

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



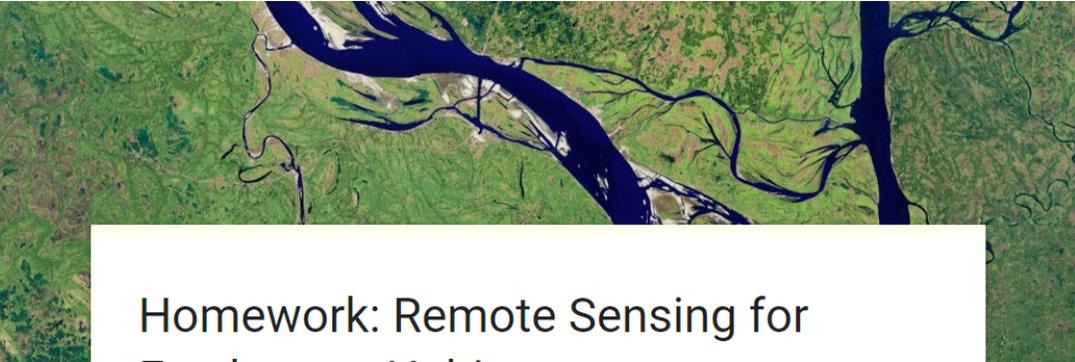
Course Structure

- 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



Homework: Remote Sensing for Freshwater Habitats

This homework includes questions from the webinar. Some questions refer to completing the steps. Thus, it must be completed before submitting them here. You can submit this form at a later time.



NASA's Applied Remote Sensing Training Program (ARSET) presents a certificate of completion to « Name » for completing: **Remote Sensing for Freshwater Habitats** September 17 – October 1, 2019 Trainers: Amber McCullum & Juan Torres-Pérez



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>

The screenshot shows the ARSET (Applied Remote Sensing Training) website. The header includes the NASA logo, the ARSET title, and navigation links for Earth Sciences Division, Applied Sciences, and Capacity Building Program. A search bar is present in the top right. Below the header, there are navigation tabs for Home, About, and Trainings. The main content area features a title for an introductory webinar, a thumbnail image of a satellite map, and a list of dates and topics for the sessions. A sidebar on the right contains navigation links for Land Management, Online Trainings, and In-Person Trainings, along with an 'Upcoming Training' section listing the current webinar.

Earth Sciences Division Applied Sciences Capacity Building Program

NASA ARSET Applied Remote Sensing Training

Search this site

Home About Trainings

Introductory Webinar: Using the UN Biodiversity Lab to Support National Conservation and Sustainable Development Goals

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Land Management

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Upcoming Training

Land

Introductory Webinar: Using the UN Biodiversity Lab to Support National Conservation and Sustainable Development Goals

Mar 24, 2020, Mar 31, 2020, Apr 07, 2020

View All Events

Date Range: March 24, 2020. March 31, 2020. April 7, 2020.

- March 24, 2020: Introduction to Spatial Data and Policies for Biodiversity
- March 31, 2020: The UN Biodiversity Lab
- April 7, 2020: Country Use-Cases

Times:

- Session A (English): 9-10:30am ET
- Session B (French): 11am-12:30pm ET
- Session C (Spanish): 2-3:30pm ET

Description:

This training, offered in partnership with the [UN Development Programme \(UNDP\)](#), will teach



