



Global Biodiversity Monitoring, Prediction & Reporting

A Future Earth Symposium, Greenberg Conference Center, Yale University



Integration: Networking Networks

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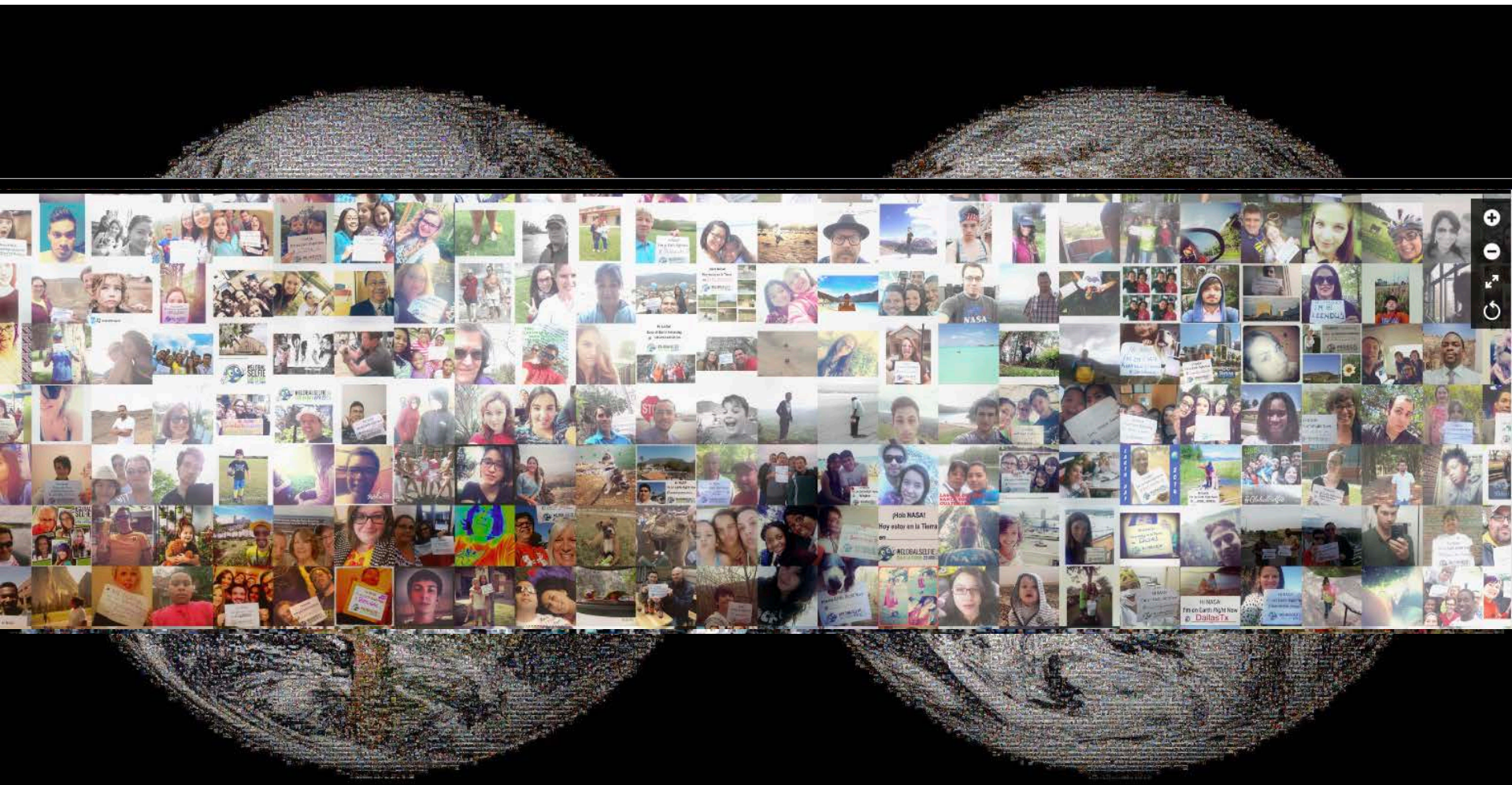
May 4, 2015

