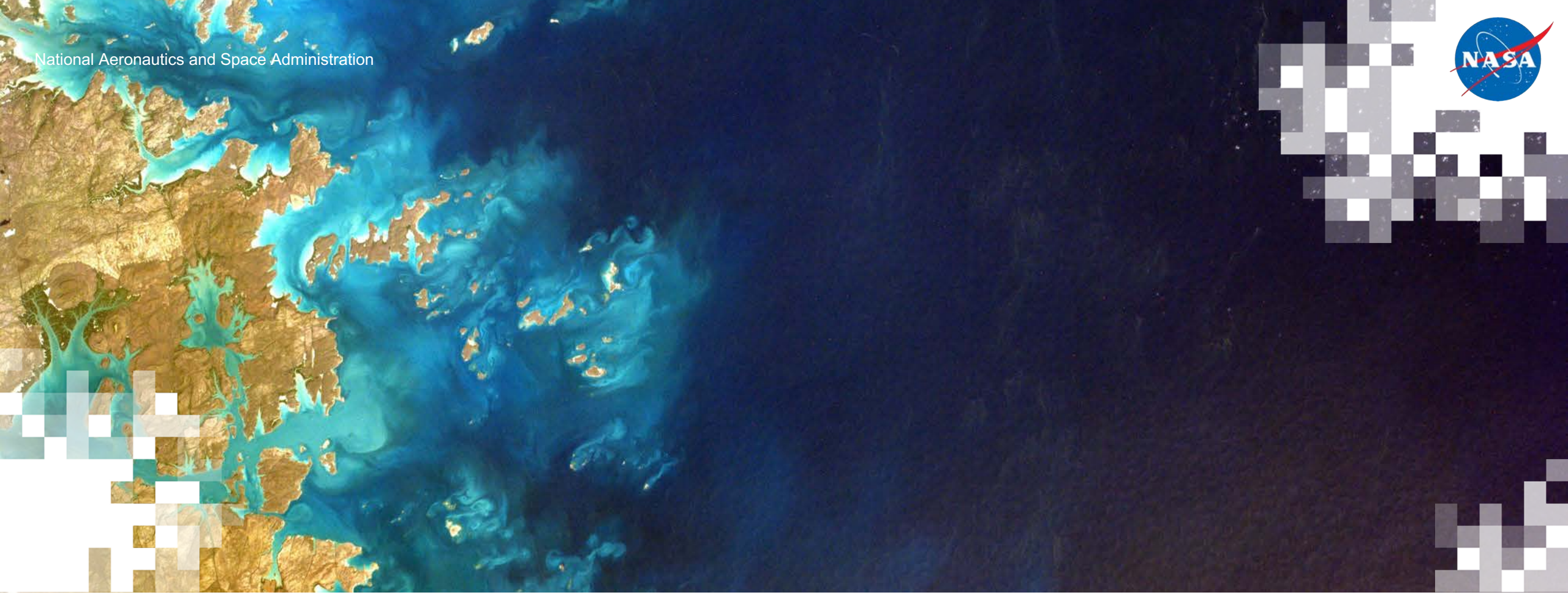


Using UN Biodiversity Lab to Support National Conservation and Sustainable Development Priorities

Amber McCullum, Juan Torres-Pérez, Annie Virnig, Marion Marigo, Diego Ochoa, Christina Supples, Scott Atkinson, Rafael Monge, Susana Rodríguez-Buriticá, Dorine Jn Paul, Sendy Augustin Salomon, Guyguy Mangoni, Christian Vargas

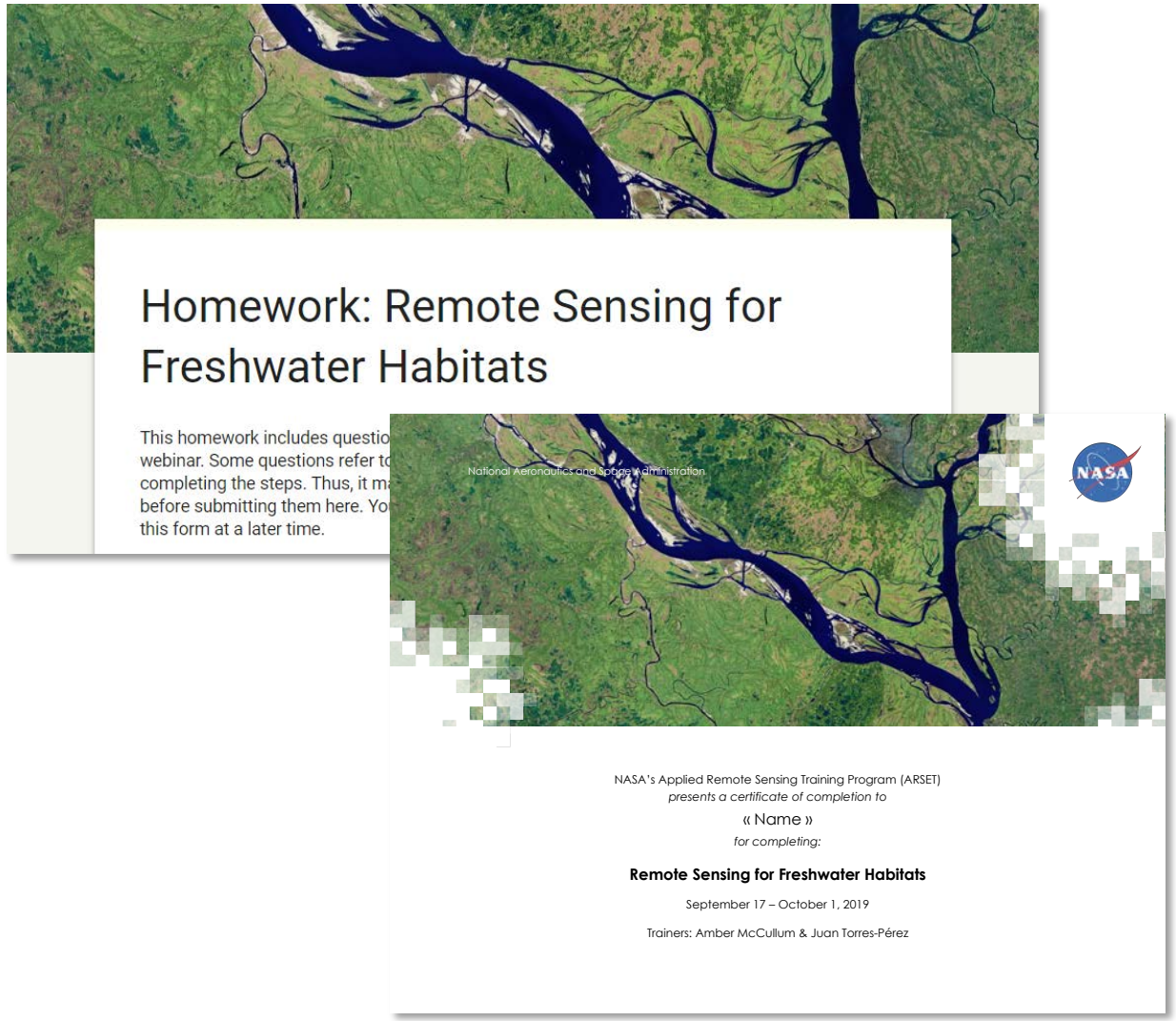
March 24 – April 7, 2020

Course Structure

- Three, 1.5-hour sessions on **March 24, 31,** and **April 7**
- There will be 3 sessions per day presenting the same material in
  - English (9:00-10:30 EST)
  - French (11:00-12:30 EST)
  - Spanish (14:00-15:30 EST)
  - **Please only sign up for and attend one session per day.**
- Webinar recordings, PowerPoint presentations, and the homework assignment can be found after each session at:
  - https://arset.gsfc.nasa.gov/land/webinars/un-biodiversity-2020
- Q&A: Following each lecture and/or by email
  - amberjean.mccullum@nasa.gov
  - juan.l.torresperez@nasa.gov

Homework and Certificates

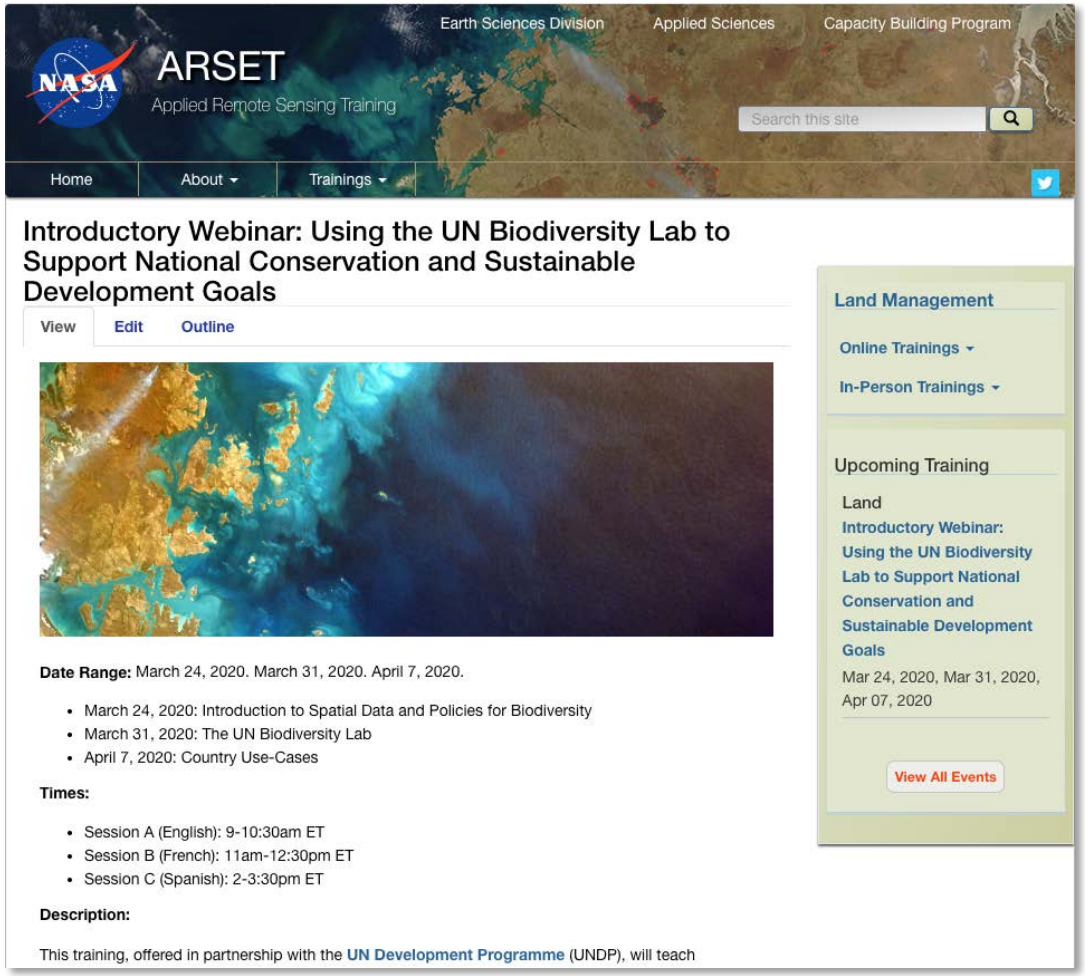
- **Homework:**
  - One homework assignment
  - Answers must be submitted via Google Forms
- **Certificate of Completion:**
  - Attend all three live webinars
  - Complete the homework assignment by **Tuesday, April 21** (access from ARSET website)
  - You will receive certificates approximately two months after completion of the course from: marines.martins@ssaihq.com



Prerequisites and Course Materials

- **Prerequisites:**
  - Please complete Sessions 1 & 2A of Fundamentals of Remote Sensing or have equivalent experience.

