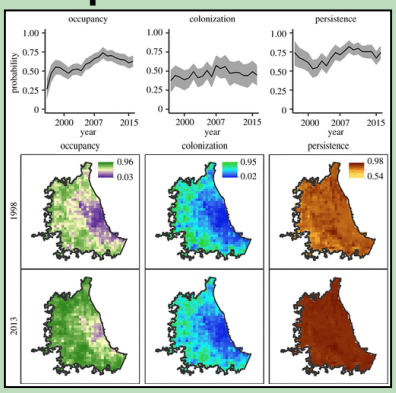
We are amassing a record of all the websites and applications that have been created through our program. Our aim is to create a database similar to our publications and projects search tool that directs our community to the appropriate data, tools, and methodologies related to Biological Diversity and Ecological Forecasting. This list will be housed and advertised on our newly remodeled program website. Even if your tool is several years old, please send it on to us (keith.gaddis@NASA.gov) to add to our list.

Research Briefs

Prey abundance & urbanization influence the establishment of avian predators in a metropolitan landscape

McCabe et al. (2018) Proc. R. Soc. B 285

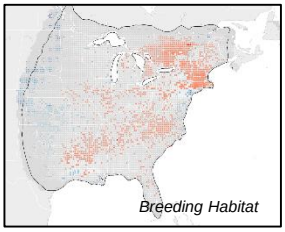
In recent years, many predators have become increasingly common in urban environments. This study examines this phenomena by combining 21 years of citizen science and remote sensing data. Specifically, the PIs modelled occupancy, colonization and persistence of accipiter hawks in the greater Chicago area as a function of tree canopy cover, impervious surface cover, and prey availability. In the late 1990s, hawks occupied 26% of sites around Chicago, but after two decades, their occupancy fluctuated close to 67% of sites and they colonized increasingly urbanized areas. Over time, a hyper-abundance of prey, in the form of backyard birds, allowed hawks to persist and adapt to areas of relatively high imperviousness.

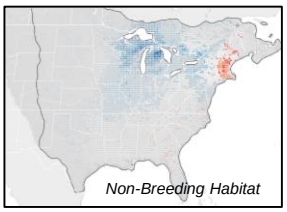


Changes in likelihood of occupancy, colonization, and persistence of accipiter hawks across time (top) and space (bottom).

Mapping North American Birds with NASA Data

NASA Feature, 2018





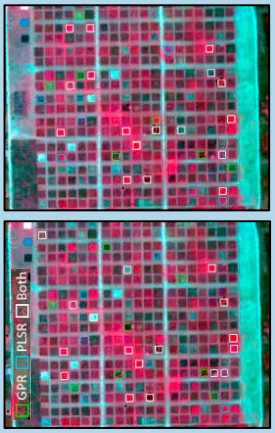
Change in blue jay abundance across 2007-16 where blue is increase and red is decrease

Birders, researchers and the general public now have a new way to monitor 107 bird species across North America in unprecedented detail, thanks to a collaboration between NASA and the Cornell Lab of Ornithology in Ithaca, New York. Combining the online bird distribution database, eBird with NASA Earth-observing satellite data (including land cover, water cover, elevation, and topography), eBird Status & Trends provides a unique window into the life cycles of birds and advance the understanding of North America's bird populations. The new online resource produces maps and products that explore the range, abundance, habitat, and trends for individual bird species informed by land cover, water cover, elevation, and topography. This update leverages advances pioneered under a NASA Applied Sciences project that combined eBird data with NASA Earth-observing data to assist the Nature Conservancy in California with its BirdReturns project.

Mapping foliar functional traits and their uncertainties across three years in a grassland experiment

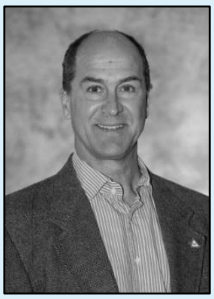
Wang et al. (2019) Remote Sens Environ

In this study, NASA PIs utilized NASA AVIRIS – Next Generation imaging spectroscopy data to map 15 foliar functional traits in a grassland experiment at the Cedar Creek Ecosystem Science Reserve across three years. They found that foliar functional traits can be retrieved in these grasslands with moderate to high accuracies using either partial least squares regression or Gaussian processes regression. The highest uncertainties related to low vegetation cover, high diversity levels, or irrigation and nitrogen treatments. Trait values in each plot were relatively stable across three years of managed species richness. These results provide a template for mapping foliar traits and their uncertainties in grasslands, and point to the need for extensive ground data across time to properly evaluate performance of trait mapping algorithms.