Global Biodiversity Observation



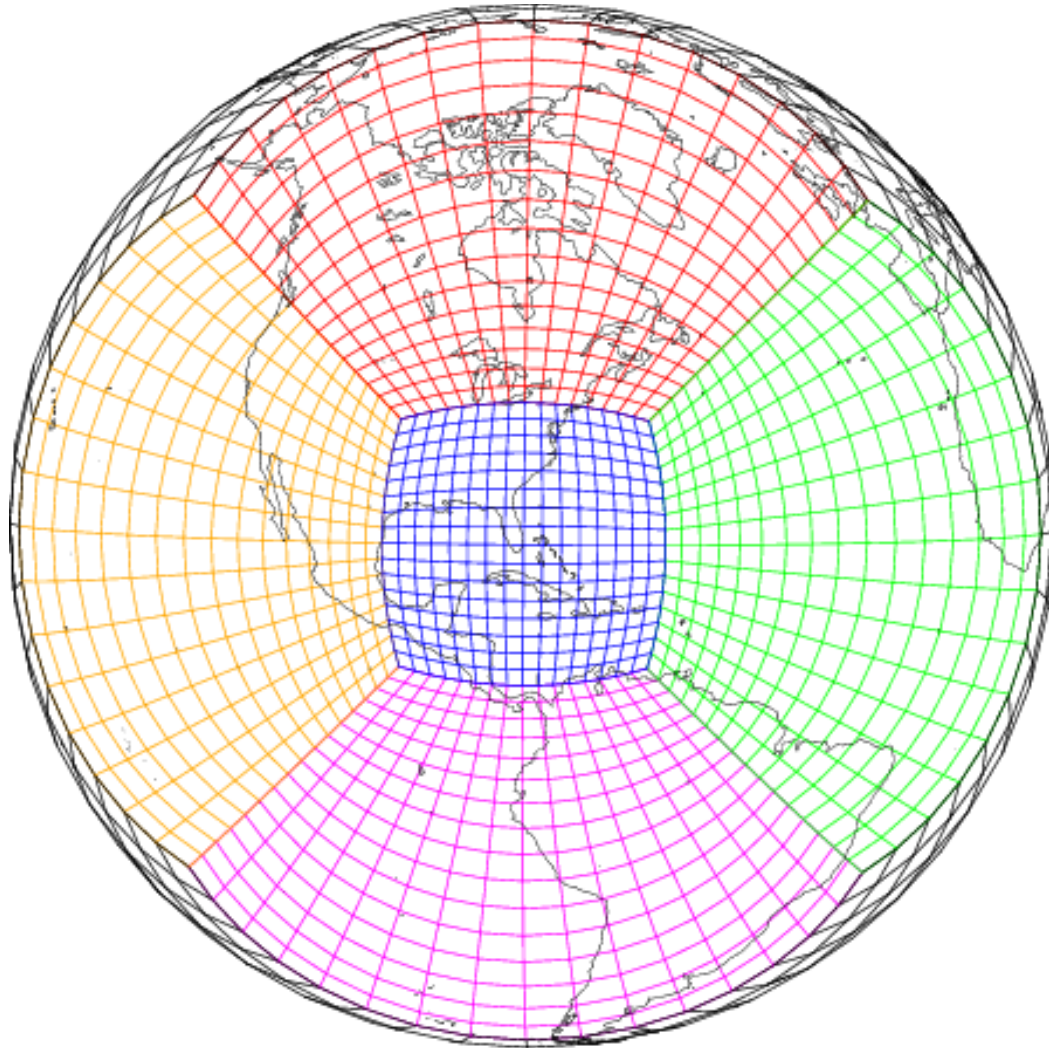
(credit: NASA/NOAA/GSFC/Suomi NPP/VIIRS/Norman Kuring)