- **Course Materials:**
  - https://arset.gsfc.nasa.gov/land/webinars/un-biodiversity-2020



Course Outline

Session 1: Intro to Remote Sensing and Policies for Biodiversity

- NASA satellites and sensors
- Global policy context
- Introduction to UNDP's work on spatial data
- NASA-supported biodiversity projects

Session 2: UN Biodiversity Lab: Introduction and Training

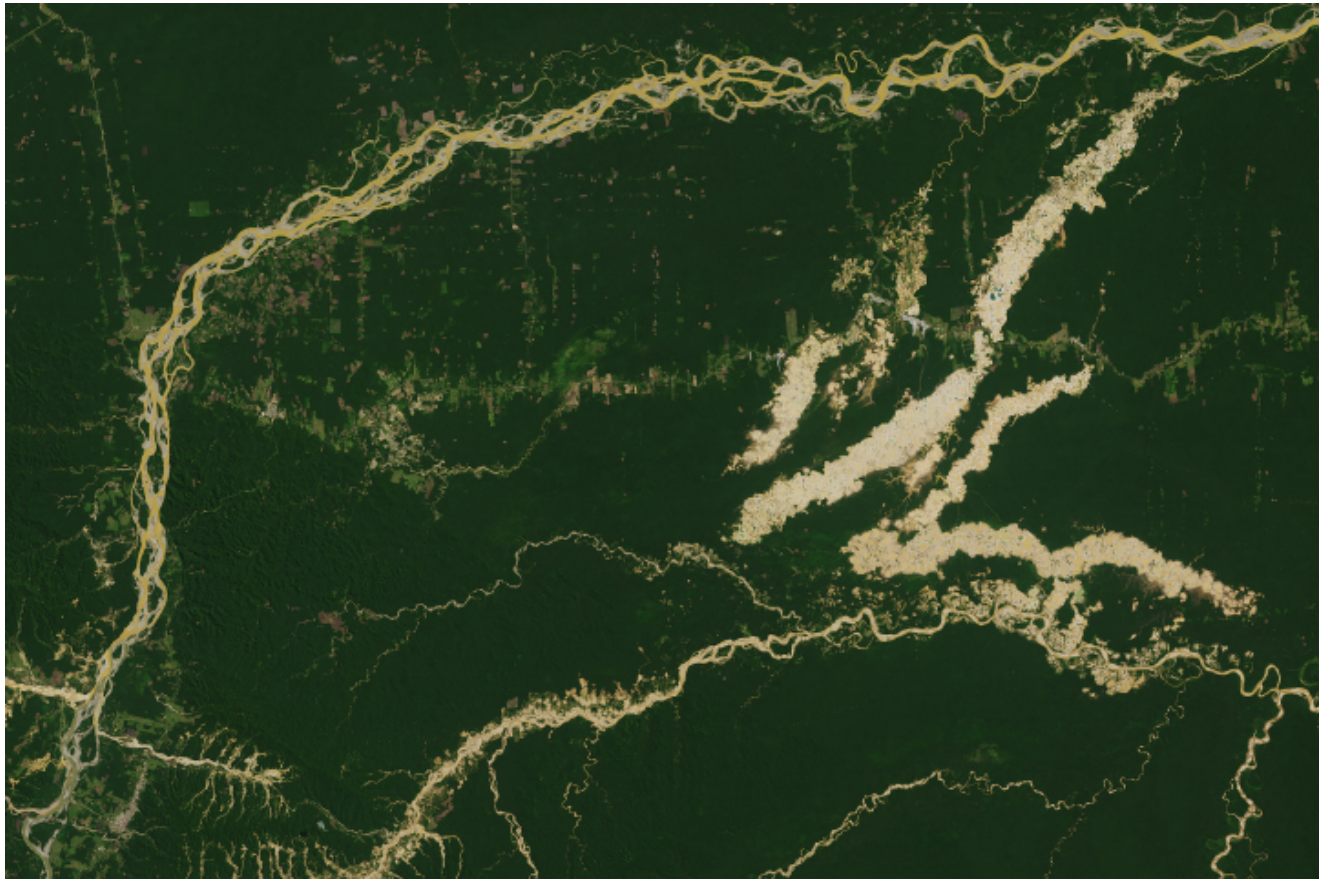
- Overview of UN Biodiversity Lab
- Data products and tools
- Demonstration of data access and analysis

Session 3: How are Countries Using Spatial Data to Support Conservation of Nature?

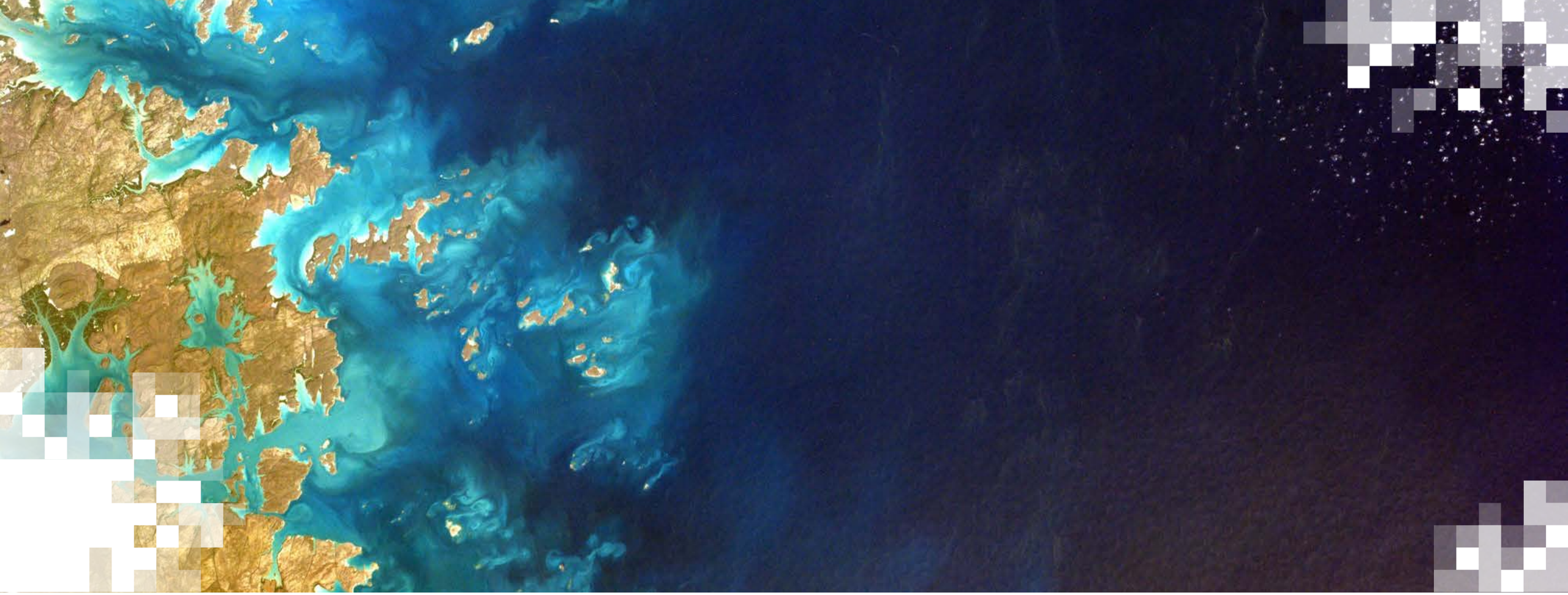
- Overview of countries involved in UN Biodiversity Lab
- Country-specific examples for English, French, and Spanish

Session 1 Agenda

- Introduction to remote sensing for biodiversity
- NASA satellites and sensors
- Global policy context
- Overview of UNDP's spatial data work
- Overview of the UN Biodiversity Lab
- NASA-supported biodiversity projects
- Q&A Session



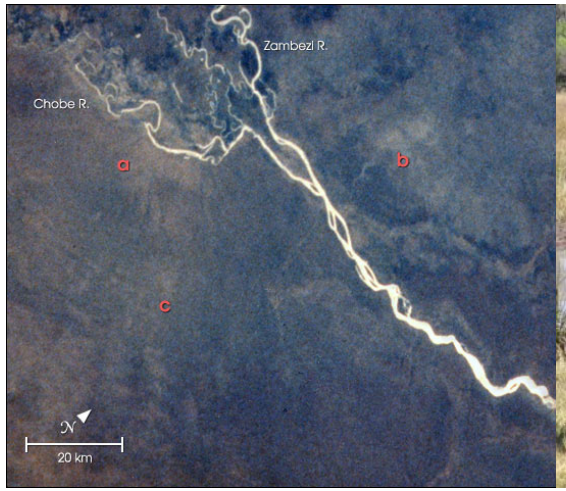
Tracking deforestation in the Madre de Dios region of Peru with Landsat. Image Credit: NASA

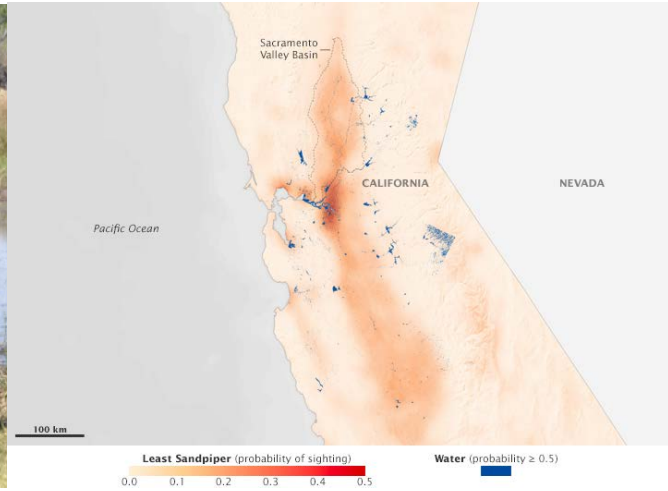


Remote Sensing for Biodiversity

Remote Sensing and Biodiversity

- What is the **VALUE** of NASA Earth Observations for monitoring biodiversity?
  - Consistent measurements in space and time
  - Comparisons with ground observations
  - Used in remote locations where in-situ data are scarce
  - Provide a time series of data to identify changes in ecosystems



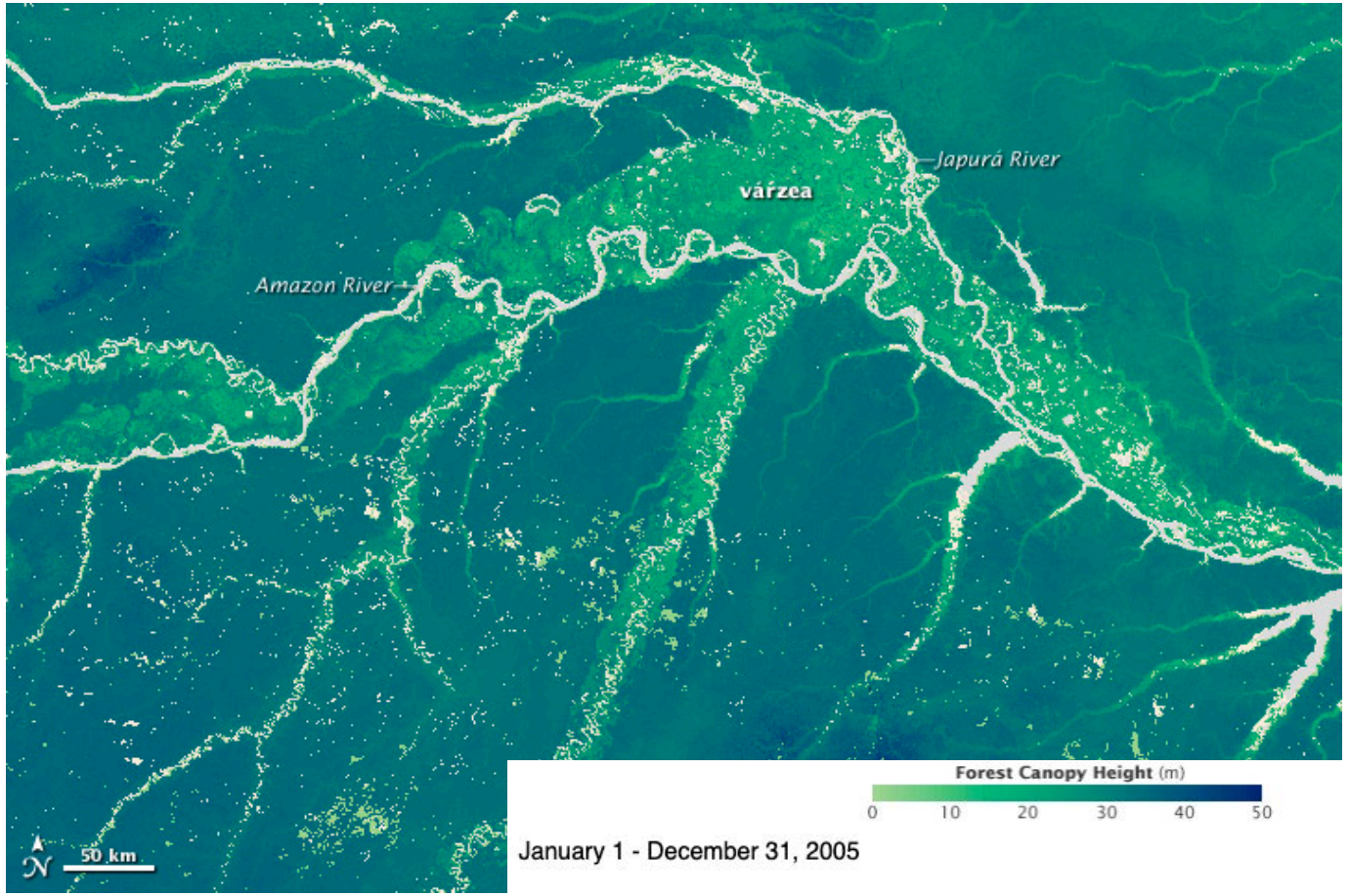


Elephant tracks in Botswana rom Landsat (left); Map of probability of sandpiper sightings in California (right).

