NASA Biodiversity & Ecological Forecasting

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

Spring 2019

Conference Sessions

We are in the midst of planning our 2020 conference calendar. We are submitting session proposals for IUCN WCC, IALE, ESA, and NACCB. Please let us know if you are interested in collaborating or contributing. Also, please let us know of other conferences we should have a greater presence.

NOTE: AGU 2019 Session

Abstract submission is open for **AGU 2019**, and we invite you to submit abstracts for poster or oral contributions to our session **"Advances in the application of remote sensing for biodiversity monitoring."** Click here to submit by the **July 31 deadline.**

Updates Reminder

Please send us manuscripts that have been accepted to journals. The best time to email is after the manuscript has been accepted, but well before it appears online or in print. This allows us to work internally to have your work highlighted when your paper is actually published. Also, please let us know if you or your collaborators have received recognition from your institution or community for your research. These updates help us advertise our program to the public, administration, and our community.

15th Annual NASA BDEF Team Meeting - 2019

The NASA Biodiversity and Ecological Forecasting (BDEF) Team Meeting and one day MBON All Hands Meeting were held in DC, May 21-24. Over 160 participants attended, with 60 oral presentations and 40 posters featuring NASA funded research.

Surface Biology & Geology Community Workshop

On June 12-14, the Surface Biology and Geology (SBG) Community Workshop was held in DC. SBG is one of five designated observables recommended for NASA by the 2017 NAS Decadal Survey.

SBG
SURFACE BIOLOGY AND GEOLOGY

This potential hyperspectral plus thermal multispectral mission would build on the success of past and ongoing missions and open new doors for answering essential ecological, geological, and hydrological questions. The SBG study team is determining how to implement this observing system by:

- Identifying a diverse set of potential observing architectures
- Assessing their performance/cost relative to SBG objectives
- Designing actual candidate SBG architectures

The meeting provided an overview of the four Research & Applications Working Groups (Algorithms, Cal/Val, Modeling, Applications) while opening discussion on the objectives for the observing system, concepts for system architectures, and scientific advances in imaging spectroscopy and thermal remote sensing. Over 170 participants attended the three day meeting.

Applied Remote Sensing Training

Land Degradation and Sustainable Cities SDGs

July 9,16, 23, 2019 (10-11:30 and 18-19:30 EST)

Attendees will learn QGIS plugin, Trends.Earth, created by Conservation International. Speakers from the UN Convention to Combat Desertification and UN Habitat will speak to its use for decision making.

A Q&A Session on Radar Remote Sensing

July 17, 2019 (13-15:00 and 17-19:00 EST)

The goal of this live session is to provide participants with the opportunity to ask questions to a panel of SAR data experts.

EO for Disaster Risk Assessment & Resilience

July 6, 8, 13, 15, 2019 (13-15:00 and 17-19:00 EST)

This webinar series will focus on EO data useful for disaster risk assessment. The series will cover natural disasters including tropical cyclones, flooding, wildfires, and heat stress. The training will also include access of socioeconomic and disaster damage data.

Opportunities

Remote Sensing in Ecosystem Modelling: Special Issue

Invitation open for manuscripts that merge EO and other data products to understand ecosystems through modelling. Manuscripts will be accepted until September 30, 2020.

OceanObs'19

This is a community driven conference for global participation to communicate decadal progress of ocean observing networks and to chart innovative solutions that address growing needs for ocean information. Opportunities exist for participation in breakout sessions (including a session on Ecosystem Health and Biodiversity).

NEON Science Summit – Hosted by Earth Lab

Boulder, Colorado on October 15-17

This meeting will convene current and prospective users of data from the National Ecological Observatory Network (NEON) to explore major questions that can be addressed at continental scales. Applications due July 22, 2019.

Earth Observations for SDG Awards

This awards program will recognize productivity, innovation, and exemplary communications of results and experiences in the use of EO to support the SDGs. Nominations are due by June 30, 2019.

Conway Science Fellowship

Awarded to address one of three NPS challenges: Increasing visitor use, ocean and coastal resource stewardship, and collaborative conservation. Applications are due by June 30, 2019.