#globalselfie



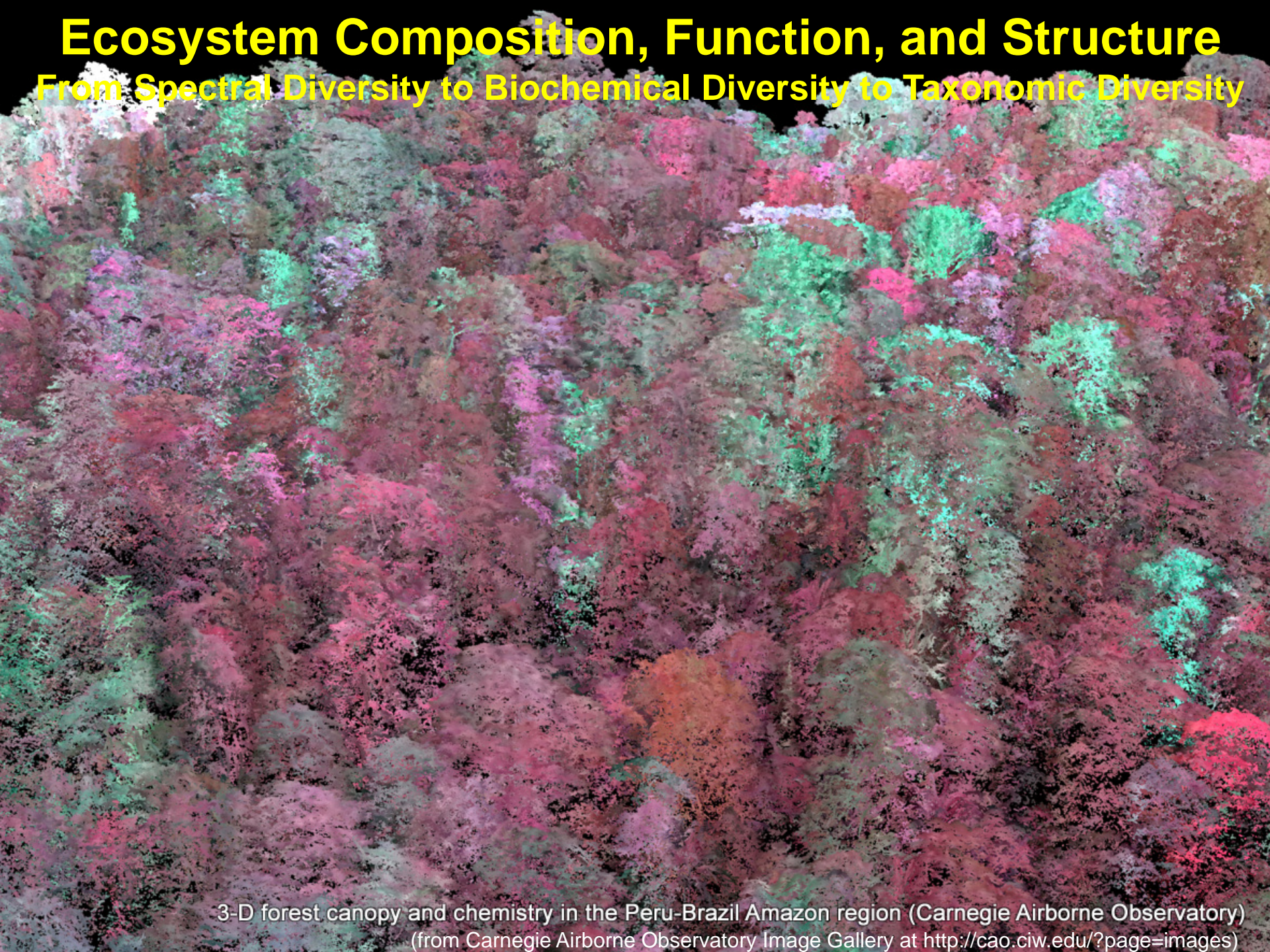
A Climate Example from NOAA GFDL

Grid Stretching in GFDL Atmosphere Dynamical Core



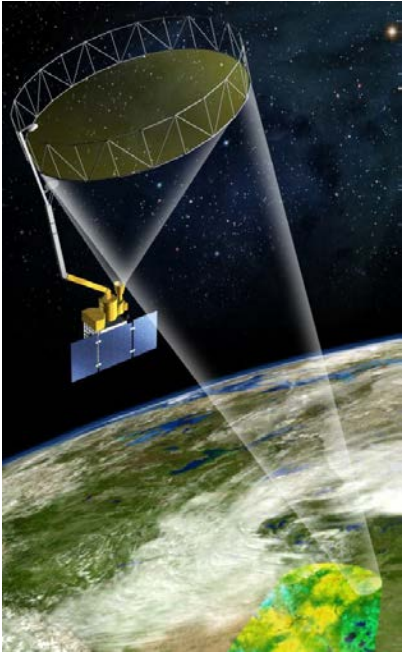
Ecosystem Composition, Function, and Structure

From Spectral Diversity to Biochemical Diversity to Taxonomic Diversity

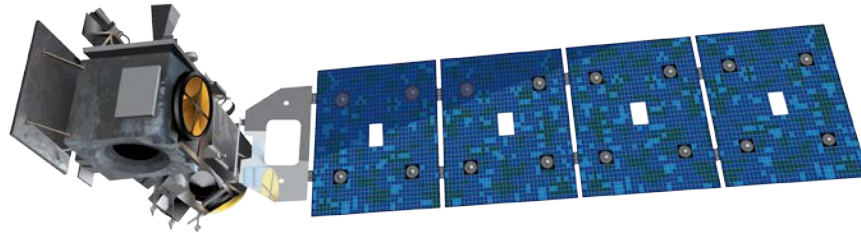


3-D forest canopy and chemistry in the Peru-Brazil Amazon region (Carnegie Airborne Observatory)
(from Carnegie Airborne Observatory Image Gallery at <http://cao.ciw.edu/?page=images>)