Remote Sensing and Biodiversity

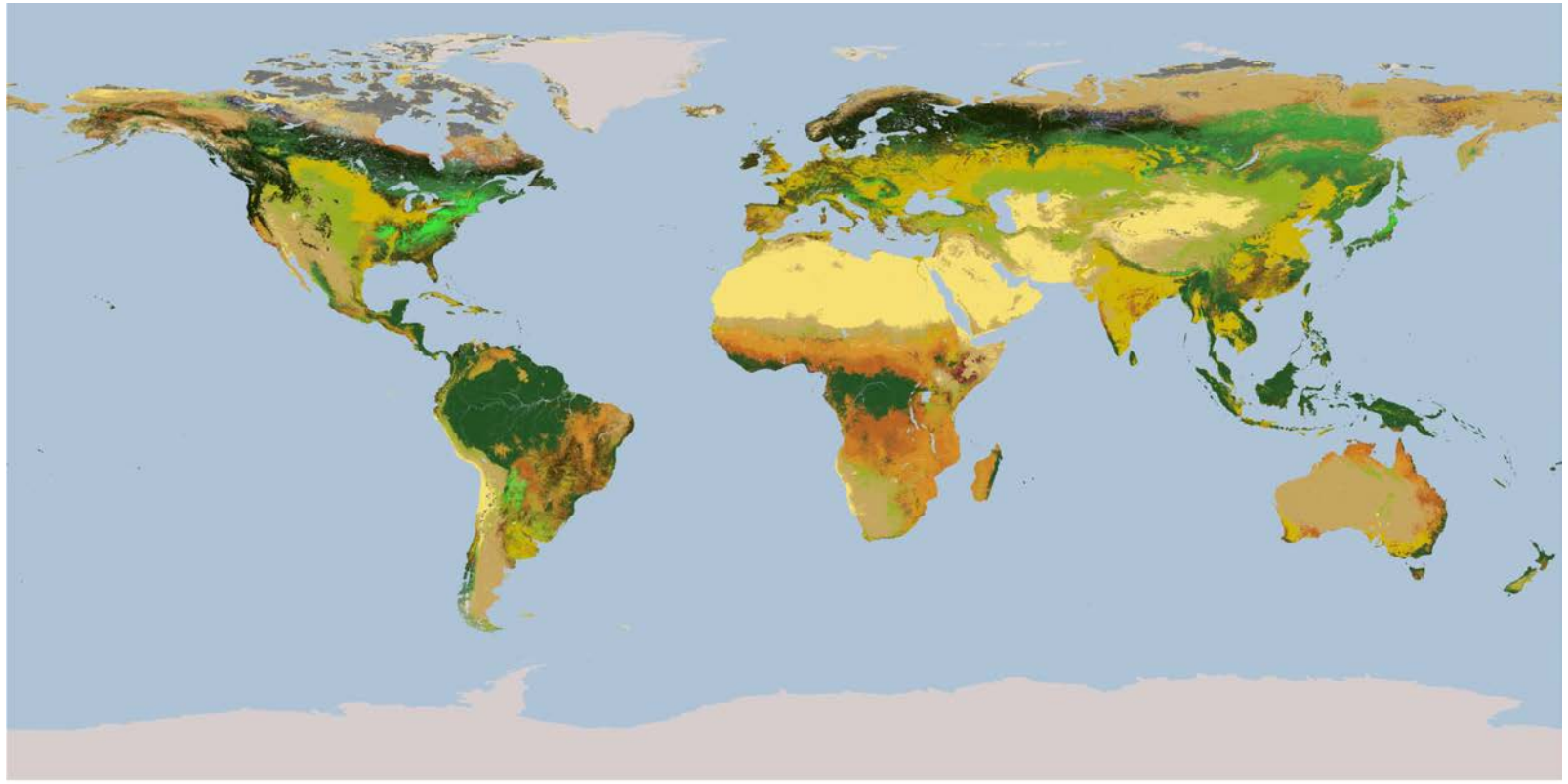
- What can we **EVALUATE** with NASA Earth Observations?
  - Ecosystem extent, structure, and change

- Physical environment (climate, topography)
- Land cover
- Fragmentation
- Degradation
- Vegetation productivity or health
- Forest canopy height



Forest Canopy Height (multiple sensors). Image Credit: NASA

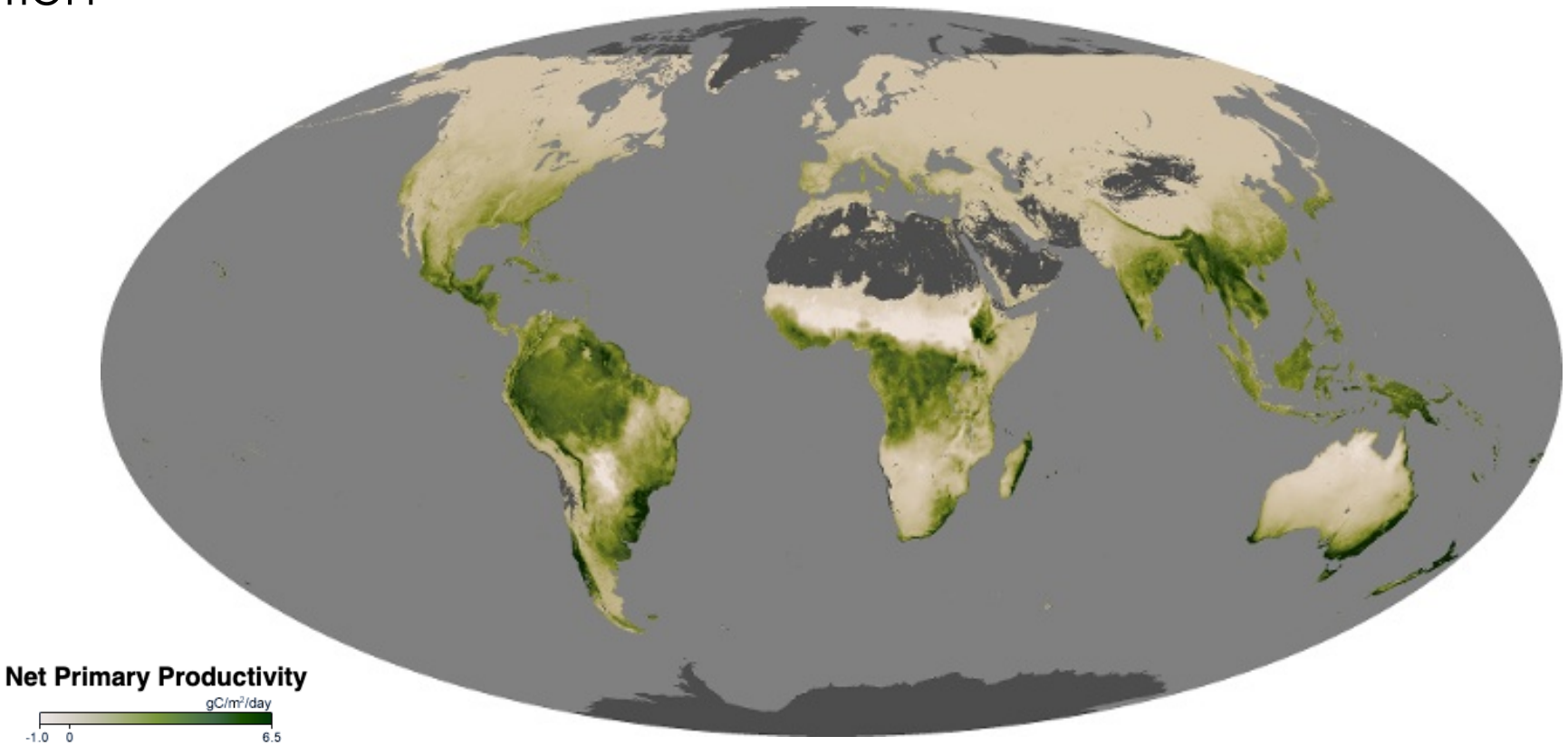
Ecosystem Structure and Composition



Landcover map from MODIS. Image Credit: NASA

Ecosystem Function

- Monitoring of the energy dynamics of an ecosystem
  - Net Primary Productivity (NPP)
  - Evapotranspiration
  - Albedo
  - Temperature



NPP via MODIS. Image Credit: NASA

Ecosystem Change

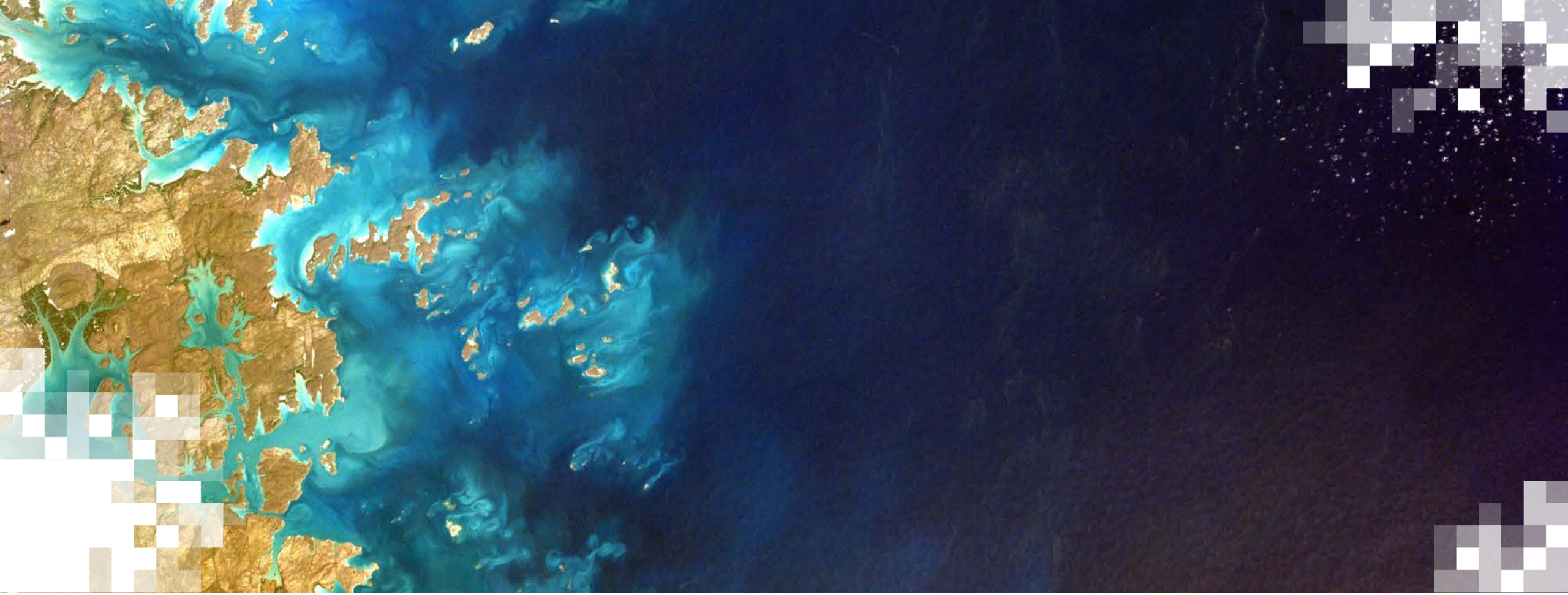
- Changes in land cover over time
  - Deforestation
  - Reforestation
  - Wildfires
  - Harvests/fallowed land
  - Urban growth

Landsat. Image Credit: NASA

Brazil forest changes:
- 2015: Deforestation
- 2017: Fire
- 2018: New Pasture

What are the limitations of Earth Observations?

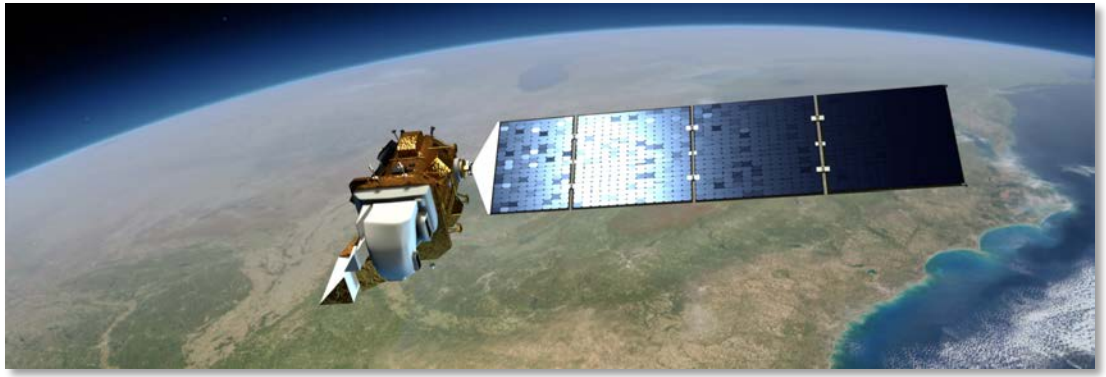
- Difficult to obtain high spectral, spatial, and temporal resolution at the same time
  - Spatial vs. temporal resolution
    - More frequent data often means coarser spatial resolution
- Large amounts of data
  - Various formats, large file sizes
  - Difficult to process and analyze
    - Requires use of tools and knowledge of the data
- Data often available from multiple sources
- High spectral or spatial resolution data can be costly and largely unavailable globally