Upcoming Conferences

Society for Conservation GIS
Monterey, CA (7/15 – 7/17/19)

I.C. for Conservation Biology
Malaysia (7/21 – 7/25/19)

Embedding Ecology in SDGs
Lisbon, Spain (7/29 – 8/3/19)

Ecological Society of America
Louisville, KY (8/11 – 8/16/19)

OceanObs'19
Honolulu, Hawaii (9/16 – 10/3/19)

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

AGU 2019
San Francisco, CA (12/9 – 12/13/19)

GLOBE Land Cover App

This spring, NASA GLOBE launched a new app to include citizen scientists in our efforts to map the three-dimensional structure of ecosystems. With the GLOBE Trees feature of the app, observers record tree height by tilting their phone up and down to align the screen with the tree's top branch and base, and pace off the distance to the tree. The app does the rest to calculate the tree's height. Anyone can visualize all of the tree height and other GLOBE data simply by visiting the website (https://observer.globe.gov).

Research Briefs

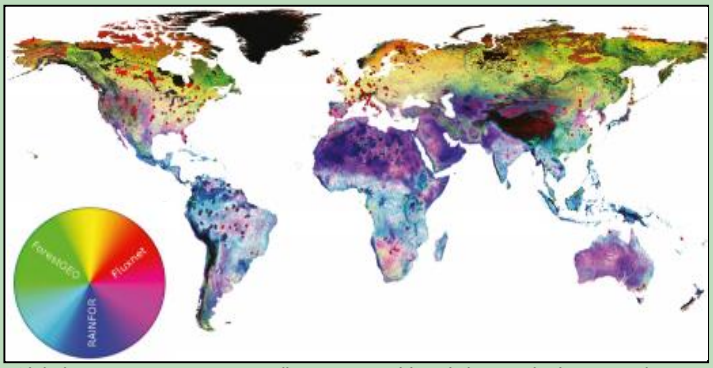
Enhancing Global Change Experiments Through Integration of Remote-Sensing Techniques

Shiklomanov et al (2019) Front Ecol Environ

The authors discuss five RS techniques that improve the context and accuracy of global change studies:

- **Spectroscopy** is used to study leaf traits.
- **Thermal** and **Florescent Imaging** provides continuous information of plant biochemical cycles.
- **Terrestrial Laser Scanning** can be used to measure tree canopy coverage.
- **Digital Repeat Photography** provides information about plant and tree coverage over time.

Collaboration between remote-sensing scientists and ecologists will markedly improve the depth and reach of global change studies, by increasing the precision of inference beyond the boundaries of the experiments.



Global ecosystems are not equally represented in existing monitoring networks. Colors represent bioclimatic similarity to the area covered by three large global networks. Dark colors represent areas not well represented by any network.

The Ethical Considerations of Ecological Forecasting: *For Marine Resources*

Hobday et al (2019) ICES J. Mar. Sci.

10 Principles to Avoid Eco-Forecasting Ethical Pitfalls

1: Be open and transparent.
2: Don't deliver forecasts that lead to unregulated impacts.
3: Skill assessments - tests model with out-of-sample data.
4: Do not ignore uncertainty.
5: Plan for and manage expectations of continued delivery.
6: Stakeholder capacity building around forecast.
8: Be vigilant for inequity in forecast use.
9: Scope the system context widely.
10: Consider the holistic outcome of forecast system.

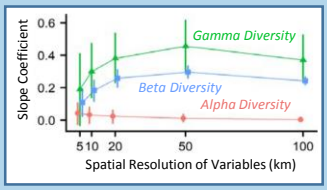
A set of principles that should be considered when scoping, developing, delivering, and evaluating ecological forecasts for marine resource users, based on author's case study review.

Ecological forecasts are now possible at a range of time scales. Delivery of these products offers resource managers and users relevant insight into ecosystem patterns and future conditions to support decision making. However, the pace of progress in forecast development is so rapid that the scientific community may not be considering fully the impacts on stakeholders. Delivery of information involves a range of judgements, or "ethical" considerations, including treatment of forecast failure, inequity in stakeholder response options, and winners and losers in commercial markets. Here, the authors explore the unanticipated considerations via case studies spanning commercial fishing, recreational fishing, aquaculture, and conservation.

