NASA Biodiversity & Ecological Forecasting

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

Summer 2018

GLOBE Land Cover App

This month, NASA GLOBE launched a new app to create more detailed satellite-based global maps of land cover that are fed by on-the-ground images gathered by citizen scientists. The App (Land Cover: Adopt a Pixel) enables smartphone photography and field land cover classifications that are then matched with satellite observations. The app will provide an exponential increase in ground validation for land cover mapping and a novel means for the public to engage with satellite imagery and the Earth.
https://www.globe.gov/globe-data

Updates Reminder

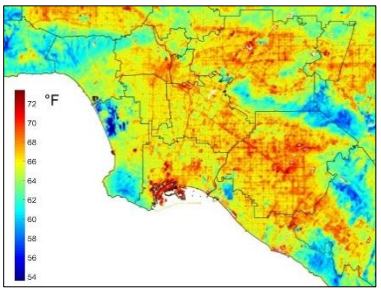
Please send us manuscripts that have been accepted to journals. The best time to email is after the manuscript has been accepted, but well before it appears online or in print so we can work internally to highlight your paper when it is published. Also, please let us know of any awards or recognition for your research that help us advertise our program and PIs to the public, administration, and our research community.

The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS)

On June 29th the SpaceX cargo resupply mission launched from Florida's Cape Canaveral Air Force Station carrying the The ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) instrument to the ISS where it begins a 12 month mission. After a few days of testing and start-up activities, ECOSTRESS acquired its first-light image on July 9th.

The ECOSTRESS mission will measure the temperature of plants and use that information to better understand how much water plants need and how they respond to stress. The mission will address three overarching science questions:

- How is the terrestrial biosphere responding to changes in water availability?
- How do changes in diurnal vegetation water stress impact the global carbon cycle?
- Can agricultural vulnerability be reduced through advanced monitoring of agricultural water consumptive use and improved drought estimation?



ECOSTRESS captured surface temperature in Los Angeles, CA in the early morning hours of 7/22/18.

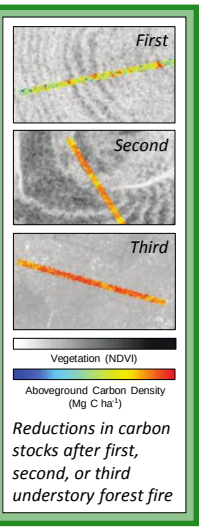
The ECOSTRESS mission will answer these questions using a multispectral thermal infrared radiometer that will acquire the most detailed temperature images of the Earth surface ever acquired from space. This instrument is capable of measuring the temperature of an individual farmer's field.

Research Briefs

Quantifying long-term changes in carbon stocks and forest structure from Amazon forest degradation

Rappaport et al. (2018) Environ. Res. Lett. 13

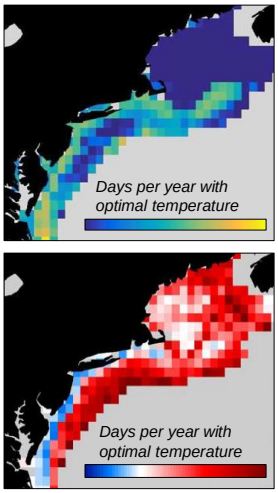
Forest degradation is widespread across the Amazon, yet degradation emissions remain excluded from carbon monitoring systems due to data gaps on forest recovery from logging and fire. In a recent study, Danielle Rappaport and colleagues published the first look-up table of carbon emission factors for Amazon forest degradation. Using Landsat time series and airborne LIDAR, they constructed models of carbon loss and recovery from the largest sample to date of logged and burned Amazon forests. The PIs found that the carbon legacy of Amazon forest degradation was larger, more persistent, and more variable than previously reported. Their published degradation emissions factors represent an important foundation for further investigations into the relative contributions of forest degradation to regional carbon cycling and REDD + efforts.



Reductions in carbon stocks after first, second, or third understory forest fire

Implications of future northwest Atlantic bottom temperatures on the American lobster fishery

Rheuban et al. (2017) J. Geophys. Res. - Oceans 122 (12)



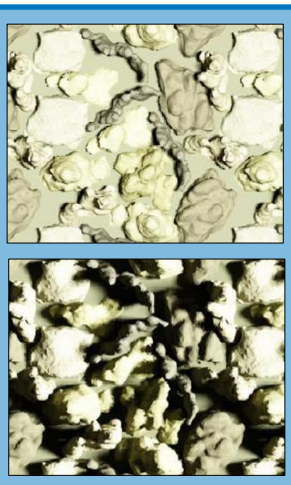
Optimal Lobster habitat under present (top) and forecasted future (bottom) benthic temp.