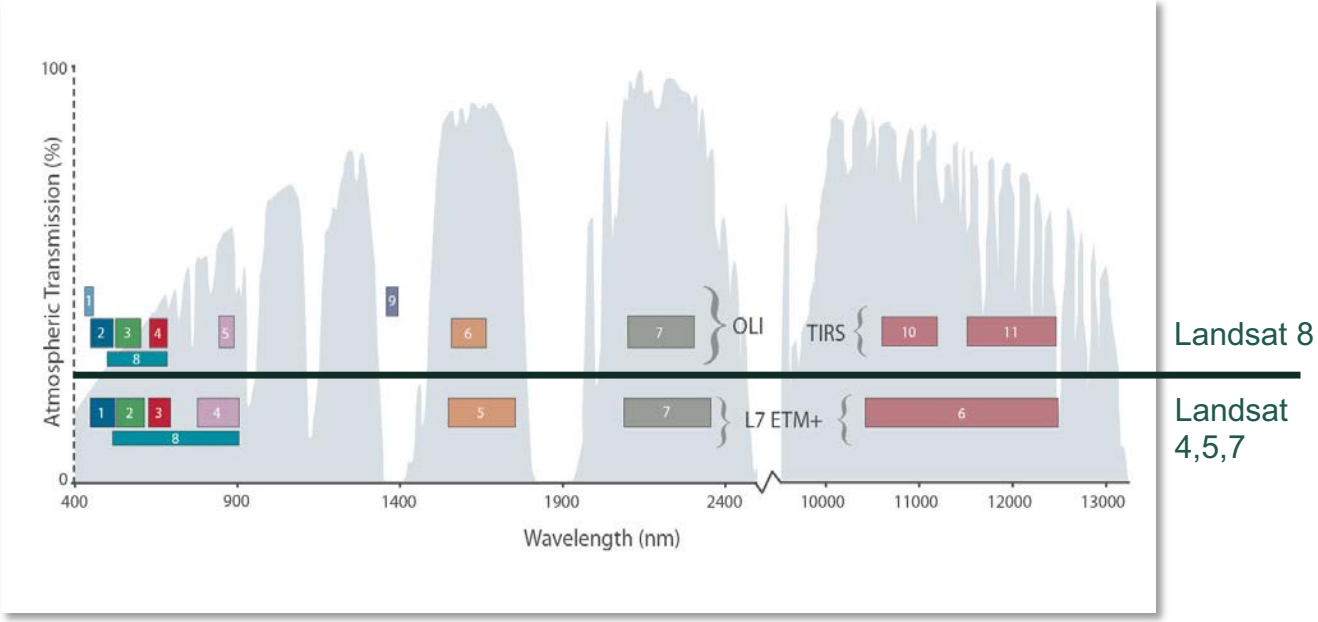


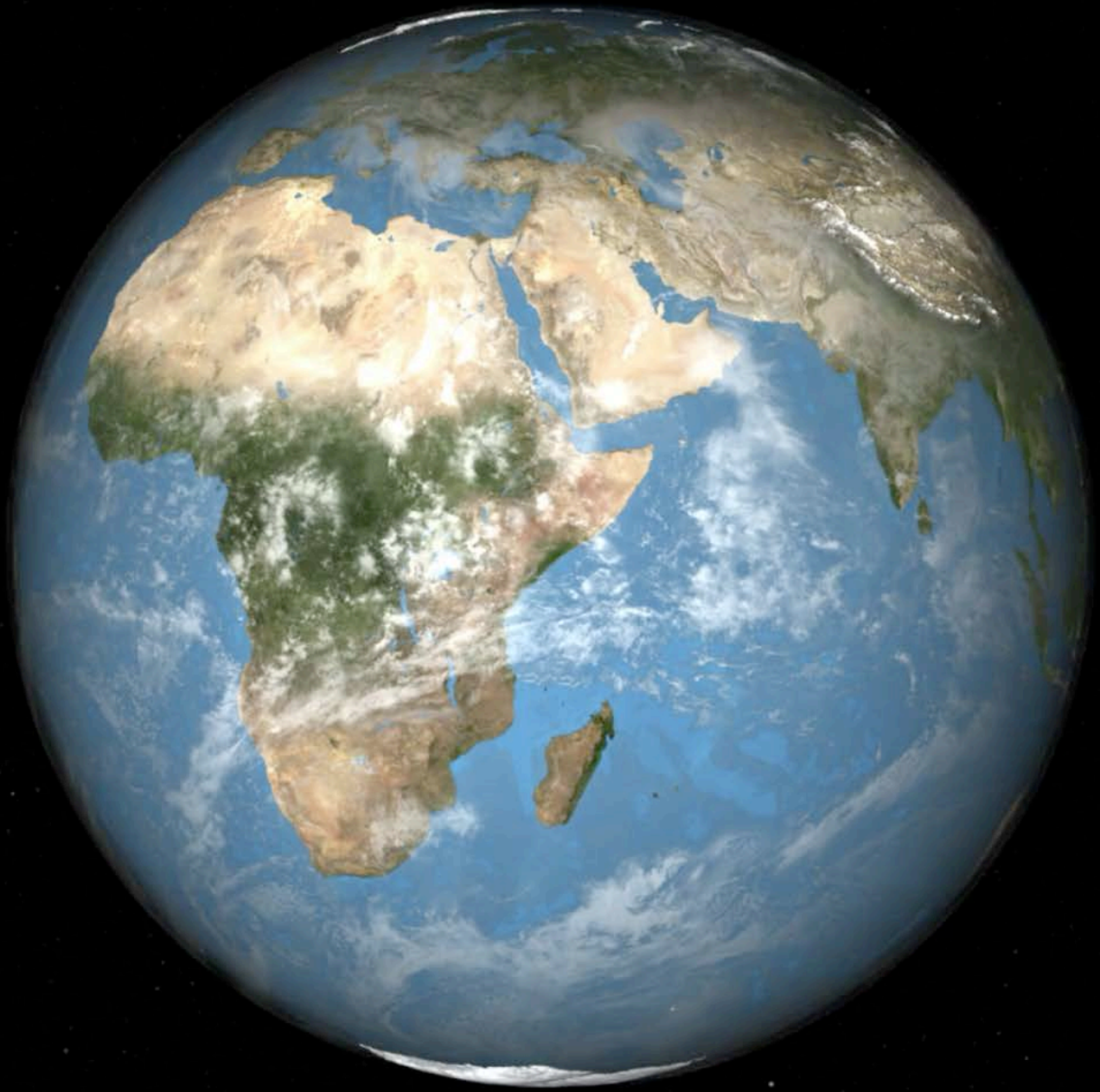
Satellites and Sensors for Biodiversity

Landsat

- First Landsat launched in 1972
- Landsat 8 launched in 2013
- NASA created and launched
  - USGS maintains data
- Passive sensor - obtains values of reflectance from Earth's surface
- 30-meter pixels, 15-meter panchromatic band
- Image of the entire Earth every 16 days

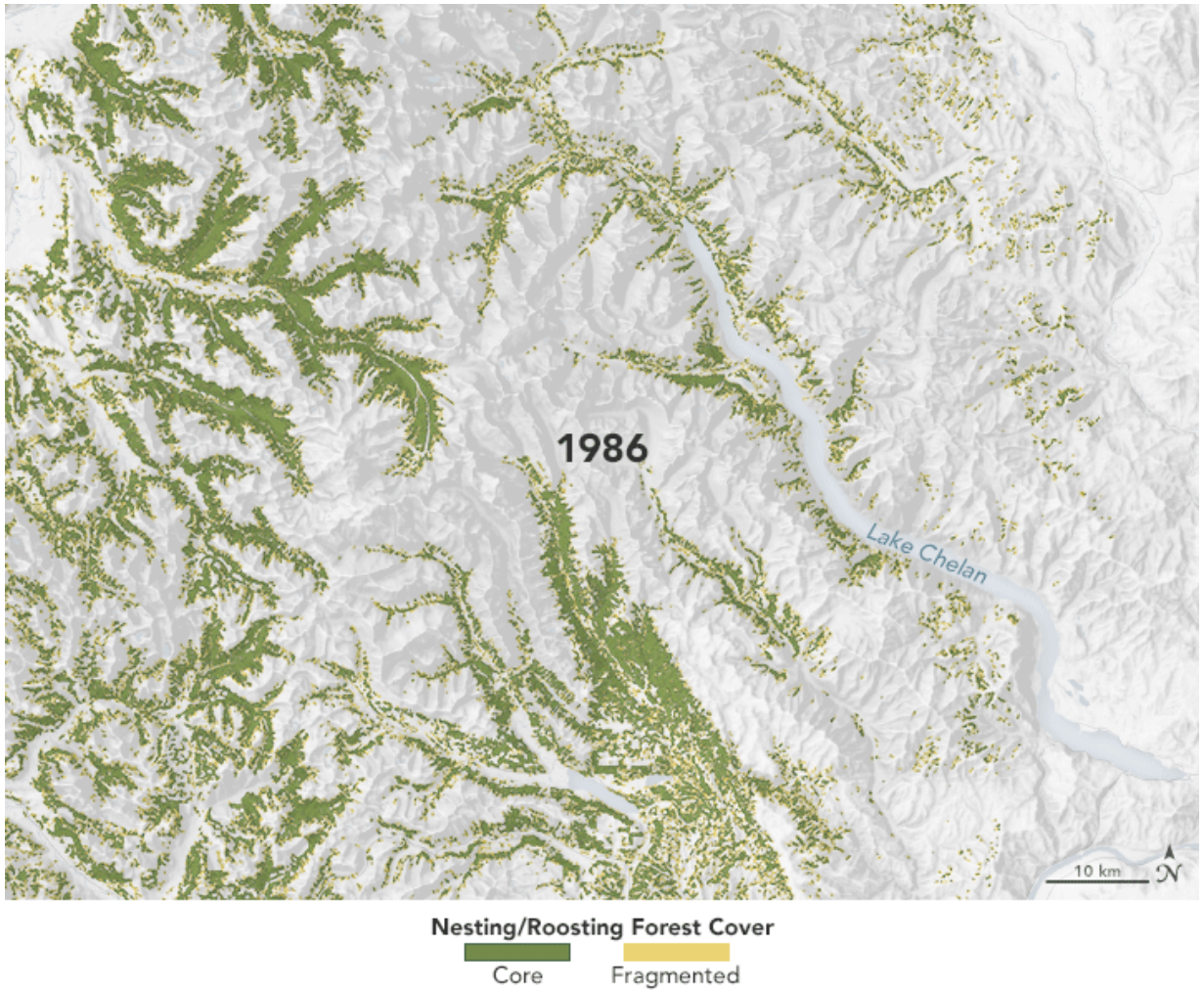






Landsat

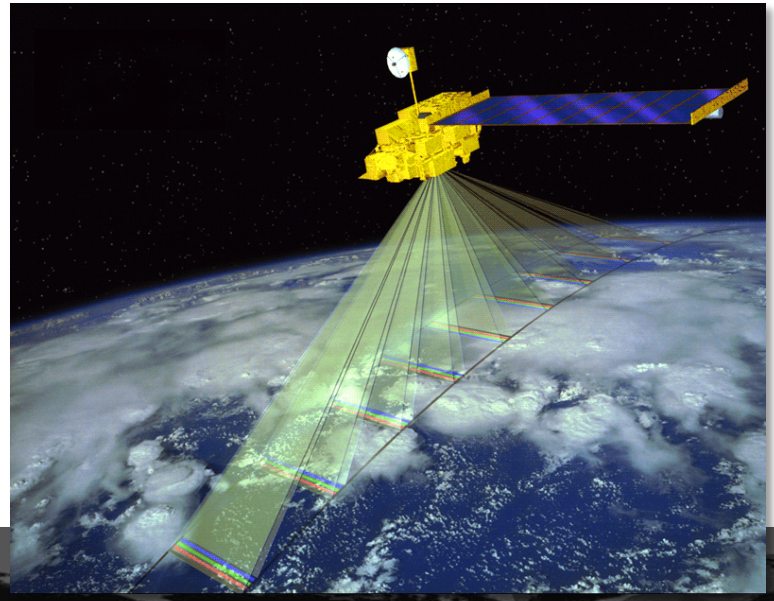
- **Landsat Pros/Cons**
  - Long Record (pro)
    - Time series analysis
  - Spatial Resolution (pro)
    - Higher than other sensors with more frequent measurements (e.g. MODIS)
  - Temporal Resolution (con)
    - May miss short-term changes/patterns



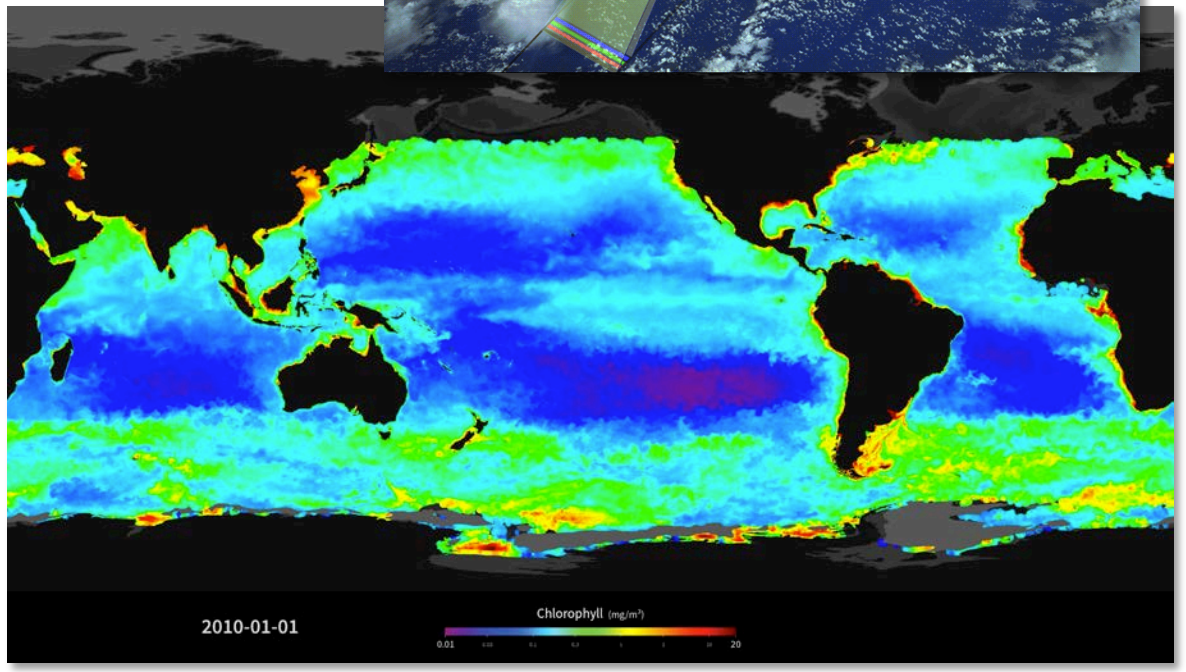
Changes in spotted owl habitat in eastern Washington using Landsat. Image Credit: NASA.