Top Down: Capturing Ecosystem Composition, Function, and Structure *Globally from Space*



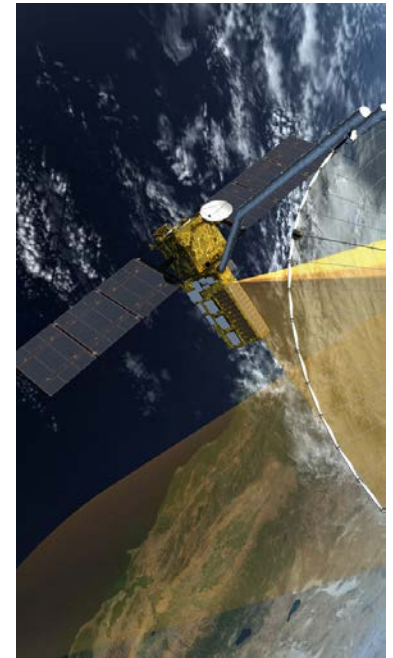
Soil Moisture Active Passive
(SMAP) Mission 2015



ICESat-2: ATLAS Lidar 2017

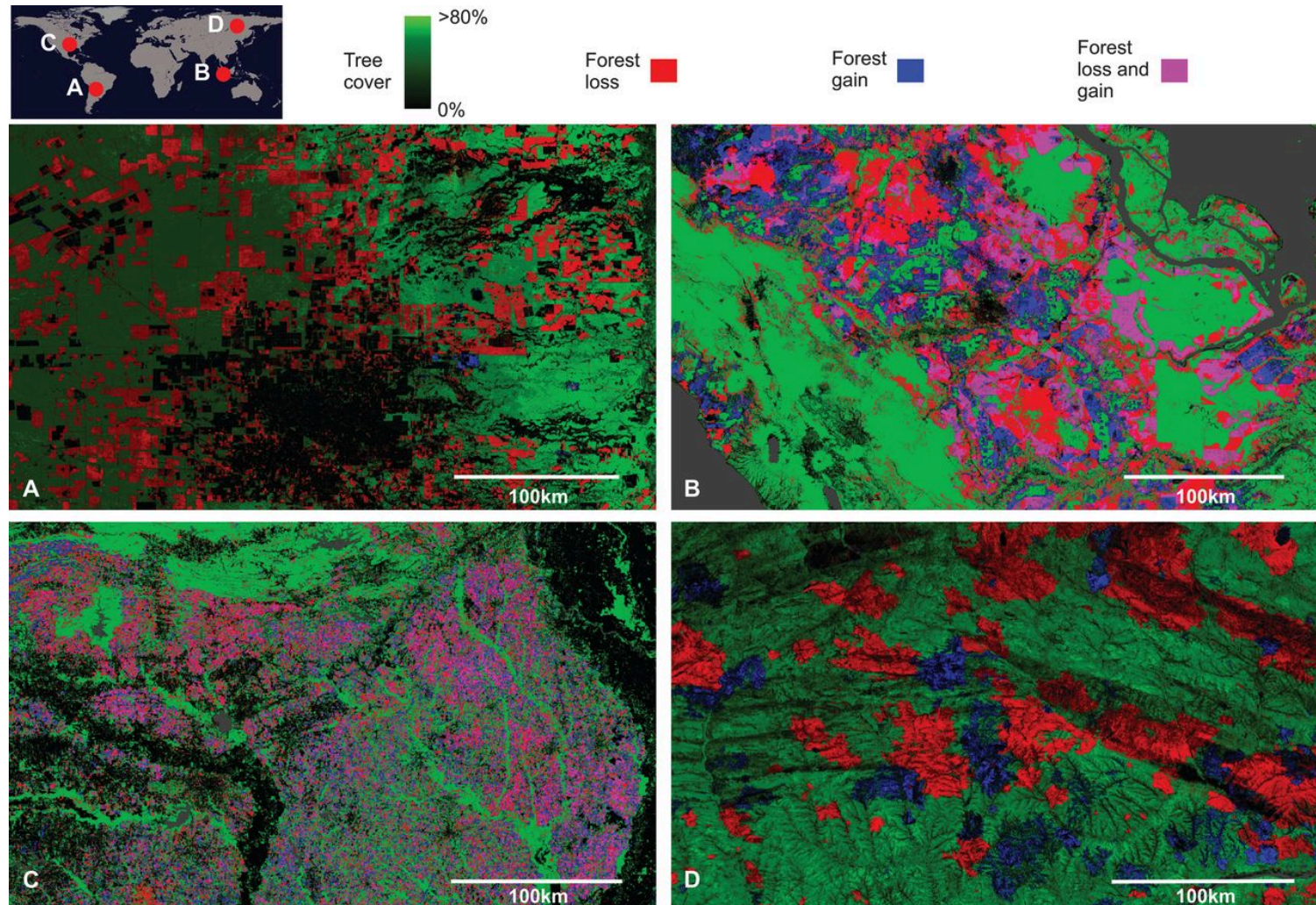


HyspIRI: VSWIR Spectrometer and
Multispectral TIR Imager 20??



NASA-ISRO Synthetic
Aperture Radar (NISAR)
Mission 2020/2021

Fig. 2 Regional subsets of 2000 tree cover and 2000 to 2012 forest loss and gain.