A wealth of research has demonstrated that warming can trigger changes in the biology of many marine organisms. Nevertheless, global temperature records for benthic systems is inconsistently available, preventing identification of temperature dependent biological responses or early disturbance detection. For instance, the American Lobster is constrained by a narrow temperature range at which adults can survive and eggs are capable of hatching. The PIs here generated an interpolated surface that provided 30 years of monthly temperature data for the benthic northeastern US. They showed that temperatures have warmed sharply in the same areas lobster populations have declined and forecast continued losses with surviving lobster species likely to move further offshore. These results indicate major fishing industry financial loses through reduced harvest and necessary recapitalizing in ships that are capable of operating in waters further offshore.

Influence of 3D coral structures on hyperspectral benthic reflectance and water-leaving reflectance

Hedley et al. (2018) Applied Sciences

How does the color of reef-building corals change under different environmental conditions? The Pis addresses how the three-dimensional shape or "rugosity" influences the reflected color of different types of corals. From molds of Hawaiian coral species, they created 3-D computer models of massive and finger-like corals and modeled how shadowing influenced reflected light under different sky and water conditions. Their results show that shape plays an important role in the color that is reflected back to an aircraft or satellite. They present simplifying factors and guidance that can be used to map corals across the tropical oceans using ocean color remote sensing.



Upcoming Applied Remote Sensing Trainings

Advanced Webinar: Change Detection for Land Cover Mapping
Sept 28 - Oct 5, 2018 (10-12:00 & 18-20:00 EDT)
https://arset.gsfc.nasa.gov/land/webinars/adv-change18

Satellite Remote Sensing of Air Quality
Nov 18 - Nov 19, 2018 (9:00 - 18:00 IST)
IIRS, Dehradun, India
https://arset.gsfc.nasa.gov/airquality/workshops/india2018

Upcoming Conferences

The Wildlife Society Annual Conference
Cleveland, OH (Oct 7 - 11)

GEO Plenary
Kyoto, Japan (Oct 29 – Nov 2)

A Community on Ecosystem Services (ACES)
Washington, DC (Dec 3 - 5)

AGU Fall Meeting
Washington, DC (Dec 10 - 14)

Recent Publications From The Program

Adhikari, A., and A.J. Hansen. Land use change and habitat fragmentation of wildland ecosystems of the North Central United States. Landscape and Urban Planning 177 (2018): 196-216.

Bailey, H., E. Hazen, B. Mate, S.J. Bograd, L. Irvine, D.M. Palacios, K.A. Forney et al. 8 Lessons learned from WhaleWatch. Satellite Remote Sensing for Conservation Action: Case Studies from Aquatic and Terrestrial Ecosystems (2018): 229.

Brodie, S., M.G. Jacox, S.J. Bograd, H. Welch, H. Dewar, K.L. Scales, S.M. Maxwell et al. Integrating dynamic subsurface habitat metrics into species distribution models. Frontiers in Marine Science 5 (2018): 219.

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Coldren, G.A., J.A. Langley, I.C. Feller, and S.K. Chapman. Warming accelerates mangrove expansion and surface elevation gain in a subtropical wetland. Journal of Ecology (2018).

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Hauser, D., K.L. Laidre, and H.L. Stern. Vulnerability of Arctic marine mammals to vessel traffic in the increasingly ice-free Northwest Passage and Northern Sea Route. Proceedings of the National Academy of Sciences (2018): 201803543.

Hazen, E.L., K.L. Scales, S.M. Maxwell, D.K. Briscoe, H. Welch, S.J. Bograd, H. Bailey et al. A dynamic ocean management tool to reduce bycatch and support sustainable fisheries. Science Advances 4, no. 5 (2018): eaar3001.

Hendricks, S., E.C. Anderson, T. Antao, L. Bernatchez, B.R. Forester, B. Garner, B.K. Hand et al. Recent advances in conservation and population genomics data analysis. Evolutionary Applications 11, no. 8 (2018): 1197-1211.

Hilton, A., J. Bausell, and R. Kudela. Quantification of polychlorinated biphenyl (PCB) concentration in San Francisco Bay using satellite imagery. Remote Sensing 10, no. 7 (2018): 1110.

Recent Publications From The Program (continued)

Howard, K., J. Ewing-Taylor, and T. Albright. Inspiring student-driven observations: Measuring the surprising complexity of environmental temperatures using low-cost sensors. Science Scope 42, no. 1 (2018): 34.