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



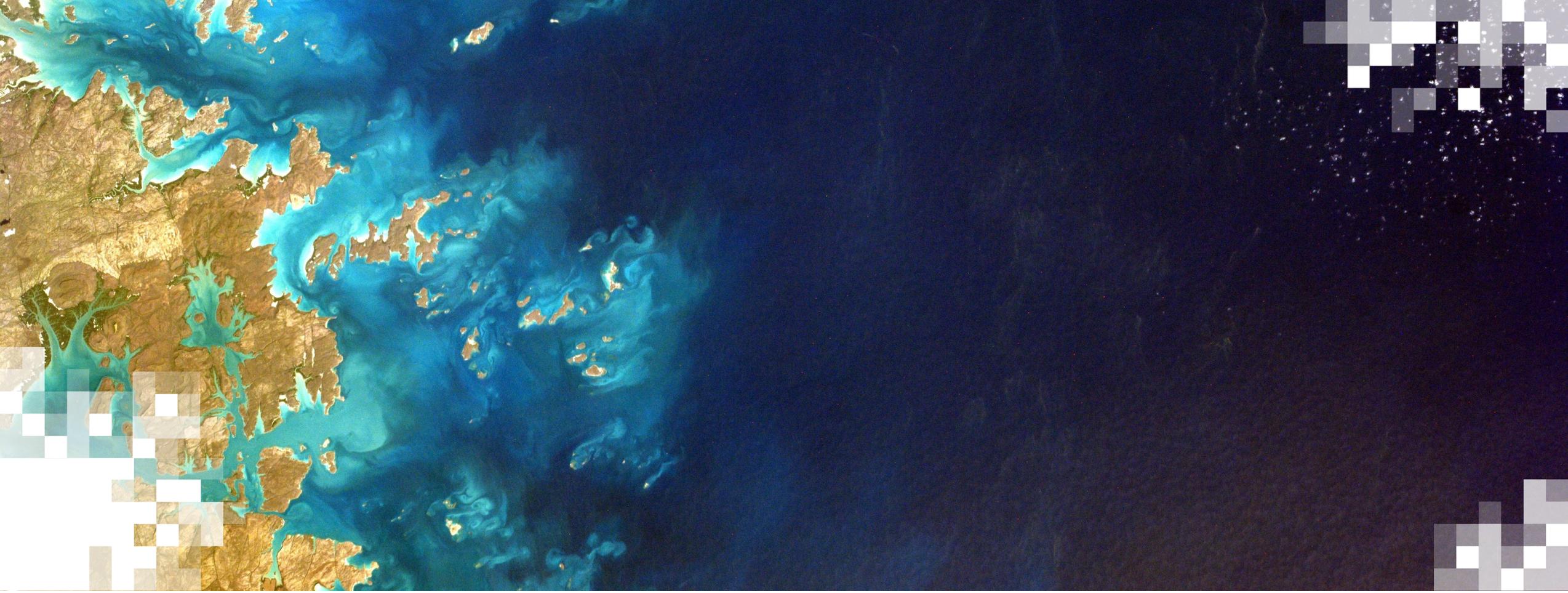
Session 1 Agenda

- 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](#)