Change in spectral signature between 2014-16, highlighting plots with greatest uncertainties.

Müller-Karger Named AAAS Fellow



Please join us in celebrating and congratulating Frank Müller-Karger on being named a Fellow of the American Association for the Advancement of Science. Frank was elected to the Biological Science Section for his distinguished contributions to marine science, particularly in advancing understanding of biodiversity and the dispersal of water from the largest rivers to the world's oceans.

Frank is a Professor in the USF College of Marine Science and the Director of the USF Institute for Marine Remote Sensing. Frank's research focuses on how marine ecosystems change over time. Using a time series of observations to study changes in water quality, primary production, and biodiversity in marine systems, he is advancing a broader understating of the impacts of human activity on ecosystems and society.

Dr. Müller-Karger was named a Commissioner to the U.S. Commission on Ocean Policy. He has served on the Ocean Studies Board of the NRC/NA. He currently serves as a Co-lead for MBON. He previously received the NASA JPL Laboratory Award for Outstanding Contributions and the NASA Administrator Award for Exceptional Contribution and Service for development of satellite technologies for ocean observation.

Researcher Spotlight

Phoebe Zarnetske

Assistant Professor, Department of Forestry
Michigan State University

Dr. Phoebe Zarnetske is a NASA Biodiversity funded researcher examining how global change and Earth's geophysical attributes alter the composition, function, and distribution of ecological communities. Her work transects scales from mesocosm experiments to continental and global spatial analyses that connect process-level understanding with geographic patterns of species and biodiversity. Her taxonomic focus spans birds, mammals, trees, and macroinvertebrates, with her field and experimental work largely based in grasslands and ponds. Through NASA support, she has led a working group of interdisciplinary scientists spanning ecology, remote sensing, and statistical modeling, to understand and quantify scaling relationships among Earth's geological and biological diversity. Dr. Zarnetske's work leverages the global coverage, fine resolution, and temporal scale of NASA remotely-sensed products to forecast spatial and temporal shifts in biodiversity.

- Dr. Zarnetske's Website

Camrin Braun

Postdoctoral Research Associate
University of Washington Applied Physics Laboratory

Former NESSF fellow, Dr. Camrin Braun recently defended his dissertation with the MIT-WHOI Joint Program, and has begun a postdoctoral position with another NASA Biodiversity and Ecological Forecasting PI, Peter Gaube. Dr. Braun's dissertation work found that mesoscale eddies in open ocean are a key feature of blue shark habitat. This work utilized popular NASA remote sensing products like SST to help characterize the ocean environment and leveraged the NASA-funded HYCOM model to simulate ocean conditions and dynamics in the vertical plane to better understand how predators interact with ocean dynamics whose key influence may actually be at depth. In his new position, Dr. Braun will scale these analyses up to a multi-species, global analysis of pelagic predators interacting with (sub)mesoscale ocean physics to determine if these same relationships hold in other geographic and taxonomic systems.

- Dr. Braun's Website

NASA Biodiversity & Ecological Forecasting

Fall 2018

Applied Remote Sensing Trainings

Remote Sensing for Conservation & Biodiversity

Jan 22 & 24, 2019 (10-18:00 EDT)

This online webinar series introduces participants to the use of satellite data for conservation and biodiversity applications. The series will highlight specific projects that have successfully used satellite data.