(A) Paraguay, centered at 21.9° S, 59.8° W; (B) Indonesia, centered at 0.4° S, 101.5° E; (C) the United States, centered at 33.8° N, 93.3° W; and (D) Russia, centered at 62.1° N, 123.4° E.



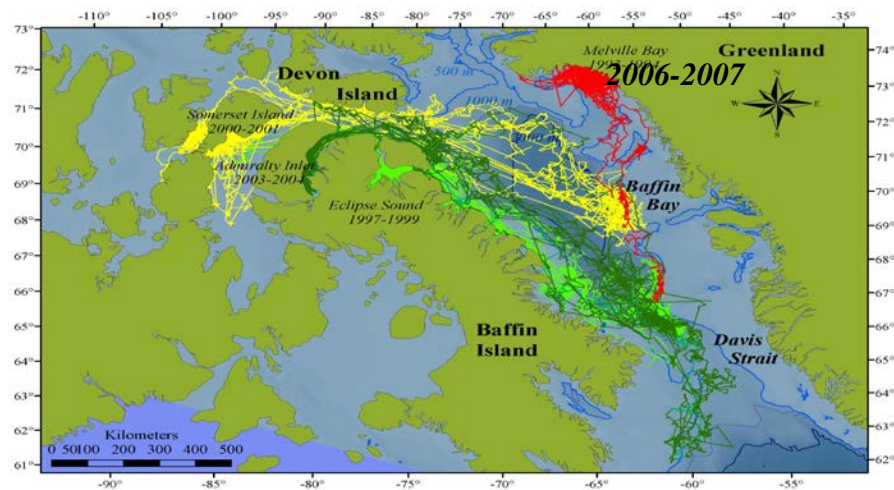
M C Hansen et al. Science 2013;342:850-853

Ubiquitous Smallsats

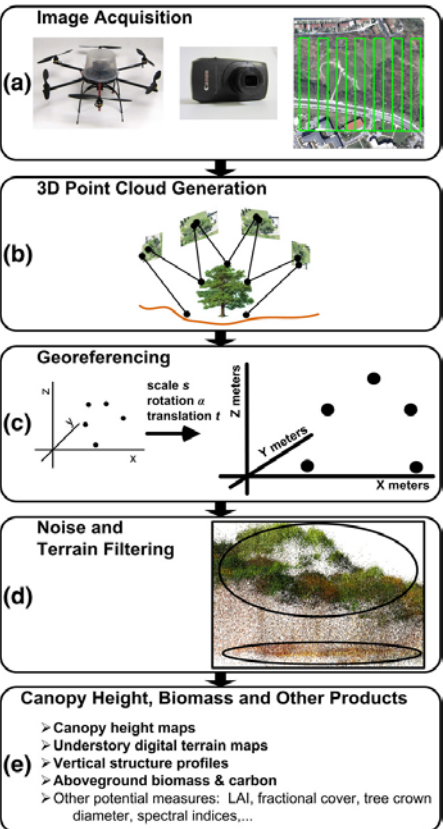


First of Planet Labs Flock Leaves ISS on 11 February 2014

(photo by JAXA astronaut Koichi Wakata)