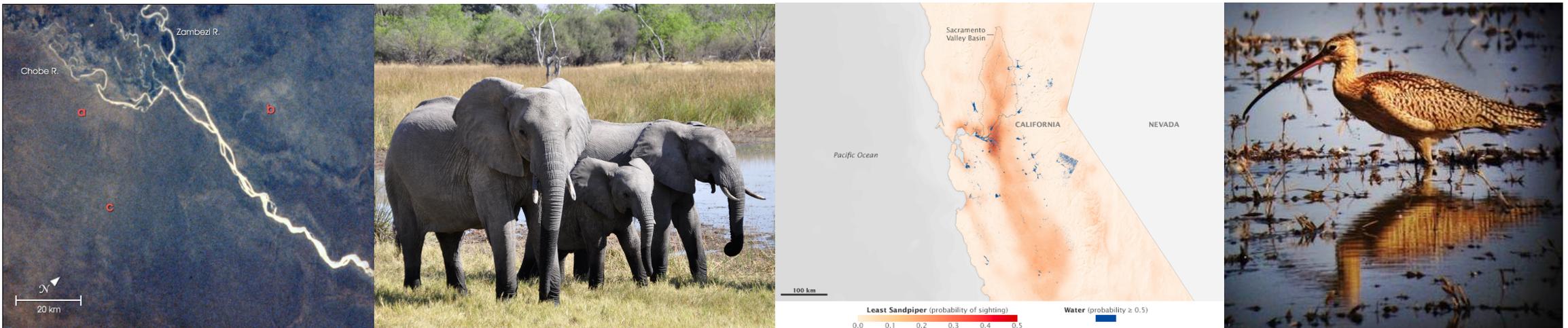




Remote Sensing for Biodiversity

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



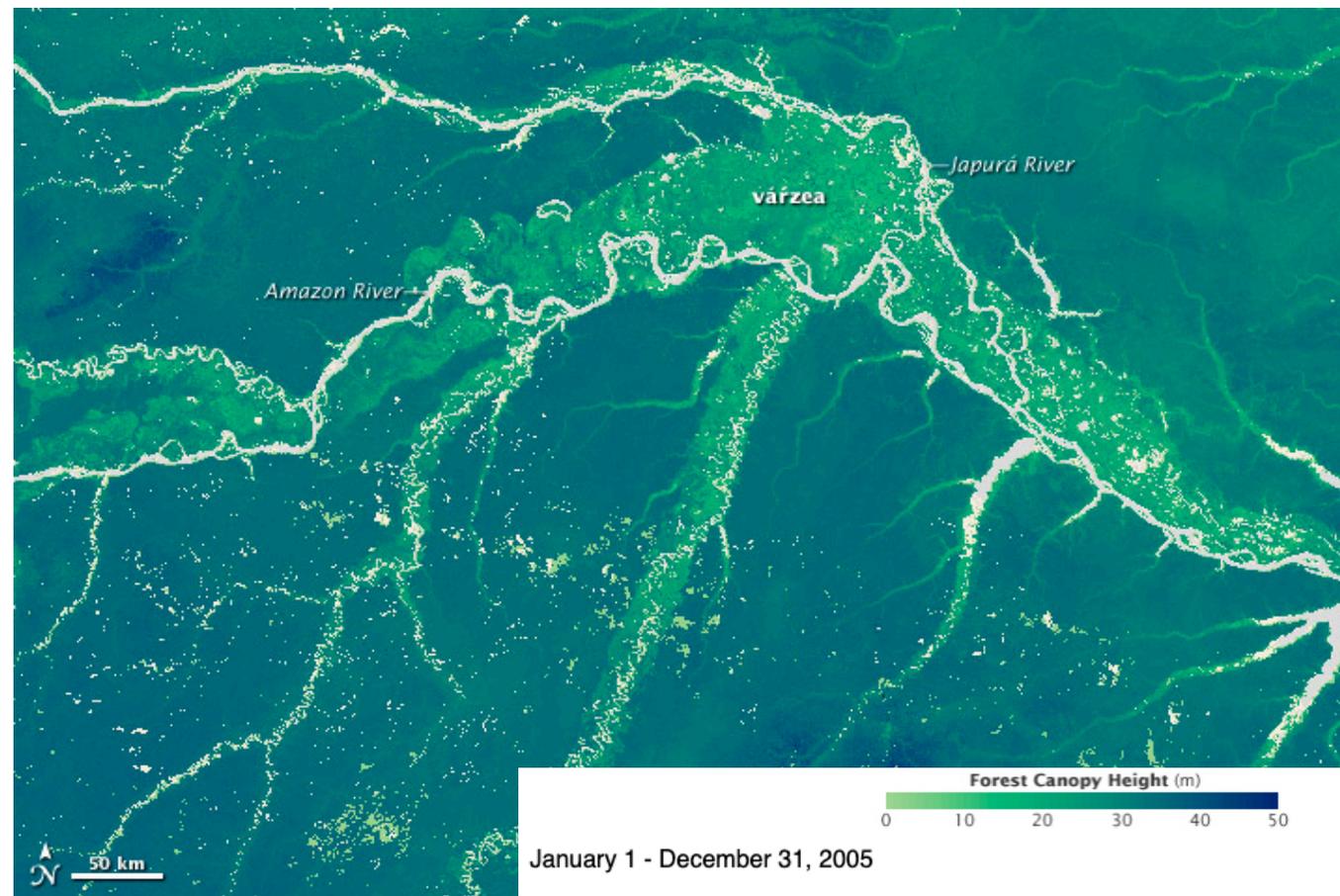
Elephant tracks in Botswana from Landsat ([left](#)); Map of probability of sandpiper sightings in California ([right](#)).