MODIS

- **Moderate Resolution Imaging Spectroradiometer (MODIS)**
  - Onboard the Terra and Aqua satellites
  - Spatial Resolution
    - 250m, 500m, 1km
  - Temporal Resolution
    - Daily, 8-day, 16-day, monthly, quarterly, yearly
    - 2000–Present
  - Spectral Coverage
    - 36 bands (major bands include red, blue, near infrared, mid-infrared)
      - Bands 1-2: 250m
      - Bands 3-7: 500m
      - Bands 8-36: 1000m

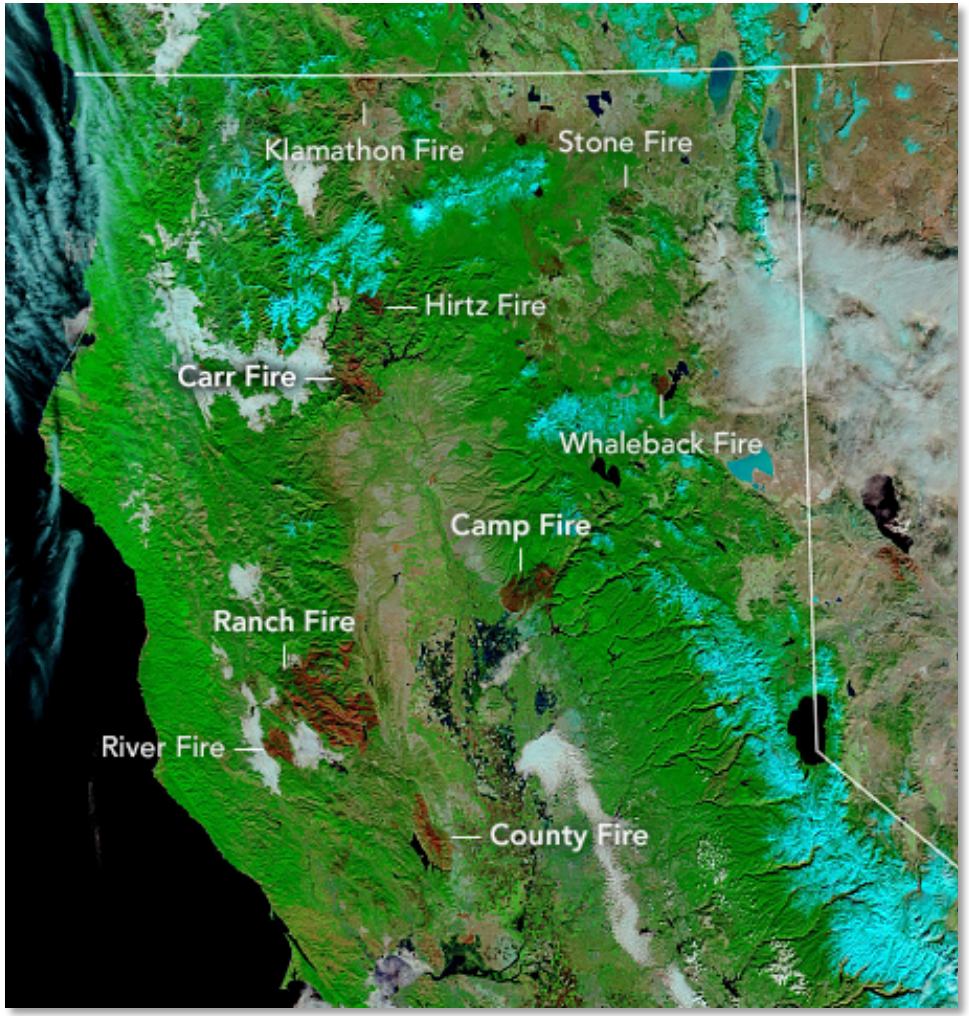


Artistic rendering of Terra (right); MODIS Ocean Bioproductivity (below). Image Credit: NASA



MODIS

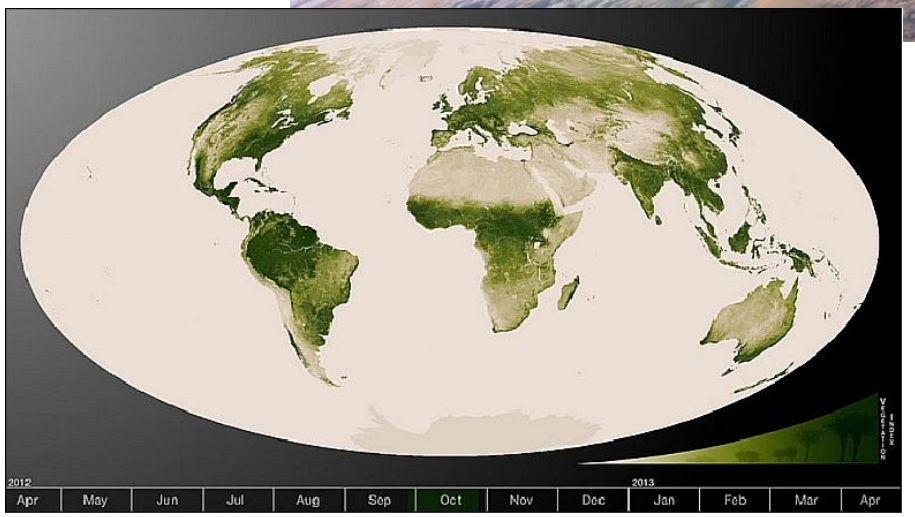
- **MODIS Pros/Cons**
  - Temporal Resolution (pro)
    - Daily measurements
  - Record Length (pro)
    - Shorter than Landsat, but still adequate
  - VIIRS Transition (pro)
    - Similar measurements to VIIRS, which will enable the continuation of the daily measurements
  - Spatial Resolution (con)
    - Coarse



MODIS image of record-setting fire activity in 2018 fits with a longer trend of larger and more frequent California fires since 2000. Image Credit: NASA

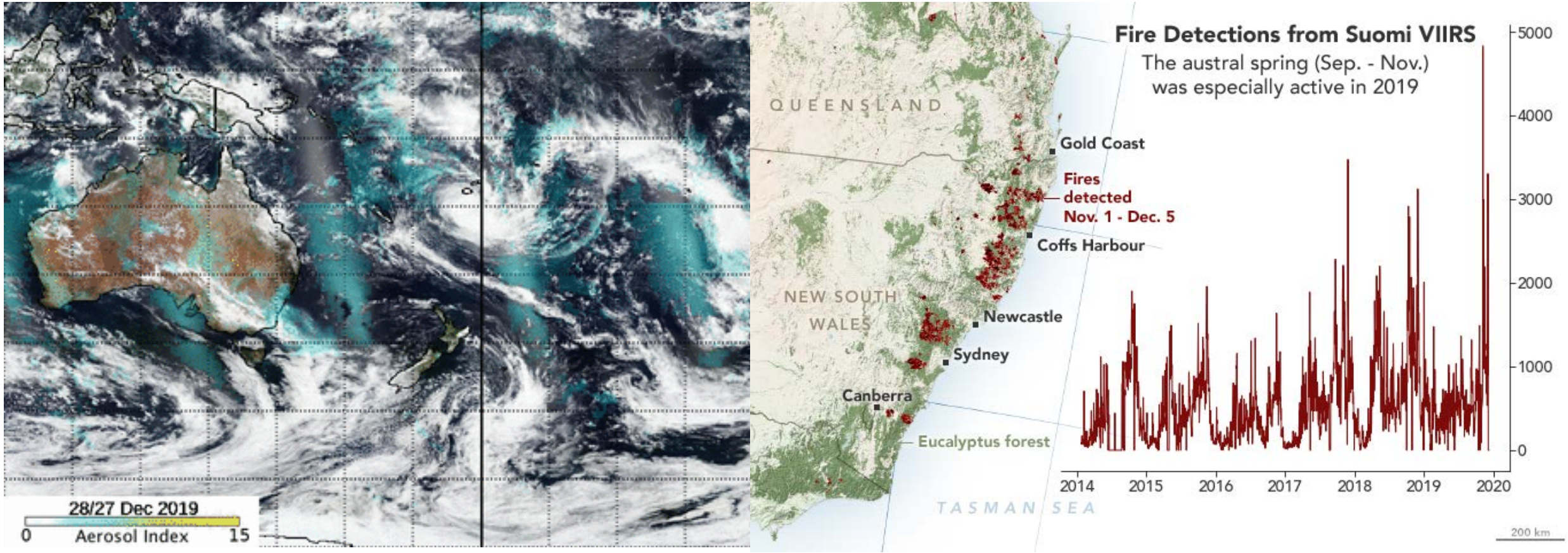
Visible Infrared Imaging Radiometer Suite (VIIRS)

- A sensor onboard the Suomi National Polar-Orbiting Partnership (NPP)
- Data available globally from January 2012 to present
- Revisit Time: 1 day
- Spatial Resolution: 375m and 750m
- Similar to MODIS (with some differences)
- Visible, near-infrared channels (reflectance)
- Shortwave and longwave infrared (brightness temperature)
- Products:
  - Surface reflectance
  - Vegetation indices
  - Thermal anomalies



Suomi NPP satellite (above); Global vegetation map (left). Image Credit: NASA/NOAA)

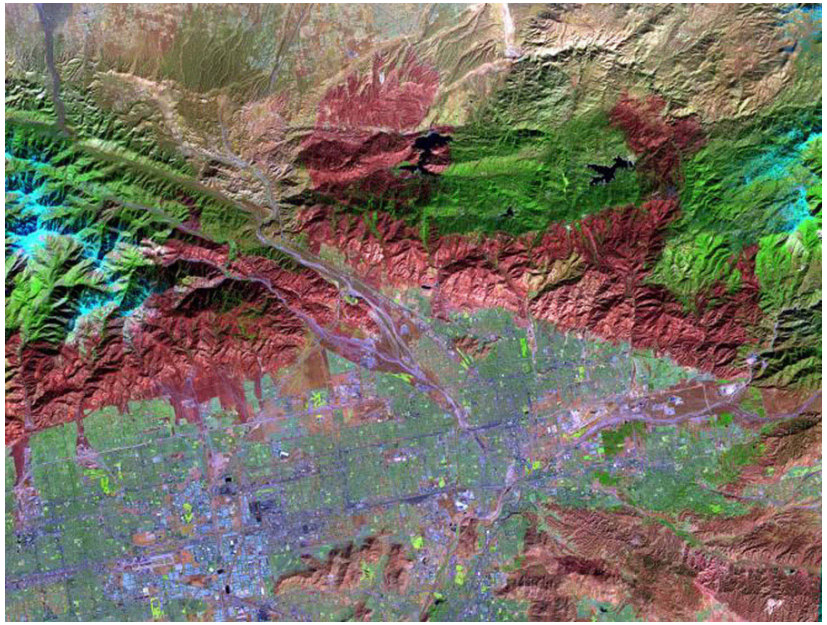
VIIRS



VIIRS and OMPS-NM instruments track the movement of aerosols from recent Australian fires (left); VIIRS detects active fire locations along eastern Australia (right). Image Credit: NASA