Funding Opportunities

A.41 Advanced Information Systems Technology (AIST)

Proposals due March 12, 2019

NASA–USGS Post-Doctoral Fellowship Opportunity

Due dates announced once positions are on USAJOBS

New Award Announcements: ROSES A.8

A.8 Sustaining Living Systems in a Time of Climate Variability and Change

Grant Ballard - Integrating Winter Ecology Into the Ross Sea MPA
Charlene DiMiceli - Modeling Edge Influence on Forest Structure
Solomon Dobrowski - Decision Support for Reforestation Planning
Chris Doughty - Forest Structure & Climate Change Impact on Biodiversity
Robert Griffin - Climate-Influenced Nutrient Flows
Andrew Hansen - Sustaining Life on Land
Robert Jones – EO for Climate-Ready Aquaculture Management
Peter Kalmus - Identifying Coral Refugia from Climate Model Ensembles
Patrick Keys - Cross-scale Impacts of SDG 15 Achievement
Rebecca Lewison - Supporting Climate-Ready and Sustainable Fisheries
Gordon Luikart - Predicting the Spread of Aquatic Invasive Species
Anna Pidgeon - Modeling Endangered' Species Forest Habitats
Erika Podest - Sustainable Forest Management in Panama
Eric Sanderson - Sustainable Development Goal 15: The Tiger As Model
James Watson - Fishing From Space
Danielle Wood - Applications for Terrestrial and Wetland Ecosystems
Benjamin Zuckerberg - The Conservation of Winter Environments

Upcoming Conferences

American Meteorological Society
Phoenix, AZ (1/6 – 1/10/19)

Society for Integrative and Comparative Biology
Tampa, FL (1/3 – 1/7/19)

International Association for Landscape Ecology
Fort Collins, CO (4/7 – 4/11/19)
Abstracts Due: 1/7/19

Evolution
Providence, RI (6/24-6/28/19)

International Congress for Conservation Biology
Kuala Lumpur, Malaysia (7/21 – 7/25/19)

Behaviour
Chicago, Il (7/23 – 7/27/19)

Embedding Ecology in Sustainable Development Goals
Lisbon, Spain (7/29 – 8/3/19)

Ecological Society of America
Louisville, KY (8/11 – 8/16/19)
Abstracts Due: 2/21/19

The Wildlife Society & The American Fisheries Society Conference
Reno, Nevada (9/29 – 10/3/19)

Recent Publications From The Program

Dickson, B., C. Albano, R. Anantharaman, P. Beier, J. Fargione, T. Graves, M. Gray, K. Hall, J. Lawler, P. Leonard, C. Littlefield, M. McClure, J. Novembre, C. Schloss, N. Schumaker, V. Shah, and D. Theobald. Circuit-theory applications to connectivity science and conservation. Conservation Biology (2018).

Forester, B., E. Landguth, B. Hand, and N. Balkenhol. Landscape Genomics for Wildlife Research. In Population Genomics (2018): 1-40.

Garaba, S., J. Aitken, B. Slat, H. Dierssen, L. Lebreton, O. Zielinski, and J. Reisser. Sensing Ocean Plastics with an Airborne Hyperspectral Shortwave Infrared Imager. Environmental science & technology 52, no. 20 (2018): 11699-11707.

Goodwin, K., F. Muller-Karger, A. Djurhuus, L. Allen, A. Allen, J. McCrow, and G. Canonico Hyde. Molecular Approaches for an Operational Marine Biodiversity Observation Network. In World Seas: an Environmental Evaluation, pp. 613-631. Academic Press, 2019.

Recent Publications From The Program (continued)

Hardy, R., C. Hu, B. Witherington, B. Lapointe, A. Meylan, E. Peebles, L. Meirose, and S. Hirama. Characterizing a Sea Turtle Developmental Habitat Using Landsat Observations of Surface-Pelagic Drift Communities in the Eastern Gulf of Mexico. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 99 (2018).

Harrison, D., M. Hinton, S. Kohin, E. Armstrong, S. Snyder, F. O'Brien, and D. Kiefer. The pelagic habitat analysis module for ecosystem-based fisheries science and management. Fisheries Oceanography 26:3 (2017): 316-335.

Kavanaugh, M., M. Church, C. Davis, D. Karl, R. Letelier, and S. Doney. ALOHA from the Edge: Reconciling three decades of in situ Eulerian observations and geographic variability in the North Pacific Subtropical Gyre. Frontiers in Marine Science 5 (2018): 130.