Remote Sensing and Biodiversity

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

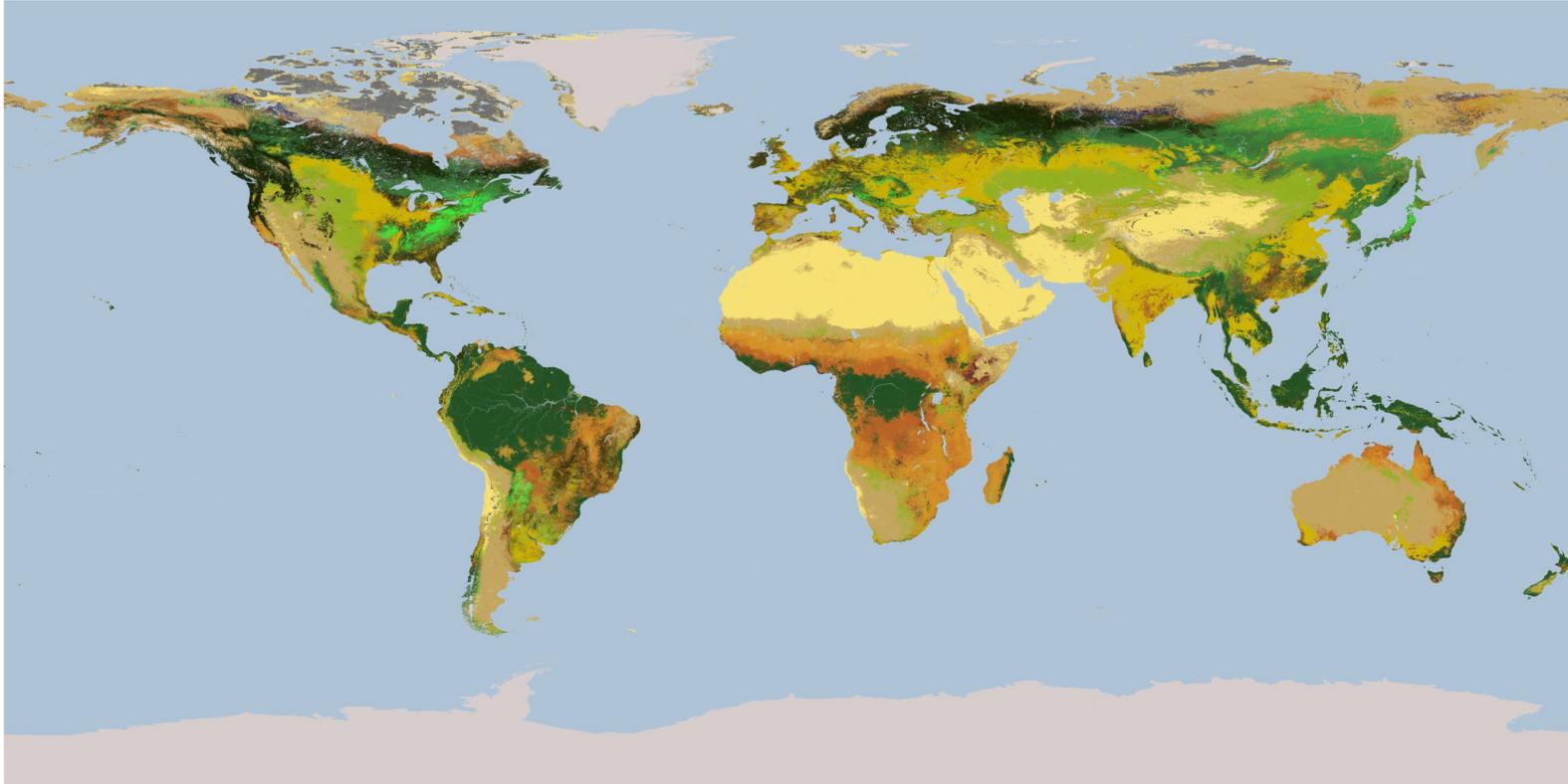
- Physical environment (climate, topography)
- Land cover
- Fragmentation
- Degradation
- Vegetation productivity or health
- Forest canopy height