Scale Matters When Comparing Biodiversity & Geodiversity

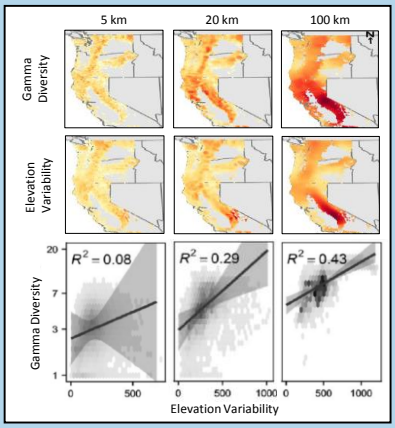
Zarnetske et al. (2019) GEB

Geodiversity has strong effects on biodiversity patterns. However, major gaps remain in our understanding of how relationships between biodiversity and geodiversity vary over space and time. Biodiversity data are globally sparse and unevenly distributed. In contrast, many forms of geodiversity can be measured continuously across the globe with satellite remote sensing at meter scale elucidating biodiversity–geodiversity relationships across scales.



Scaling relationships between variation in biodiversity and geodiversity seen in the glm slope coefficients.

The authors compare one geodiversity variable, elevation (SRTM), with three forms of taxonomic diversity (alpha, beta, and gamma) of trees (FIA plots) at five spatial resolutions. Both the spatial resolution and form of diversity examined influence the distribution of variance for the variables and strength of the relationships between them.



Distribution of variation in tree biodiversity and topographic geodiversity (above in red) and their relationship (below) depend on spatial resolution examined (shown at 5, 20, 100 km).

Researcher Spotlight

Danielle Rappaport

PhD Candidate,
University of Maryland

Ms. Danielle Rappaport examines the human transformation of forested landscapes. She uses emerging analytic and remote sensing technologies to characterize the ecological legacy of land-use change at policy-relevant scales. Her current work advances our understanding of the long-term impacts of forest degradation from fire and logging on carbon storage and biodiversity at the Amazon frontier. Ms. Rappaport has developed approaches for integrating 3D sound and structure data to target operational forest monitoring needs. Her research enhances the use of remote audio surveys to enable routine multi-taxa monitoring system that bypasses the need for manual species identification. Ms. Rappaport 's work is on the leading edge of remote sensing science utilizing the latest Earth observations and in situ tools to detect and understand previously intractable biological phenomena. These advances bridge the scale gaps between field-based and space-borne observations to measure subtle ecosystem variability at the landscape scale. Ms. Rappaport is a NESSF awardee. Her dissertation is scheduled for completion this winter.

- Ms. Rappaport's Website

Adam Wilson

Assistant Professor,
University at Buffalo

Dr. Adam Wilson studies the impacts of global change on biodiversity and ecosystem function at regional to global scales. He uses long-term records of ecosystem dynamics recorded in satellite remote sensing products and field observations, together with mechanistic and statistical modelling, to infer how ecosystems have responded to past environmental change. He is especially interested in the role of biodiversity in modulating ecosystem resilience. Dr. Wilson has a history of support through the NASA Biodiversity program as well as interdisciplinary calls with Ecological Forecasting and AIST. He additionally serves as a NASA GLOBE educator in a local elementary school to get students excited about science, the Earth system, and NASA. His work has been featured in the NY Times, Washington Post, BBC, Vox, and Wired. In addition, his NASA-funded work on the effects of climate on post-fire recovery in Southern Africa received an award from the United Nations in 2017. Dr. Wilson leverages NASA's multi-decadal remotely sensed records of ecosystem change to use patterns of past environmental change to improve our prediction of the future.

- Dr. Wilson's Website

Orbiting Carbon Observatory 3 (OCO-3) Launch

On May 4th, the Orbiting Carbon Observatory 3 launched to the ISS. OCO-3 will observe near-global measurements of carbon dioxide on land and sea. This instrument is far more versatile and powerful than its predecessor, OCO-2. Since ISS orbits Earth every 90 minutes, OCO-3 will complete 16 passes a day. OCO-3 will map the movement of carbon dioxide between plants and the atmosphere This data will help us better understand plant uptake of carbon and the impact current environmental and anthropogenic change have on the future.

Recent Publications From The Program

Amish, S., O. Ali, M. Peacock, M. Miller, M. Robinson, S. Smith, G. Luikart, and H. Neville. "Assessing thermal adaptation using family-based association and FST outlier tests in a threatened trout species." Molecular ecology (2019).