Bottom Up: *In situ* Observations Expanding—But Need Networking



Asian Carp Monitoring Fact Sheet
eDNA Surveillance and Calibration

US Army Corps of Engineers
Chicago District

Chicago Sanitary and Ship Canal – Aquatic Nuisance Species Dispersal Barrier

Overview:
One of the tools implemented by the Asian Carp Regional Coordinating Committee's (ACRCC) Monitoring and Rapid Response Work Group (MRRWG) to conduct monitoring of Asian carp in the Chicago Area Waterway System (CAWS) is Environmental DNA (eDNA) surveillance. eDNA is a genetic tool that indicates the presence or absence of species-specific DNA in the aquatic environment. Fishes, including Asian carp, release cells containing DNA into the environment from mucus, feces and urine. DNA degrades in the environment, but this process is not instantaneous, and DNA can be held in suspension and transported. Species can be detected by filtering water samples and then extracting and amplifying short fragments of the shed DNA. The MRRWG has used eDNA as an early detection monitoring tool in the Chicago Area Waterway System (CAWS) since 2010, led by USACE. In 2013, eDNA monitoring will be led by the U.S. Fish and Wildlife Service.

A positive eDNA detection indicates the presence of Asian carp DNA. At present, eDNA evidence cannot verify whether the DNA is from a live fish, nor does it provide information about Asian carp quantity, age, size, how they got there or how long they may have been there.

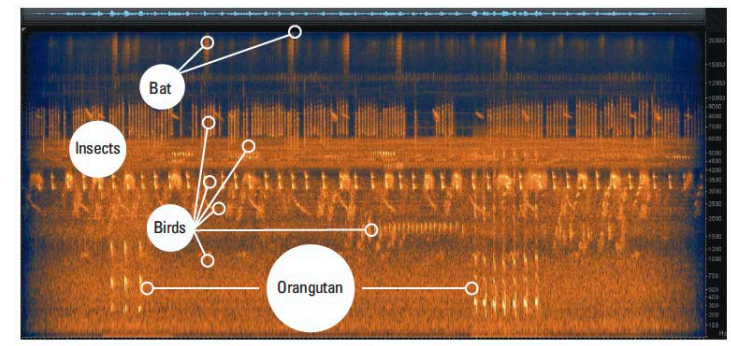
Methods:
The Quality Assurance Project Plan (QAPP) for the eDNA Monitoring of Invasive Asian Carp in the CAWS outlines the detailed procedures for the planning, collection, filtering, processing and reporting of eDNA samples and is available online: www.asiancarp.us/documents/USACE-eDNA-QAPP.pdf

Map of 2012 eDNA results

Replicates from Site 1, Replicates from Site 2, Replicates from Site 3

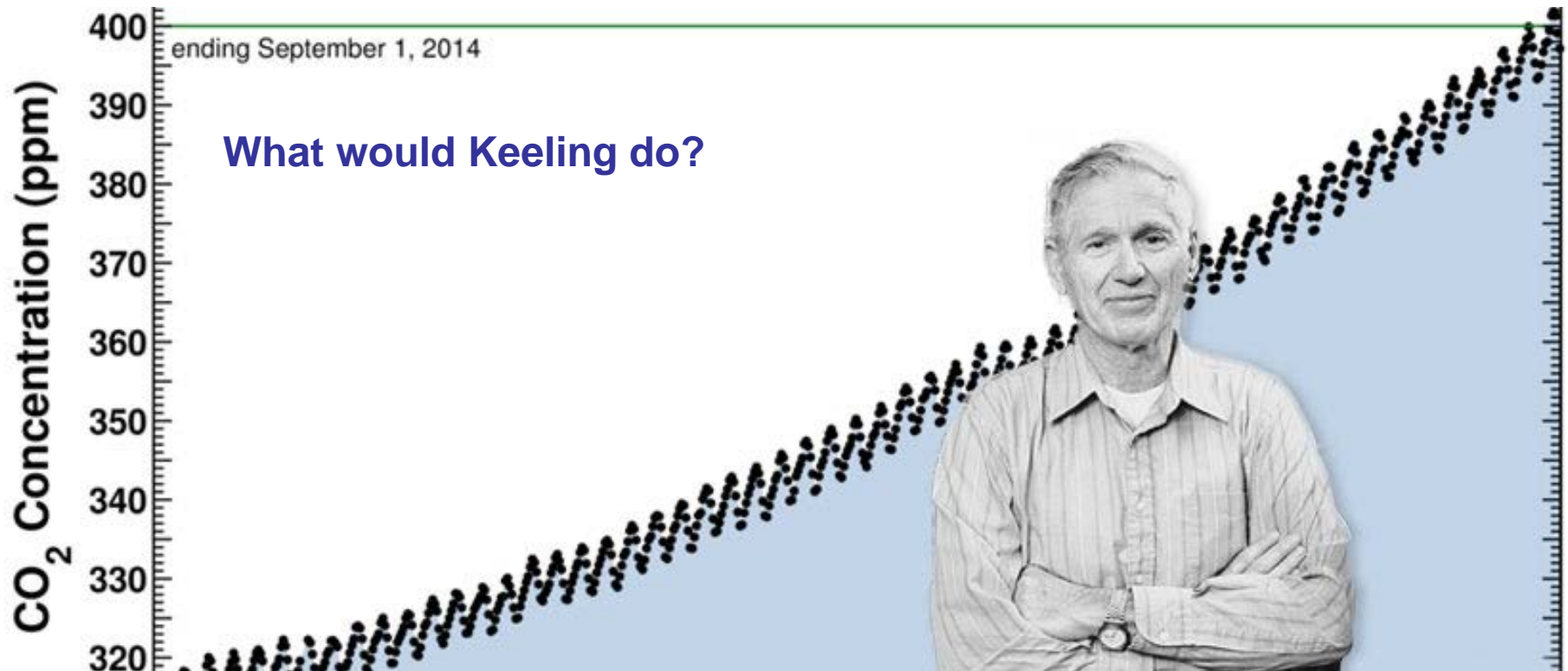
Silver carp DNA bands in gel electrophoresis (UAG photo)