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



Ecosystem Structure and Composition



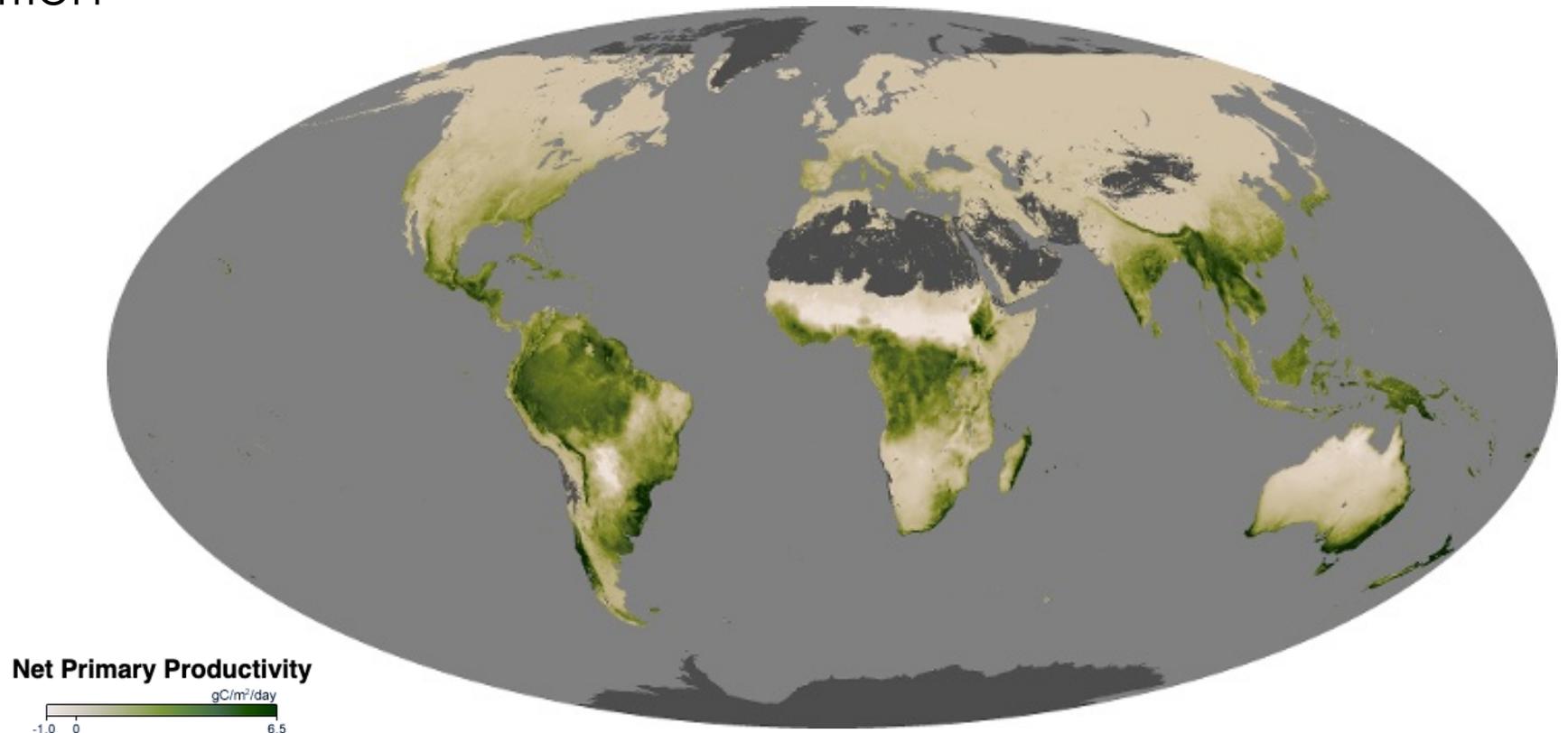
- | | | |
|-------------------------------|-----------------------|---------------------------------|
| 0 Water | 6 Closed Shrublands | 12 Croplands |
| 1 Evergreen Needleleaf Forest | 7 Open Shrublands | 13 Urban and Built-Up |
| 2 Evergreen Broadleaf Forest | 8 Woody Savannas | 14 Cropland/Natural Veg. Mosaic |
| 3 Deciduous Needleleaf Forest | 9 Savannas | 15 Snow and Ice |
| 4 Deciduous Broadleaf Forest | 10 Grasslands | 16 Barren or Sparsely Vegetated |
| 5 Mixed Forests | 11 Permanent Wetlands | 17 Tundra |

Landcover map from
MODIS. Image Credit:
[NASA](https://www.nasa.gov)



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

Brazil forest changes:

- 2015: Deforestation
- 2017: Fire
- 2018: New Pasture



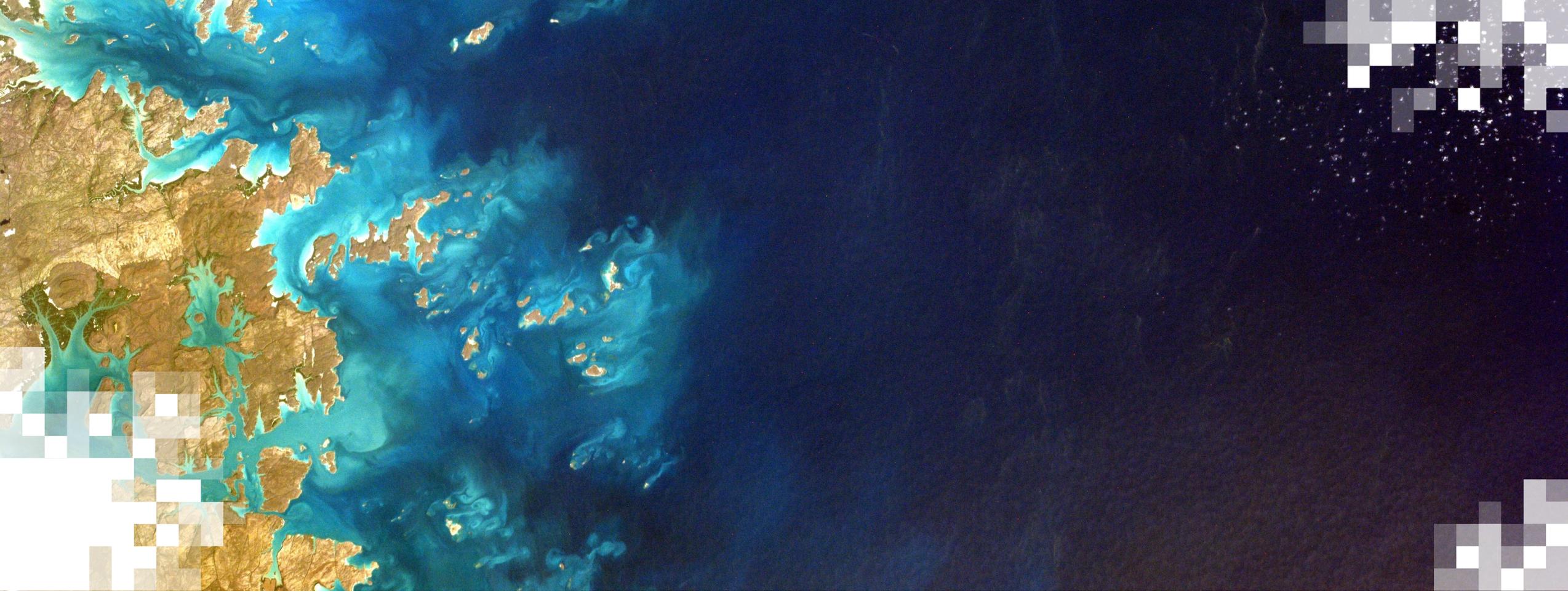
Landsat. Image Credit: [NASA](#)