Benito, X., M. Feitl, S. Fritz, P. Mosquera, T. Schneider, H. Hampel, L. Quevedo, and M. Steinitz-Kannan. "Identifying temporal and spatial patterns of diatom community change in the tropical Andes over the last c. 150 years." Journal of Biogeography (2019).

Bogan, S., A. Antonarakis, and P. Moorcroft. "Imaging spectrometry-derived estimates of regional ecosystem composition for the Sierra Nevada, California." Remote Sensing of Environment 228 (2019): 14-30.

Castagna, A., B. Johnson, K. Voss, H. Dierssen, H. Patrick, T. Germer, K. Sabbe, and W. Vyverman. "Uncertainty in global downwelling plane irradiance estimates from sintered polytetrafluoroethylene plaque radiance measurements." Applied Optics 58:16 (2019): 4497-4511.

Fennel, K., S. Alin, L. Barbero, W. Evans, T. Bourgeois, S. Cooley, J. Dunne, R. Feely, J. Hernandez-Ayon, X. Hu, S. Lohrenz, F. Muller-Karger, R. Najjar, L. Robbins, E. Shadwick, S. Siedlecki, N. Steiner, A. Sutton, D. Turk, P. Vlahos, and Z. Wang. "Carbon cycling in the North American coastal ocean: a synthesis." Biogeosciences 16 (2019).

Gomes, H., K. McKee, A. Mile, S. Thandapu, K. Al-Hashmi, X. Jiang, and J. Goes. "Corrigendum: Influence of Light Availability and Prey Type on the Growth and Photo-Physiological Rates of the Mixotroph Noctiluca scintillans." Frontiers in Marine Science 6 (2019): 342.

Grummer, J., L. Beheregaray, L. Bernatchez, B. Hand, G. Luikart, S. Narum, and E. Taylor. "Aquatic Landscape Genomics and Environmental Effects on Genetic Variation." Trends in Ecology & Evolution (2019).

Hobday, A., J. Hartog, J. Manderson, K. Mills, M. Oliver, A. Pershing, and S. Siedlecki. "Ethical considerations and unanticipated consequences associated with ecological forecasting for marine resources." ICES Journal of Marine Science (2019).

Matson, P., L. Washburn, E. Fields, C. Gotschalk, T. Ladd, D. Siegel, Z. Welch, and M. Iglesias-Rodriguez. "Formation, development, and propagation of a rare coastal coccolithophore bloom." Journal of Geophysical Research: Oceans 124:5 (2019): 3298-3316.

Meerdink, S., S. Hook, D. Roberts, and E. Abbott. "The ECOSTRESS spectral library version 1.0." Remote Sensing of Environment 230 (2019): 111196.

Nathan, L., N. Mamoozadeh, H. Tumas, S. Gunselman, K. Klass, A. Metcalfe, C. Edge, L. Waits, P. Spruell, E. Lowery, E. Connor, A. Bearlin, M. Fortin, and E. Landguth. "A spatially-explicit, individual-based demogenetic simulation framework for evaluating hybridization dynamics." Ecological Modelling 401 (2019): 40-51.

Proffitt, K., J. DeVoe, K. Barker, R. Durham, T. Hayes, M. Hebblewhite, C. Jourdonnais, P. Ramsey, and J. Shamhart. "A century of changing fire management alters ungulate forage in a wildfire-dominated landscape." Forestry: An International Journal of Forest Research (2019).

Rodgers, T., J. Olson, and K. Mock. "Use of RN ase H-dependent PCR for discrimination and detection of closely related species from environmental DNA." Methods in Ecology and Evolution (2019).

Shiklomanov, A., B. Bradley, K. Dahlin, A. Fox, C. Gough, F. Hoffman, E. Middleton, S. Serbin, L. Smallman, and W. Smith. "Enhancing global change experiments through integration of remote-sensing techniques." Frontiers in Ecology and the Environment 17:4 (2019): 215-224.

Tinoco, B., L. Graham, P. Astudillo, A. Nieto, J. Aguilar, S. Latta, and C. Graham. "Survival estimates of bird species across altered habitats in the tropical Andes." Journal of Field Ornithology (2019).

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