Monitoring Biodiversity from Space

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Digital Data in Biodiversity Research Conference
How is the global Earth changing?

What causes these changes in the Earth system?

How will the Earth system change in the future?

How can Earth system science provide societal benefit?
Earth Science at NASA

Earth Science Technology Office

Flight Program

Research and Analysis Program

Applied Sciences Program
Earth Science at NASA

- Earth Science Technology Office
- Flight Program
- Research and Analysis Program
- Applied Sciences Program
Earth Science at NASA

Research and Analysis Program

Applied Sciences Program
Earth Science at NASA

Applied Sciences Program
- Health and Air Quality
- Disasters
- Water Resources
- Ecological Forecasting

Research and Analysis Program
- Biodiversity
- Terrestrial Ecology
- Ocean Biology and Biogeochemistry
- Land Cover/Land Use Change

Carbon Cycle and Ecosystems
Earth Science at NASA

Research and Analysis Program

Applied Sciences Program

Health and Air Quality
Disasters
Water Resources

Carbon Cycle and Ecosystems

Terrestrial Ecology
Ocean Biology and Biogeochemistry
Land Cover/Land Use Change

Ecological Forecasting

Biodiversity

Woody Turner, Program Manager
Biodiversity

Uses Earth Observations and models to improve our understanding of biological diversity, how and why it’s changing and its effects on and interactions with the Earth system.
Ecological Forecasting

Integrates Earth observations and models to enable better conservation and more sustainable natural resource management.
The Benefits

Satellite imagery provides a relatively inexpensive method to collect multi-temporal information over large areas.

**Land**
- Land cover
- Topography
- Snow cover
- Disturbance

**Ocean**
- Sea Surface Temperature
- Sea Surface Height
- Chlorophyll concentration
The Challenge

**Land**
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**Ocean**
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Images:
1. A hummingbird in flight.
2. A mountain lion.
3. A fish in an aquarium.
4. A whale breaching in the ocean.
A global biodiversity observation network that contributes to effective management policies for the world’s biodiversity and ecosystem services.

Activities to advance, build, and deliver remote sensing supported species distribution and species abundance Essential Biodiversity Variables (Walter Jetz, Yale University)

Integration of Earth observations for decision making on biodiversity management and conservation in Colombia (Victor Gutierrez-Velez, Temple University)

Laying the foundation of the Pole-to-Pole Marine Biodiversity Observation Network of the Americas (Enrique Montes, University of South Florida-Tampa)

https://geobon.org
Citizen Science and Crowd Sourcing

SNAPSHOT WISCONSIN

Integrating camera traps, remote sensing and citizen science to improve ecological forecasting
SNAPSHOT WISCONSIN

 Volunteers set up cameras

 Upload photos to database

 Crowdsourcing photo id

 Wildlife monitoring and modeling

PI Phil Townsend, University of Wisconsin
600 volunteers 800 cameras 10 million photos

Project statistics

998 Enrolled volunteers maintain
1,152 Cameras, returning
20,411,915 Photos
(Updated May 23, 2018)
Crowdsourcing with Zooniverse

5,000 volunteers 1 million classifications
Online Global Community

Zooniverse
snapshotwisconsin.org
Estimating animal distributions

WNDR currently estimates animal distributions using fall harvest statistics and assumptions related to doe productivity and other factors.

Models predict:
- Relatively few deer in the north and central part of the state; more deer in the west.
- Greater carnivore richness in the north.
- Lower deer abundance in the north due to greater carnivore richness and temperature.

Deer abundance: A) Data used by DNR; B) Project model results.

Comparison of carnivore richness (left) with deer abundance (right).
Environmental DNA (eDNA)
System for Mapping and Predicting Species of Concern
PI: John Olson, CSU Monterey Bay

National Petroleum Reserve - Alaska

23 million acres
1000s of miles of streams
Being rapidly developed
System for Mapping and Predicting Species of Concern
PI: John Olson, CSU Monterey Bay

Develop & apply eDNA assays

Arctic Char Complex
(Salvelinus alpinus, malma)
Bayesian data-model synthesis for biological conservation and management in Antarctica

Heather J. Lynch¹, Mathew Schwaller²
Chris Che-Castaldo¹, Grant Humphries¹, Michael Schrimpf¹

¹Stony Brook University Ecology & Evolution
²NASA Goddard
From Research to Governance in Antarctica
Heather Lynch (Stony Brook University) & Matthew Schwaller (NASA Goddard)

2 - Discovery: Discovered several penguin and petrel "mega-colonies". Reshaping our understanding of seabird biogeography.

3 - Ground validation: Landsat-enabled exploration of previously unsurveyed territory

4 - Influencing management: Danger Islands colonies were not considered a high priority for conservation but this is now being revised as a direct result of discoveries made using Landsat imagery under NASA funding.

>300 stories in major media press (national & international)
How can you find and use NASA data?
NASA’s Applied Remote Sensing Training Program (ARSET)
https://arset.gsfc.nasa.gov

- Empowering the global community through remote sensing training
- Part of NASA’s Applied Sciences Capacity Building Program
- Goal to increase the use of Earth science in decision-making through training for:
  - policy makers
  - environmental managers
  - other professionals in the public and private sector

Topics for Trainings Include:
- Water Resources
- Air Quality
- Disasters
- Eco
DEVELOP National Internship Program

“Shaping the future by integrating Earth observations into global decision making.”

Participants + Earth Observations + Decision Makers

DEVELOP bridges the gap between NASA Earth Science and society, building capacity in both its participants and end-user organizations to better prepare them to handle the environmental challenges that face society.

https://develop.larc.nasa.gov
Thank You!

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