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

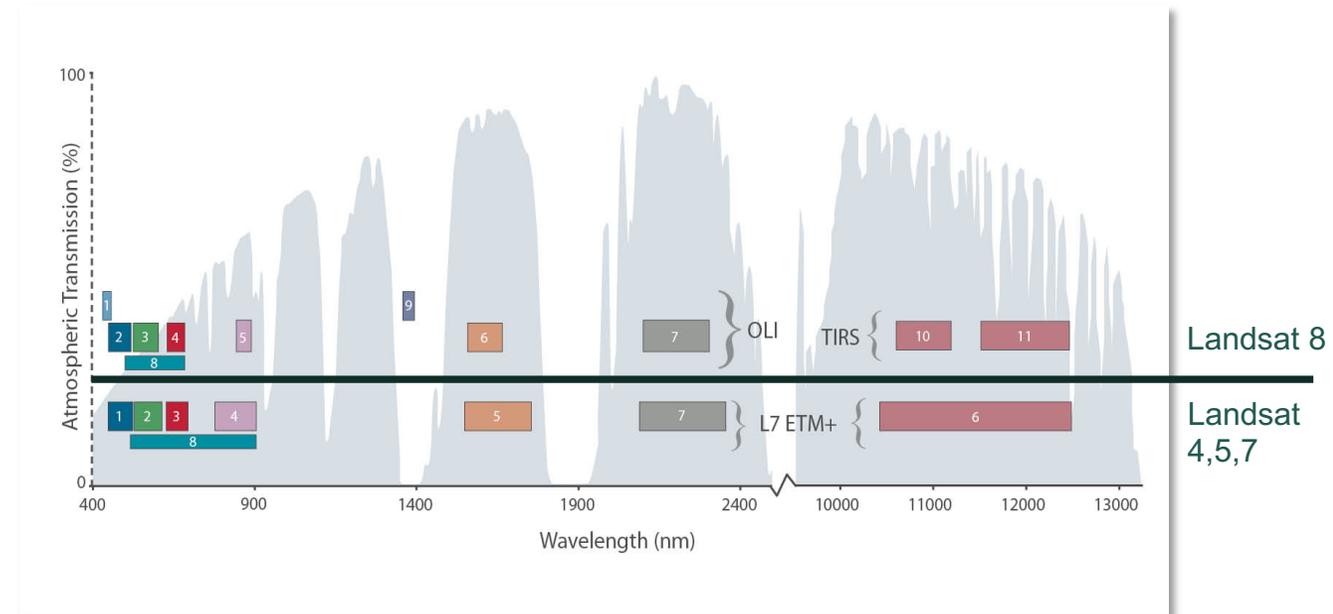
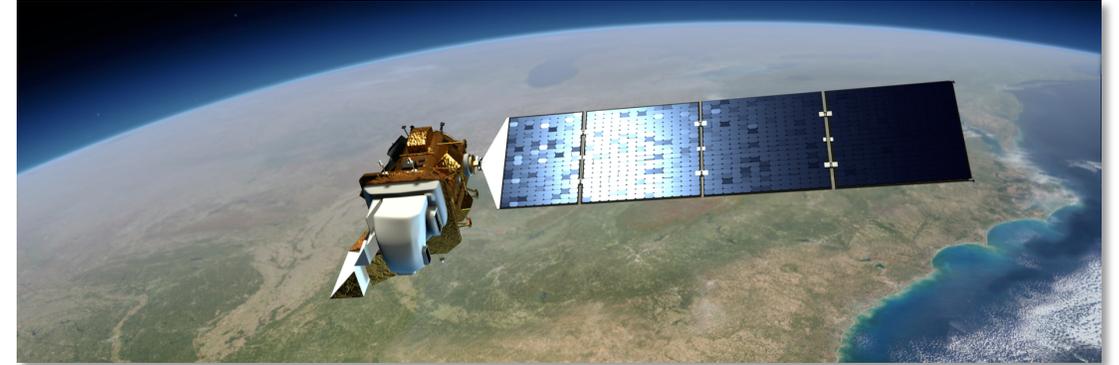