Other Satellites and Sensors for Biodiversity

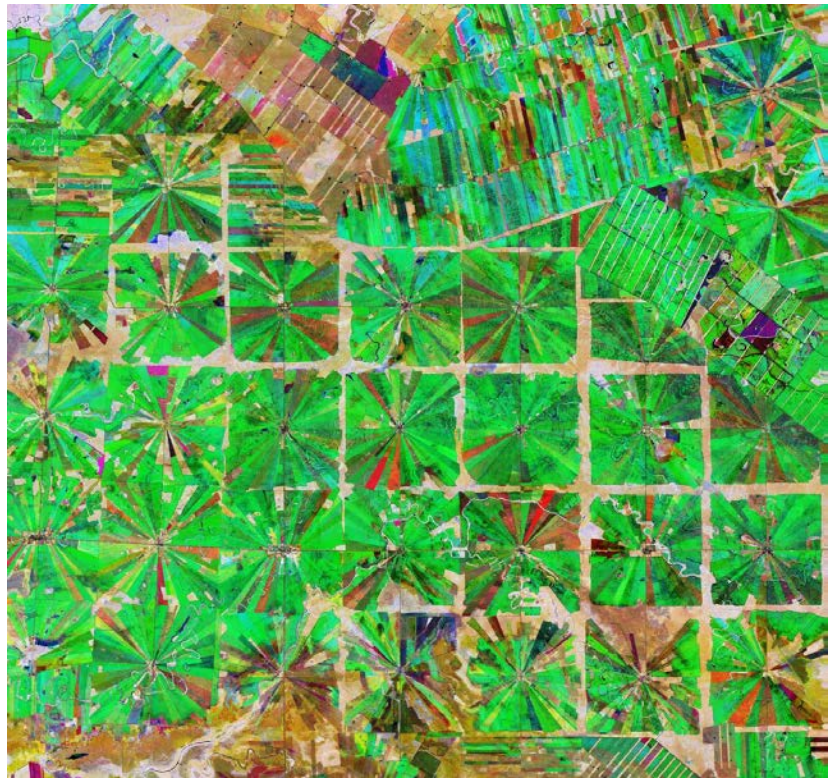
- **Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER):**
  - Onboard TERRA, with similar spectral and spatial resolution to Landsat (15-90m)
  - Images are "tasked," so no consistent measurements in the same location
  - Vegetation health, land change, wildfires, flooding, etc.
  - ASTER overview webinar
- **Shuttle Radar Topography Mission (SRTM):**
  - Flown onboard the Endeavor in 2000
  - Elevation data (90m and 30m)
  - Often combined with ASTER or Landsat data



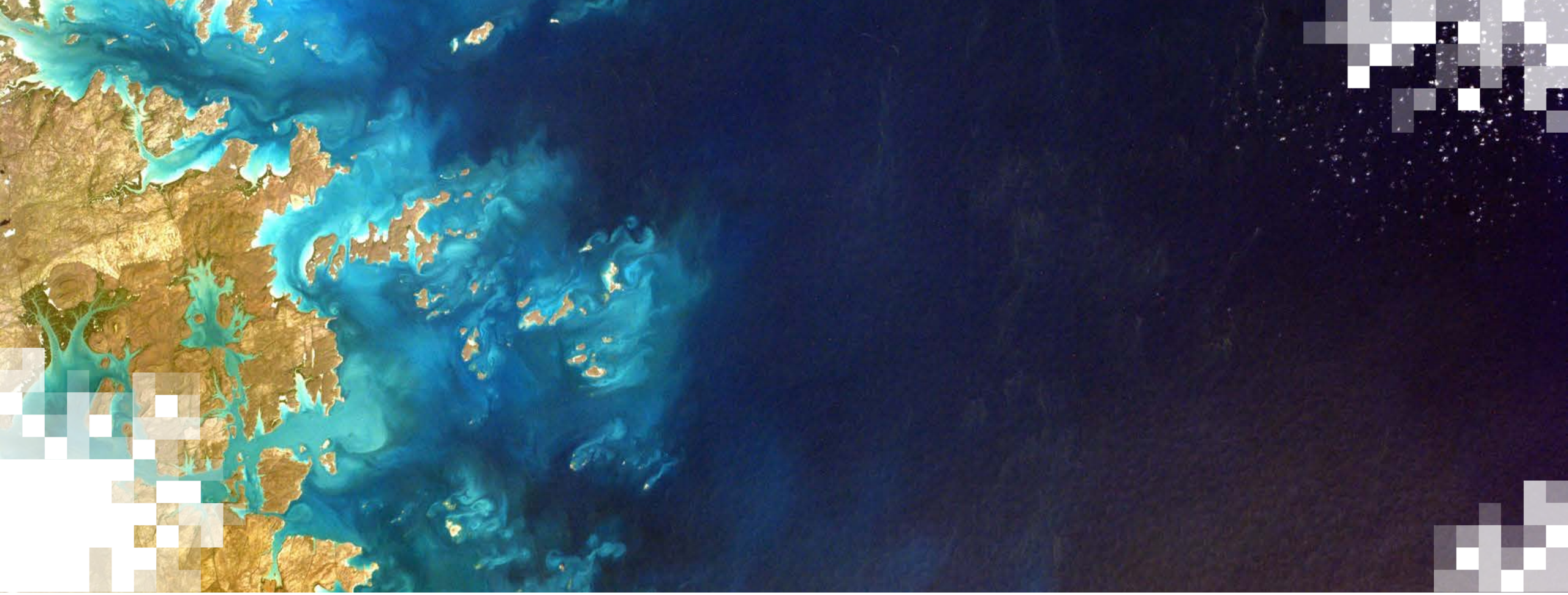
ASTER image of 2003 Old Fire/Grand Prix fire east of Los Angeles. Image Credit: NASA

ESA Satellites and Sensors for Biodiversity

- **Sentinel-2**
  - 13 spectral bands
  - Spatial Resolution:
    - Red, Green, Blue (RGB) at 10 meters
    - Near-infrared and Shortwave infrared at 20 and 60 meters
  - Revisit time: ~5 days
  - Often combined with Landsat for continuity
    - Harmonized Sentinel-2 and Landsat surface reflectance products available
- **SPOT (multiple satellites)**
  - National Centre for Space Studies (*CNES*), French government space agency
  - 4 multispectral bands
  - 6-meter spatial resolution
  - Revisit time: ~2-3 days



Composite Sentinel-2 image of forests converted to farmland in Brazil 2019. Image Credit: ESA



Guest Speakers: Christina Supples and Annie Virnig

Empowered lives.
Resilient nations.

INTRODUCTION TO KEY INTERNATIONAL POLICIES & UNDP'S WORK ON SPATIAL DATA

NASA ARSET Webinar Series
24 March 2020

PRESENTATION OVERVIEW

1. Setting the context
2. Overview of UNDP support to build spatial data capacity
3. Global Biodiversity Support Programme
4. UN Biodiversity Lab
5. NASA-Supported Projects
6. Discussion & conclusions

1. SETTING THE CONTEXT

WE ARE WITNESSING AN UNRAVELING OF THE PLANET

- IPCC report shows that we must act in the next 10 years to avoid catastrophic impacts of climate change
- IPBES report shows 1 million species at risk of extinction
- Unsustainable land use accounts for ¼ of greenhouse gas emissions

Photo: Equator Prize Winner Komunitas Adat Muara Tae

LEVERAGING AN INTERNATIONAL POLICY FRAMEWORK

- 2030 Agenda for Sustainable Development
- Convention on Biological Diversity
- UN Framework Convention on Climate Change
- UN Convention to Combat Desertification

Photo: IISD/ENG| Francis Dejon

IDENTIFYING SYNERGIES ACROSS NATIONAL PLANS

- 2030 Agenda for Sustainable Development
  - National Development Plan; national SDG indicators
- Convention on Biological Diversity
  - National Biodiversity Strategies and Action Plans (NBSAPs)
- UN Framework Convention on Climate Change
  - Nationally Determined Contributions (NDCs)
  - Reducing emissions from deforestation and forest degradation (REDD+)
- UN Convention to Combat Desertification
  - Land Degradation Neutrality Targets (LDN)

Photo: Equator Prize Winner Tulele Peisa

TROPICAL FORESTS ARE A KEY ECOSYSTEM AT THE NATURE-CLIMATE NEXUS

- Tropical forest loss accounts for more than 90% of global deforestation
- Globally, this is equal to the total GHG emissions of the European Union
- Investments comprise less than 1.5 percent—only US$3.2 billion—of the US$256 billion committed by multilaterals & developed country donors

Photo: Equator Prize Winner Riba Agroforestry Research Center

WHAT ARE NATURE-BASED SOLUTIONS?

- Protection, restoration, and sustainable use of forests, grasslands, and wetlands
- Emphasized as critical by the IPCC Special Report on Land (2019)
- Often already included in NBSAPs & REDD+ plans
- Often promoted by indigenous peoples and local communities

STRONG NEED TO INCLUDE NATURE-BASED SOLUTIONS IN NDCs

- To keep planetary warming below 2°C, NDC ambition must be tripled
- To keep planetary warming below 1.5°C, NDC ambition must increase 5X
- Nature-based solutions can provide 1/3 of climate mitigation solutions

Photo: Amazon Watch

SPATIAL DATA CAN PLAY A POWERFUL ROLE FOR NATURE AND CLIMATE

- Identify WHERE & HOW to take action on nature for biodiversity, climate, and sustainable development
- Support monitoring & transparency for the CBD, UNFCCC, and nature-based Sustainable Development Goals

ABILITY OF POLICYMAKERS TO ACCESS & USE SPATIAL DATA IS VARIABLE

- National Biodiversity Plans & Fifth National Reports show lack of spatial data:
  - 4 maps per National Biodiversity Plan, 5 per 5NR
  - 1 out of every 3 5NRs had no actionable maps (identifying areas for protection/restoration)
  - <4% focused on ecosystem services

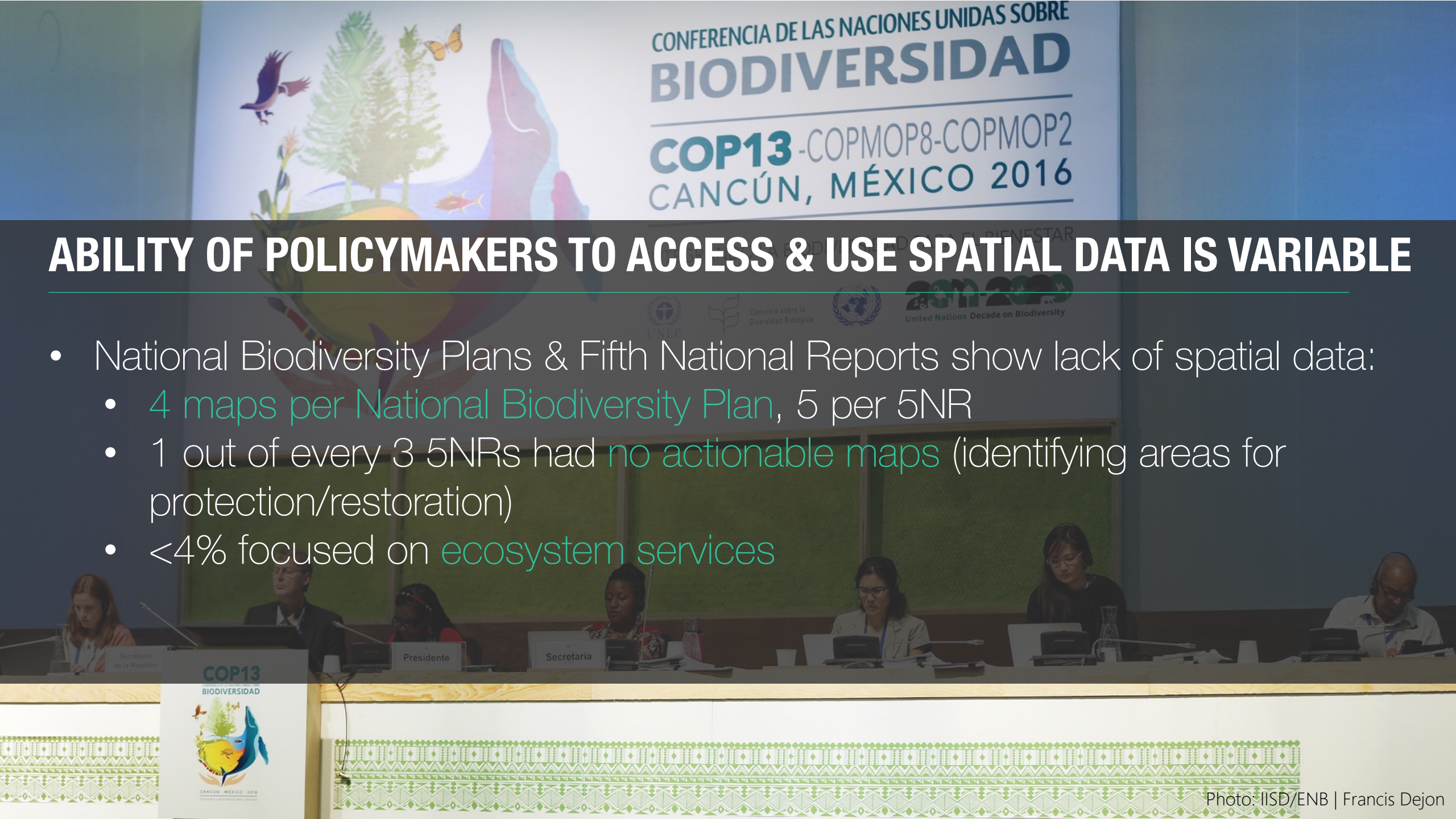


Photo: IISD/ENB | Francis Dejon

2. UNDP SUPPORT TO BUILD SPATIAL DATA CAPACITY

Empowered lives.
Resilient nations.