What's Next?
USACE is leading an interagency eDNA Calibration Study (ECALS) with USGS and USFWS to reduce the uncertainty surrounding eDNA results and refine the eDNA method.



Everything in its place. A recording from the Sumatran rainforest illustrates the acoustic niche hypothesis, in which different kinds of animals utilize different parts of the sound spectrum. Bats, for instance, call at higher frequencies while orangutans use lower frequency sound.

Challenge = Networking Observations



(from: <https://scripps.ucsd.edu/news/wendy-and-eric-schmidt-award-500000-grant-keeling-curve>)



Collecting environmental DNA

(*Science* 346:301-302, 10/17/14)

What Type of Network Do We Need?



OR



GEO Biodiversity Observation Network (GEO BON)



GEO BON



GEO Home



GEO BON: Biodiversity Observation Network

- About
- Contributors
- Working Groups
- Meetings
- Essential Biodiversity Variables
- Documents
- Outreach
- Observations
- Links
- Contact

Highlights

Adequacy of Biodiversity Observation Systems

In response to a decision taken last November at the Nagoya conference of the Convention on Biological Diversity, GEO BON has produced and submitted to the CBD a report entitled "Adequacy of Biodiversity Observation Systems to support the CBD 2020 Targets". The report can be read [here](#).

EC JRC launches DOPA, a Digital Observatory for Protected Areas

The Joint Research Centre of the European Commission has launched the Digital Observatory for Protected Areas (DOPA). A GEO BON contribution to the monitoring of biodiversity, the DOPA is designed as set of distributed web services to assess the state of, and pressure on, Protected Areas and to prioritize them accordingly in order to support decision making and fund allocation processes. It is also conceived as a monitoring and ecological forecasting service.

DOPA is supported by the European projects EuroGEOSS and UncertWEB and developed in collaboration with GBIF, UNEP-WCMC, Birdlife International, RSPB and others. Read [here](#) a description of the use of DOPA for Africa presented at MapAfrica, 23-25 November 2010, Cape Town, South Africa.

GEO BON

Biodiversity Observation Network

The Group on Earth Observations Biodiversity Observation Network – GEO BON – coordinates activities relating to the Societal Benefit Area (SBA) on Biodiversity of the Global Earth Observation System of Systems (GEOSS). Some 100 governmental, inter-governmental and non-governmental organizations are collaborating through GEO BON to organize and improve terrestrial, freshwater and marine biodiversity observation globally and make their biodiversity data, information and forecasts more readily accessible to policymakers, managers, experts and other users. Moreover, GEO BON has been recognized by the Parties to the Convention on Biological Diversity.