Satellites and Sensors for Biodiversity

Landsat

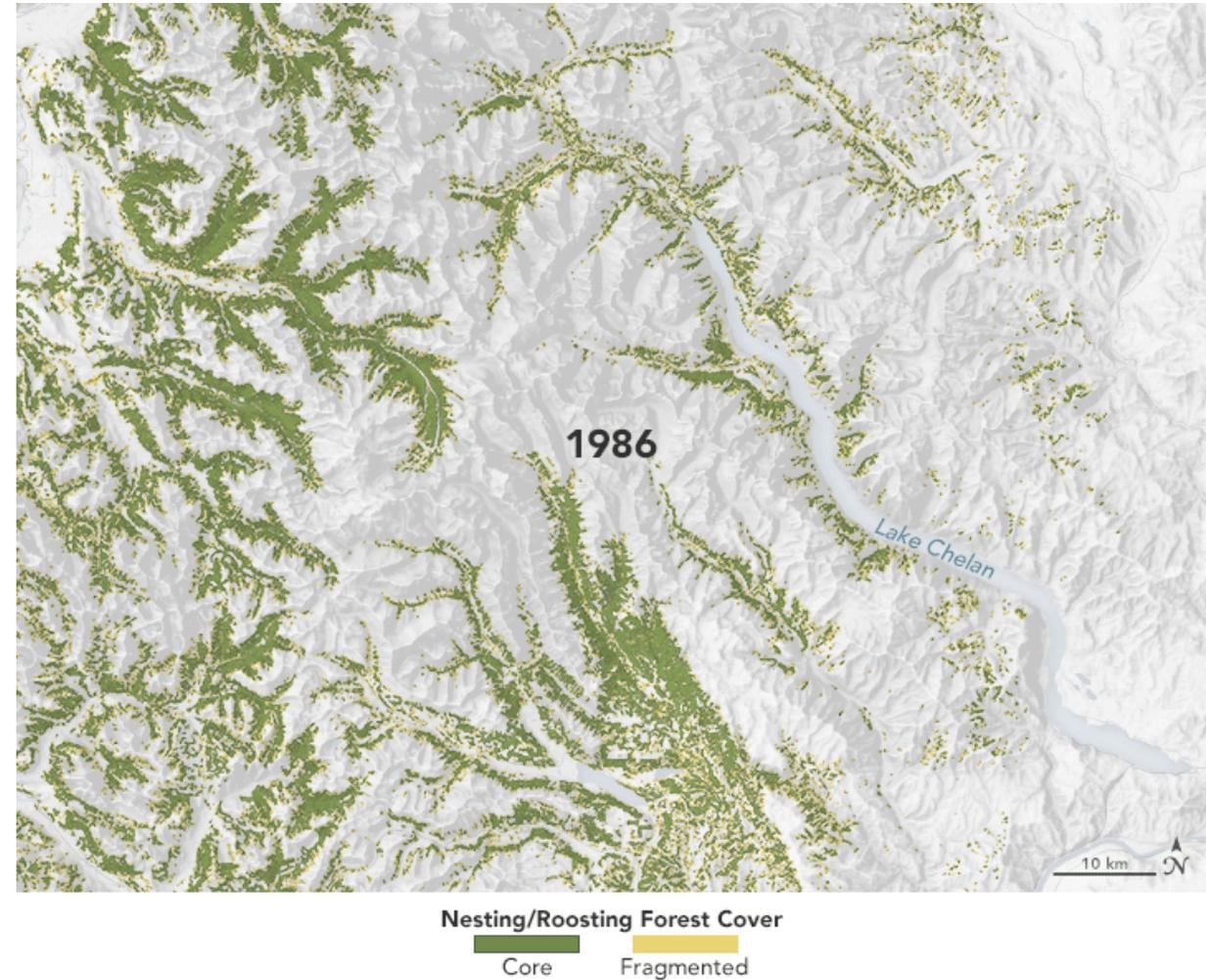
- First Landsat launched in 1972
- Landsat 8 launched in 2013
- NASA created and launched
 - USGS maintains data
- Passive sensor - obtains values of reflectance from Earth's surface
- 30-meter pixels, 15-meter panchromatic band
- Image of the entire Earth every 16 days