UNDP NATURE FOR DEVELOPMENT PROGRAMME

NATURE FOR DEVELOPMENT | 8 KEY PROJECTS

1. Equator Initiative
2. Nature for Life
3. Green Finance
4. Learning for Nature
5. New York Declaration on Forests
6. National Biodiversity Support
7. UN Biodiversity Lab
   a. NASA-**supported** projects
8. Strategic Support

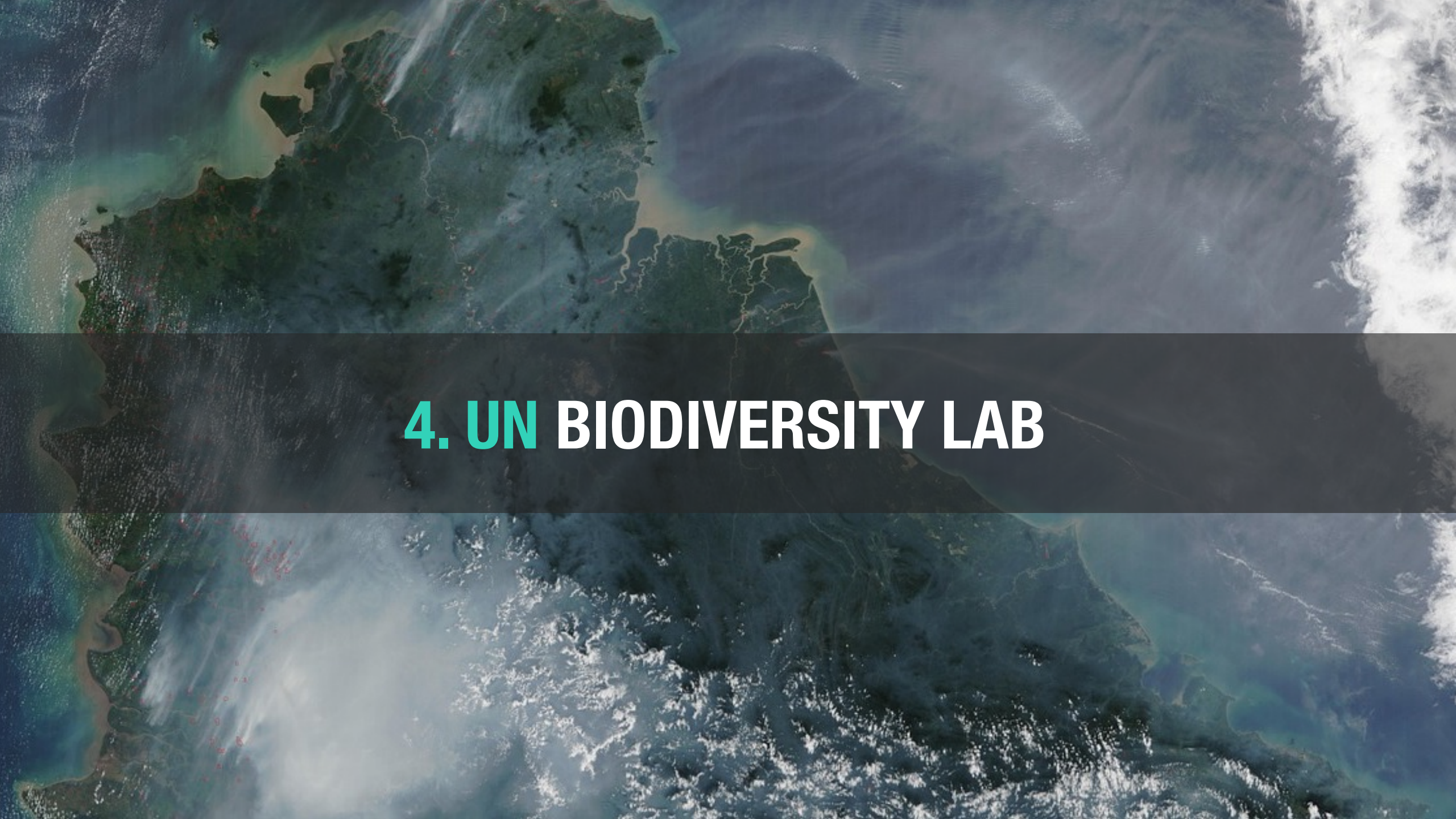
Photo: Equator Prize Winner AIDER

3. NATIONAL BIODIVERSITY SUPPORT

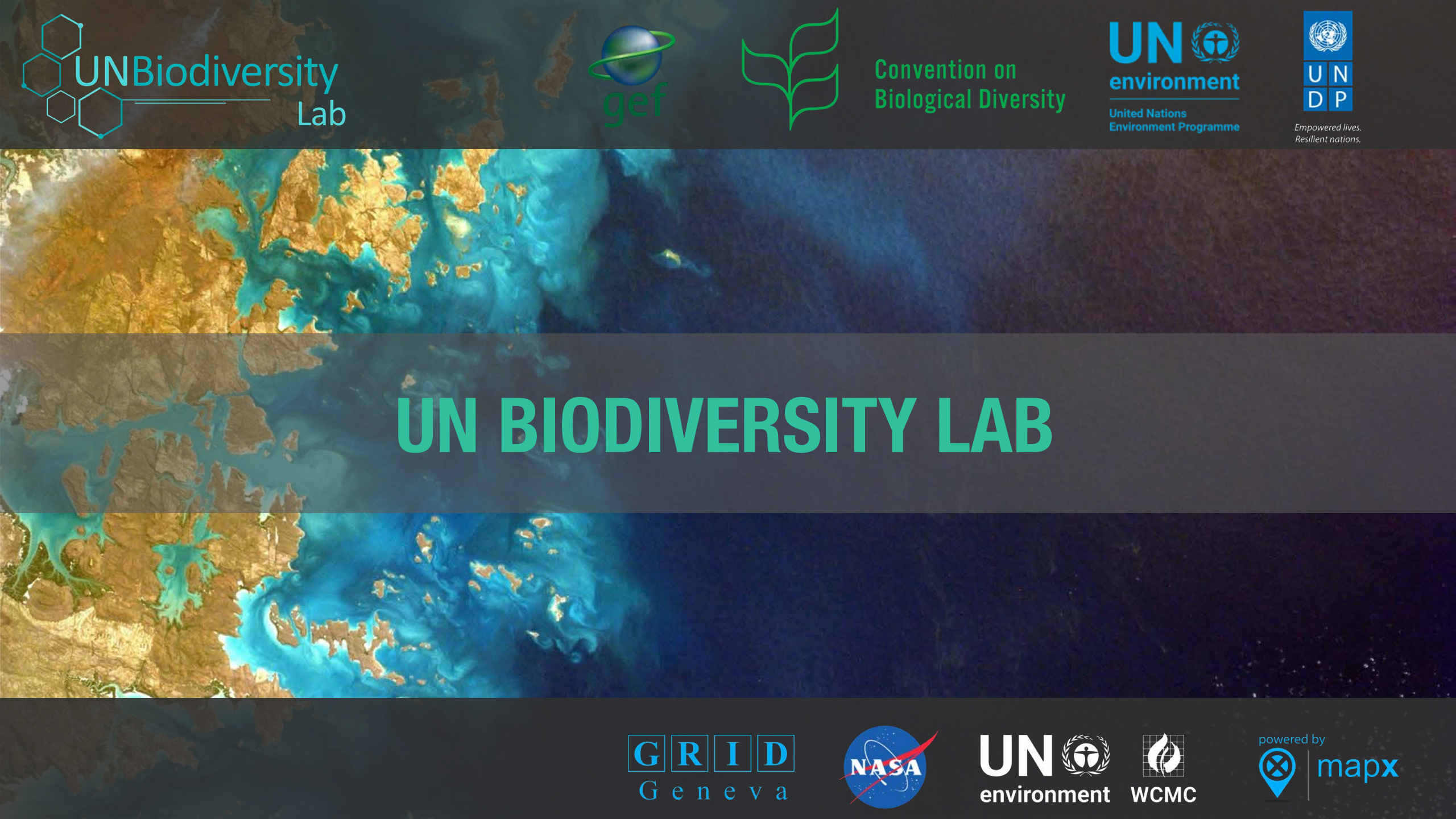
NATIONAL BIODIVERSITY SUPPORT

Photo: Equator Prize Winner FUMA Gaskiya

- National Biodiversity Support provides tools and knowledge on national biodiversity planning (NBSAPs) and reporting (Sixth National Reports) for the Convention on Biological Diversity (CBD)
- Working closely w/ UN Environment & CBD Secretariat, we influence action in nearly 140 countries



4. UN BIODIVERSITY LAB


UNBiodiversity Lab
gef
Convention on Biological Diversity
UN environment
United Nations Environment Programme
UNDP
Empowered lives. Resilient nations.
UN BIODIVERSITY LAB
GRID Geneva
NASA
UN environment
WCMC
powered by mapx

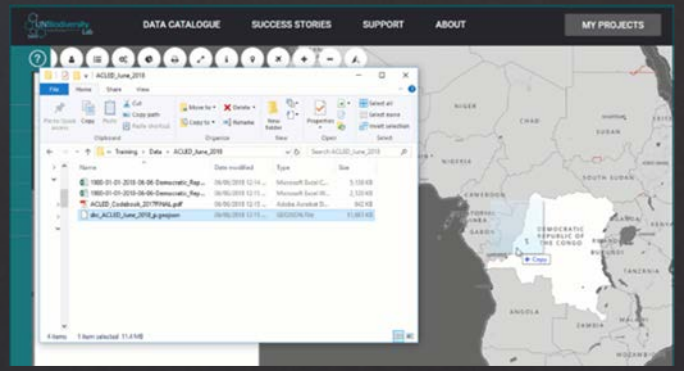
WHAT IS UN BIODIVERSITY LAB?

- Created to support policymakers in their biodiversity commitments
- Provides 137 governments with access to FREE high-quality global spatial data layers & analytic tools
- Does NOT require GIS expertise

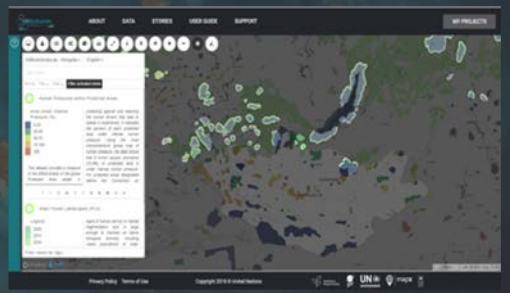
UN BIODIVERSITY LAB | FIVE KEY FEATURES

1. Access >100 global data layers

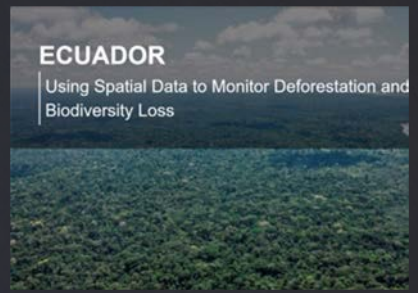
2. Visualize NASA project data



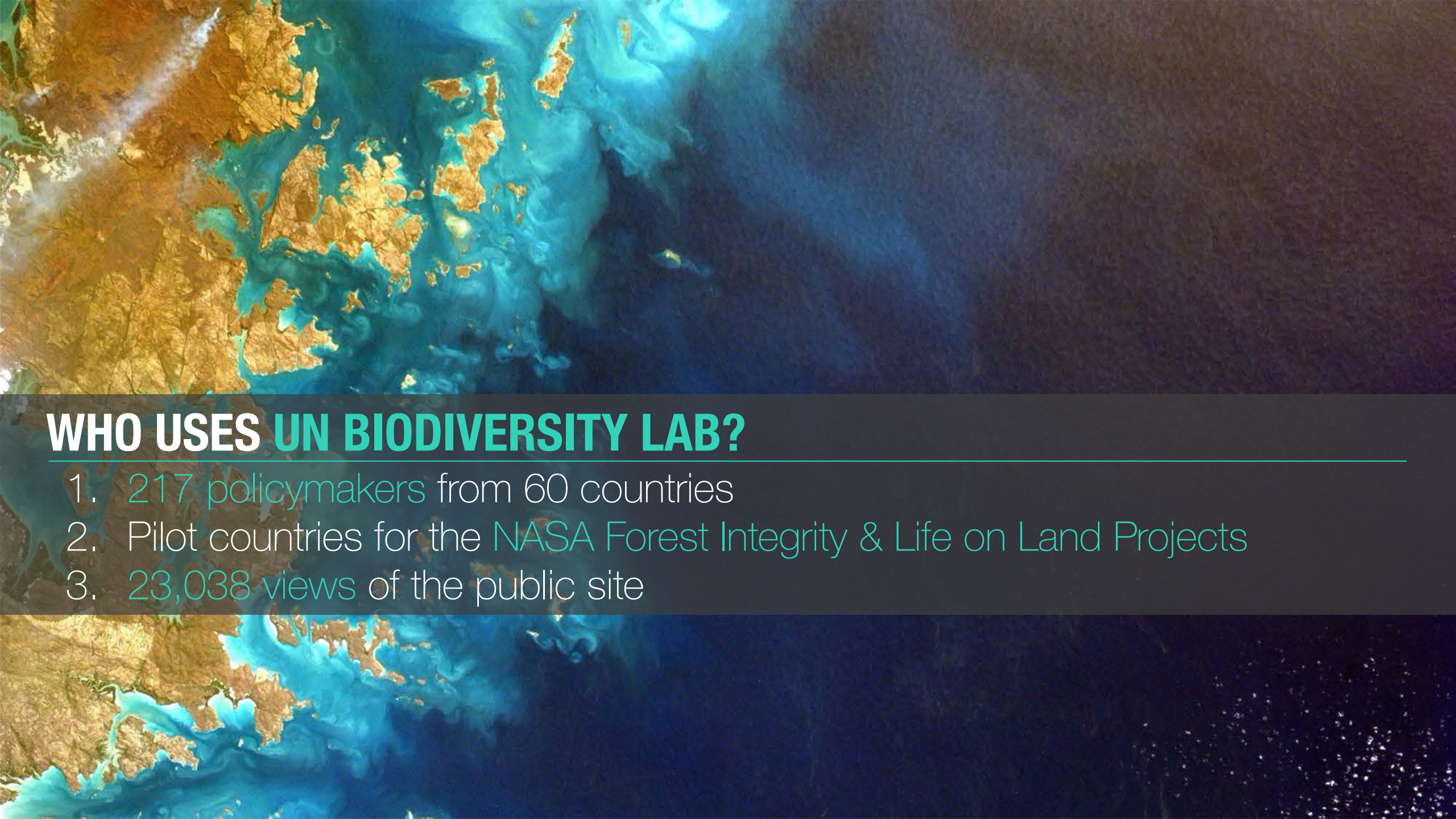
3. Govt access to private national projects