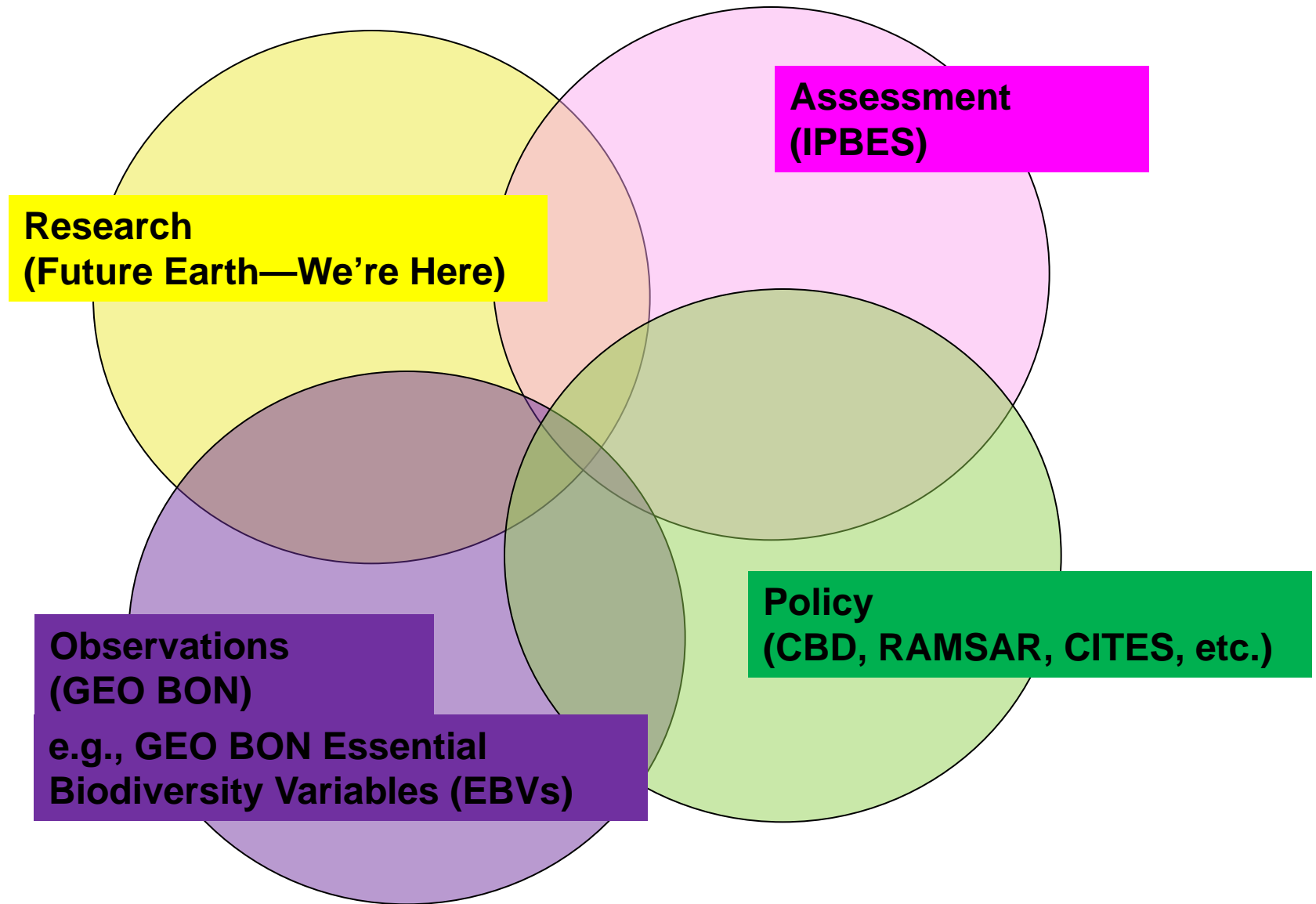
The Biodiversity Observation Network is both a Community of Practice and a Task in the GEO Work Plan. It is a voluntary partnership that is guided by a steering committee comprising the key stakeholders, including GBIF, IUCN, NASA, UNEP-WCMC and others. GEO BON draws on GEO's work on data-sharing principles to promote full and open exchange of data, and on the GEOSS Common Infrastructure to enable interoperability through adoption of consistent standards.

To assist both holders and users of biodiversity information to engage with GEO BON, this website contains links to information resources, activities and GEO BON documents, meetings and other resources.

Example Essential Biodiversity Variables Candidates

EBV Class	EBV Examples
Genetic composition	Population genetic differentiation
Species populations	Species distribution
	Population abundance
Species traits	Phenology
Community composition	Taxonomic diversity
Ecosystem function	Productivity
	Nutrient retention
Ecosystem structure	Habitat structure
	Extent and fragmentation
	Ecosystem composition by functional type

Global Biodiversity Science-Policy Network



(slide courtesy of DIVERSITAS/Anne Larigauderie)

Let's Go!

- We must monitor *globally*.
- We have many of the tools we need.
- But, we need an integrated global plan to network observations and models on the status and trends of biodiversity. >**Future Earth**
- We need regular scaling workshops and projects to develop and demonstrate our ability to network observations across scales. >**Future Earth**
- We need better model interoperability among ecol. models & between climate & ecol. models. >**F.E.**
- *Tempus fugit*. Windows of opportunity close quickly

Thank You