Leasure, D., S. Wenger, N. Chelgren, H. Neville, D. Dauwalter, R. Bjork, K. Fesenmyer, J. Dunham, M. Peacock, C. Luce, and A. Lute. Hierarchical multi-population viability analysis. Ecology (2018).

Leidner, A., and G. Buchanan, eds. Satellite Remote Sensing for Conservation Action: Case Studies from Aquatic and Terrestrial Ecosystems. Cambridge University Press, 2018.

Luikart, G., M. Kardos, B. Hand, O. Rajora, S. Aitken, and P. Hohenlohe. Population genomics: advancing understanding of nature. In Population Genomics (2018): 1-77.

McCabe, J., H. Yin, J. Cruz, V. Radeloff, A. Pidgeon, D. Bonter, and B. Zuckerberg. Prey abundance and urbanization influence the establishment of avian predators in a metropolitan landscape. Proc. R. Soc. B 285, no. 1890 (2018).

McCarthy, M., B. Dimmitt, and F. Muller-Karger. Rapid Coastal Forest Decline in Florida's Big Bend. Remote Sensing 10, no. 11 (2018): 1721.

Peters, W., M. Hebblewhite, A. Mysterud, D. Eacker, A. Hewison, J. Linnell, S. Focardi, F. Urbano, J. De Groeve, B. Gehr, M. Heurich, A. Jarnemo, P. Kjellander, M. Kröschel, N. Morellet, L. Pedrotti, H. Reinecke, R. Sandfort, L. Sönnichsen, P. Sunde, and F. Cagnacci. Large herbivore migration plasticity along environmental gradients in Europe: life-history traits modulate forage effects. Oikos (2018).

Putman, N., G. Goni, L. Gramer, C. Hu, E. Johns, J. Trinanes, and M. Wang. Simulating transport pathways of pelagic Sargassum from the Equatorial Atlantic into the Caribbean Sea. Progress in Oceanography (2018).

Schmitz, O., C. Wilmers, S. Leroux, C. Doughty, T. Atwood, M. Galetti, A. Davies, and S. Goetz. Animals and the zoogeochemistry of the carbon cycle. Science 362, no. 6419 (2018): eaar3213.

Schuerger, A., D. Smith, D. Griffin, D. Jaffe, B. Wawrik, S. Burrows, B. Christner, C. Gonzalez-Martin, E. Lipp, D. Schmale III, and H. Yu. Science questions and knowledge gaps to study microbial transport and survival in Asian and African dust plumes reaching North America. Aerobiologia: 1-11 (2018).

St Peter, J., J. Hogland, M. Hebblewhite, M. Hurley, N. Hupp, and K. Proffitt. Linking Phenological Indices from Digital Cameras in Idaho and Montana to MODIS NDVI. Remote Sensing 10, no. 10 (2018): 1612.

Wang, M., and C. Hu. On the continuity of quantifying floating algae of the Central West Atlantic between MODIS and VIIRS. International Journal of Remote Sensing 39, no. 12 (2018): 3852-3869.

Wang, M., C. Hu, J. Cannizzaro, D. English, X. Han, D. Naar, B. Lapointe, R. Brewton, and F. Hernandez. Remote sensing of Sargassum biomass, nutrients, and pigments. Geophysical Research Letters (2018).

Wang, Z., P. Townsend, A. Schweiger, J. Couturec, A. Singha, S. Hobbie, and J. Cavender-Bares. Mapping foliar functional traits and their uncertainties across three years in a grassland experiment. Remote Sensing of Environment 221 (2019): 405–416.

Welch, H., E. Hazen, S. Bograd, M. Jacox, S. Brodie, D. Robinson, K. Scales, L. Dewitt, and R. Lewison. Practical considerations for operationalizing dynamic management tools. Journal of Applied Ecology (2018).

NASA Biodiversity and Ecological Forecasting

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Jay Skiles – Program Associate, Ames Research Center
Keith Gaddis – Senior Support Scientist, NASA HQ