4. Conduct analyses & create maps



5. Communicate success



WHO USES UN BIODIVERSITY LAB?

1. 217 policymakers from 60 countries
2. Pilot countries for the NASA Forest Integrity & Life on Land Projects
3. 23,038 views of the public site

UN BIODIVERSITY LAB I WHAT SETS US APART?

1. Political mandate & relevancy
2. UNDP & UN Environment provide key user engagement
3. National workspaces for contextual conservation action

5. NASA-SUPPORTED PROJECTS


NASA
gef
UNDP
Empowered lives.
Resilient nations.
DATA INTO ACTION | NASA PROJECTS
NORTHERN ARIZONA UNIVERSITY
UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA
GLAD GLOBAL LAND ANALYSIS & DISCOVERY
UNIVERSITY OF MARYLAND 18 56
CBCS Centre for Biodiversity & Conservation Science
MONTANA STATE UNIVERSITY

DATA INTO ACTION | NASA PROJECTS

Empowered lives.
Resilient nations.

1. NASA Forest Integrity Project *(2017-2020)*
2. NASA Life on Land Project *(2019-2021)*

NORTHERN ARIZONA UNIVERSITY

UNBC UNIVERSITY OF NORTHERN BRITISH COLUMBIA

GLAD GLOBAL LAND ANALYSIS & DISCOVERY

UNIVERSITY OF 18 56 MARYLAND

CBCS Centre for Biodiversity & Conservation Science

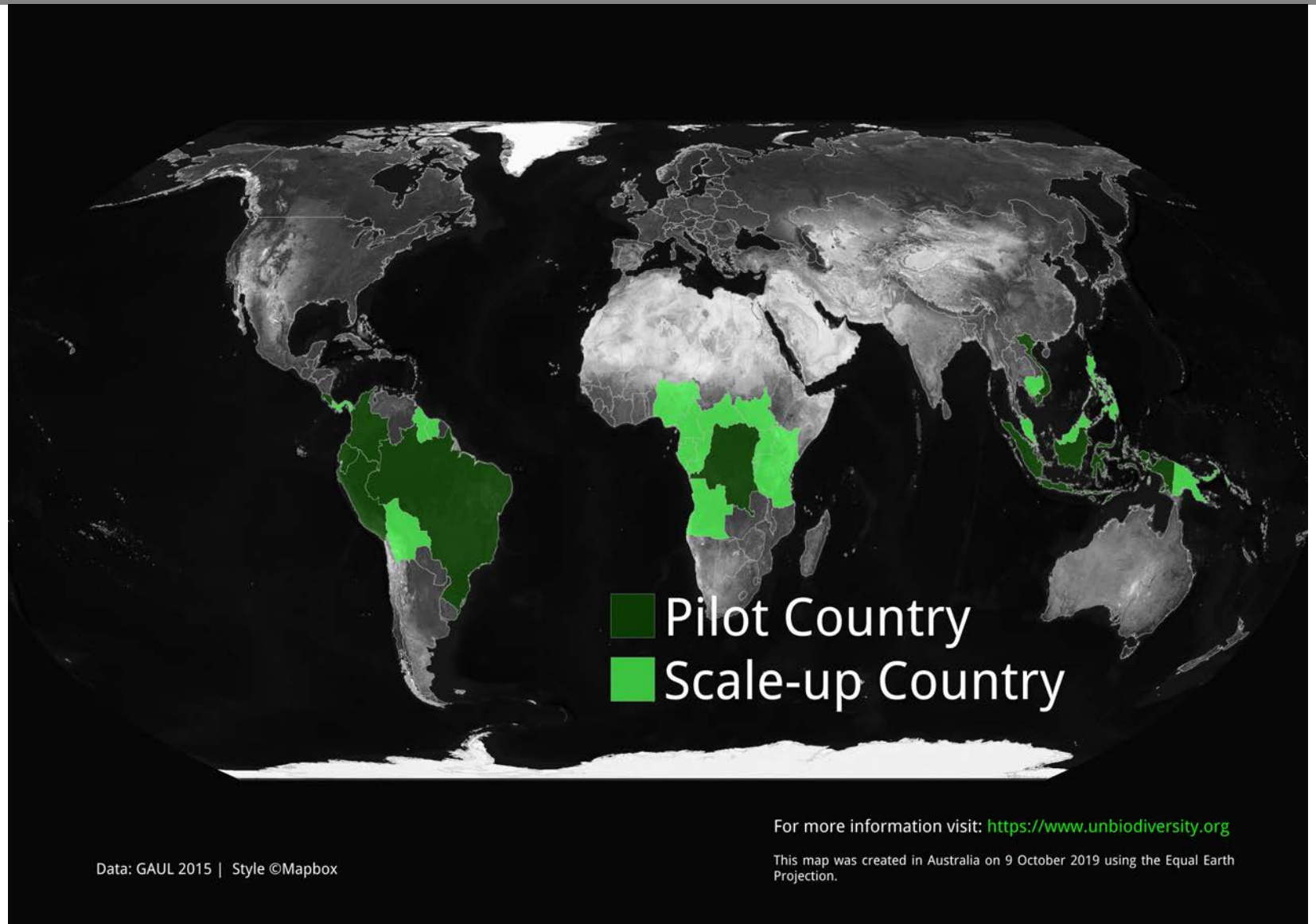
MONTANA STATE UNIVERSITY

IMPORTANCE OF FOREST INTEGRITY ACROSS CONVENTIONS

- Data on forest integrity can support governments to meet commitments to CBD, UNFCCC & the 2030 Agenda
- Through these projects we will:
  - Monitor changes in a country's forests over time
  - Identify 'last of the wilds' forests
  - Identify critical forests for connectivity
  - Focus restoration and protection efforts

NASA FOREST INTEGRITY PROJECT

NASA FOREST INTEGRITY PROJECT COUNTRIES



NASA FOREST INTEGRITY PROJECT OBJECTIVES

1. Develop high-quality spatial data on forest condition, human pressure, forest integrity, and forest connectivity
2. Analyze these data in ways relevant to users' decision-making
3. Create UN Biodiversity Lab as to support decision-makers to use and analyze these data for conservation action

Photo: Amazon Watch

KEY DATA PRODUCED BY FOREST INTEGRITY PROJECT

1. Forest Condition
2. Human Footprint
3. Forest Structural Condition Index
4. Forest Integrity Index
5. Forest Fragmentation and Connectivity
6. Impact of Forest Integrity on Key Species

Photo: Amazon Watch


NASA LIFE ON LAND PROJECT

NASA LIFE ON LAND PROJECT COUNTRIES

NASA LIFE ON LAND PROJECT OBJECTIVES

1. Assess the collaborating countries' needs for decision support regarding SDG15 under climate change
2. Project change to 2100 in forest structure and composition, vertebrate habitats, and water risk under scenarios of climate, socioeconomics, and policy
3. Use results to inform reporting and policymaking for SDG15
4. Share data through UN Biodiversity Lab

KEY DATA PRODUCED BY THE PROJECT

1. Forecasting climate change
2. Forecasting human pressure and land use change

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3. Forecasting ecosystem composition & structure
4. Forecasting vertebrate
5. Forecasting water risk

6. FINAL THOUGHTS

CONCLUSIONS

- We have 10 years to avoid catastrophic impacts of climate change, and 10 years to achieve the Sustainable Development Goals
- Calls across sectors emphasize the need for transformative change
- Action at the nature-climate nexus provides one way to align & upscale efforts
- UNDP's goal is to support policymakers and other key stakeholders to use spatial data as a powerful tool

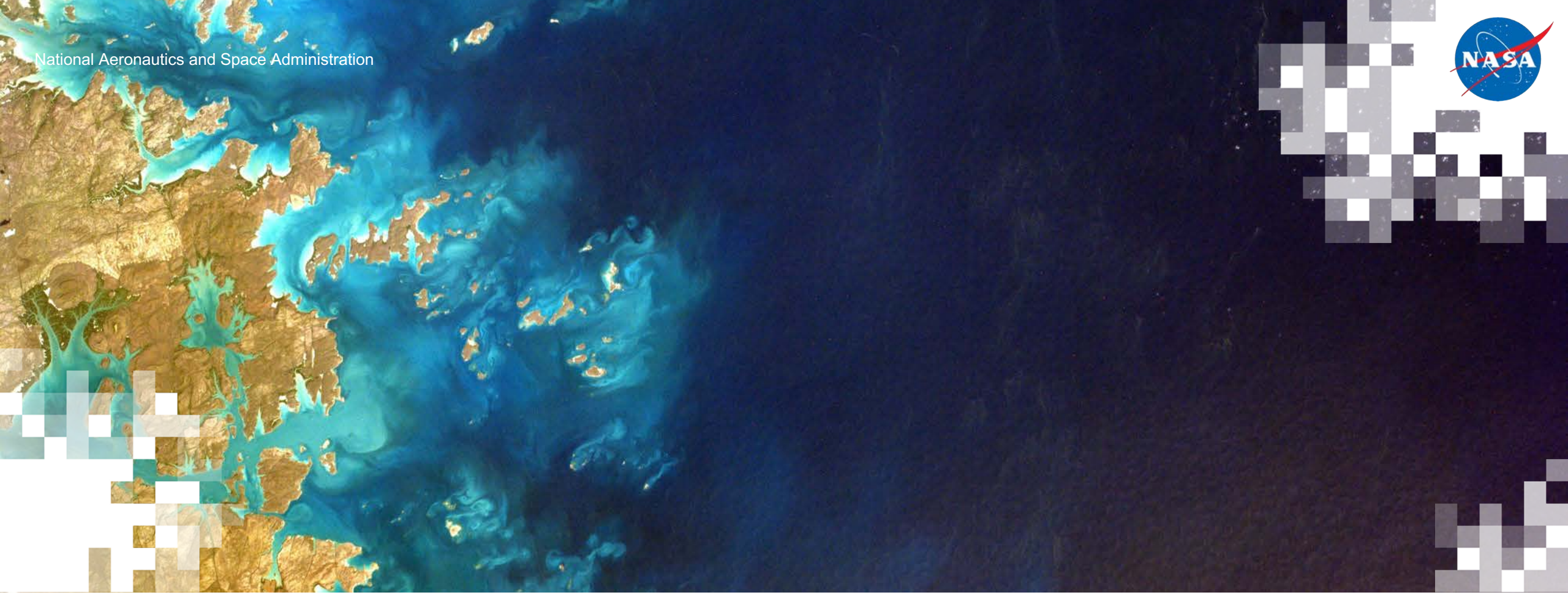
Empowered lives.
Resilient nations.

THANK YOU!

Christina Supples: christina.supples@undp.org
Annie Virnig: anne.virnig@undp.org

Contacts

- ARSET Land Management & Wildfire Contacts
  - Amber McCullum: AmberJean.Mccullum@nasa.gov
  - Juan Torres-Perez: juan.l.torresperez@nasa.gov
- General ARSET Inquiries
  - Ana Prados: aprados@umbc.edu
- ARSET Website:
  - http://arset.gsfc.nasa.gov



Next Session: The UN Biodiversity Lab

March 31, 2020

Questions

- Please enter your questions into the Q&A box
- We will post the questions and answers to the training website following the conclusion of the course


APPLIED REMOTE SENSING TRAINING PROGRAM
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Thank You!