Huemmrich, K.F., P.E. Campbell, S.K. Voorhies, D.R. Landis, and E.M. Middleton. Describing prairie C4 plant species area coverage using hyperspectral reflectance. International Journal of Remote Sensing (2018): 1-12.

Humphries, G. R. W., C. Che-Castaldo, P. J. Bull, G. Lipstein, A. Ravia, B. Carrión, T. Bolton, A. Ganguly, and H. J. Lynch. Predicting the future is hard and other lessons from a population time series data science competition. Ecological Informatics 48 (2018): 1-11.

Ireland, K.B., A.J. Hansen, R.E. Keane, K. Legg, and R.L. Gump. Putting climate adaptation on the map: Developing spatial management strategies for whitebark pine in the greater Yellowstone ecosystem. Environmental Management 61, no. 6 (2018): 981-1001.

Ironside, K.E., D.J. Mattson, T. Arundel, T. Theimer, B. Holton, M. Peters, T.C. Edwards Jr, and J. Hansen. Geomorphometry in landscape ecology: Issues of scale, physiography, and application. Environment and Ecology Research 6, no. 5 (2018): 397-412.

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Lafferty, K.D., K.C. Benesh, A.R. Mahon, C.L. Jerde, and C.G. Lowe. Detecting southern California's white sharks with environmental DNA. Frontiers in Marine Science 5 (2018): 355.

Mathys, A.S., N.C. Coops, S.W. Simard, R.H. Waring, and S.N. Aitken. Diverging distribution of seedlings and mature trees reflects recent climate change in British Columbia. Ecological Modelling 384 (2018): 145-153.

Miloslavich, P., N.J. Bax, S.E. Simmons, E. Klein, W. Appeltans, O. Aburto-Oropeza, M. Andersen Garcia et al. Essential ocean variables for global sustained observations of biodiversity and ecosystem changes. Global Change Biology 24, no. 6 (2018): 2416-2433.

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Muller-Karger, F.E., Y.M. Astor, C.R. Benitez-Nelson, K.N. Buck, K.A. Fanning, L. Lorenzoni, E. Montes et al. The scientific legacy of the CARIACO ocean time-series program. Annual Review of Marine Science (2018).

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Pigot, A.L., W.Jetz, C. Sheard, and J.A. Tobias. The macroecological dynamics of species coexistence in birds. Nature Ecology & Evolution (2018): 1.

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Rappaport, D.I., D.C. Morton, M. Longo, M. Keller, R. Dubayah, and M.N. dos-Santos. Quantifying long-term changes in carbon stocks and forest structure from Amazon forest degradation. Environmental Research Letters 13, no. 6 (2018): 065013.

Reiter, M.E., N.K. Elliott, D. Jongsomjit, G.H. Golet, and M.D. Reynolds. Impact of extreme drought and incentive programs on flooded agriculture and wetlands in California's Central Valley. PeerJ 6 (2018): e5147.

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Stoner, D.C., J.O. Sexton, D.M. Choate, J. Nagol, H.H. Bernales, S.A. Sims, K.E. Ironside, K.M. Longshore, and T.C. Edwards Jr. Climatically driven changes in primary production propagate through trophic levels. Global Change Biology (2018).

Thompson, D.R., V. Natraj, R.O. Green, M.C. Helmlinger, B. Gao, and M.L. Eastwood. Optimal estimation for imaging spectrometer atmospheric correction. Remote Sensing of Environment 216 (2018): 355-373.

Wang, M., C. Hu, J. Cannizzaro, D. English, X. Han, et al. Remote sensing of Sargassum biomass, nutrients, & pigments. Geophysical Research Letters (2018).

Wares, J.P., S. Crickenberger, A.F. Govindarajan, J.L. Hamrick, K.M. Skoczen, D.W. Trapnell, and D.S. Wethey. The cryptic population biology of *Chthamalus fragilis* (Cirripedia, Thoracica) on the Atlantic coast of North America. Journal of Crustacean Biology (2018).

Wei, J., Z. Lee, R. Garcia, L. Zoffoli, R.A. Armstrong, Z. Shang, P. Sheldon, and R.F. Chen. An assessment of Landsat-8 atmospheric correction schemes and remote sensing reflectance products in coral reefs and coastal turbid waters. Remote Sensing of Environment 215 (2018): 18-32.

Yao, W., J. van Aardt, M. van Leeuwen, D. Kelbe, and P. Romanczyk. A simulation-based approach to assess subpixel vegetation structural variation impacts on global imaging spectroscopy. IEEE Transactions on Geoscience and Remote Sensing 56, no. 7 (2018): 4149-4164.

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