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



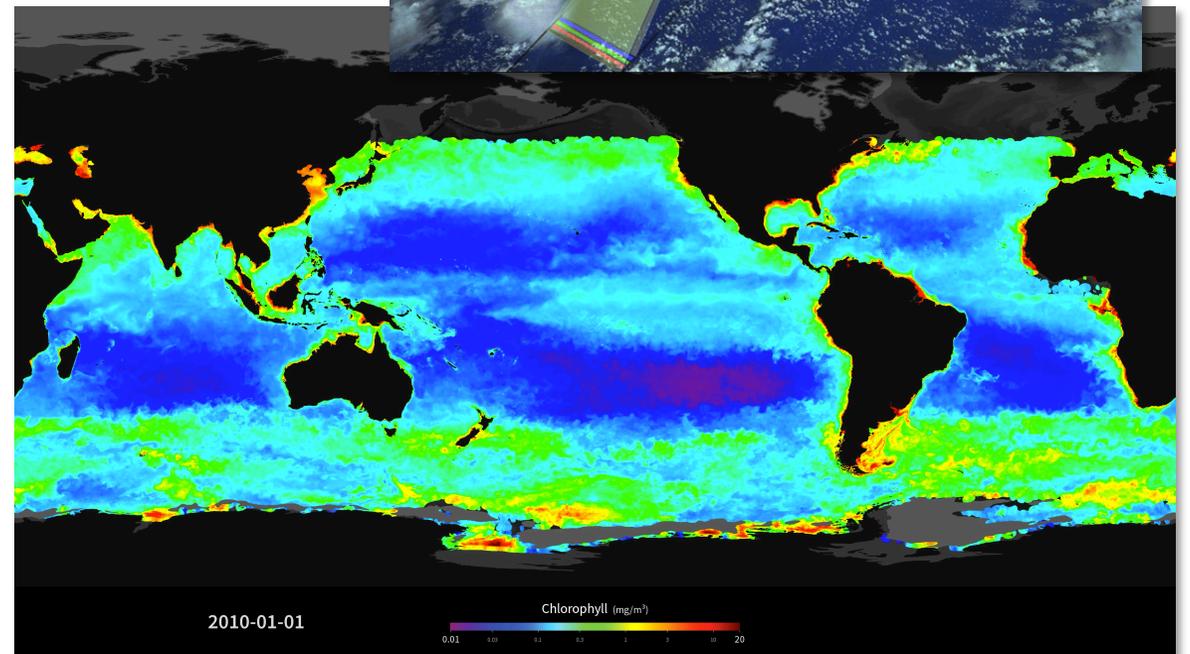
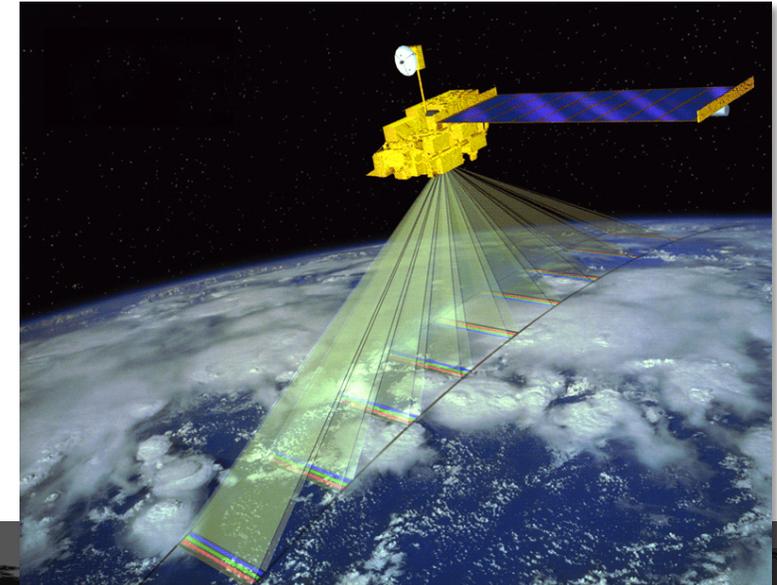
Changes in spotted owl habitat in eastern Washington using Landsat.
Image Credit: [NASA](#).



MODIS

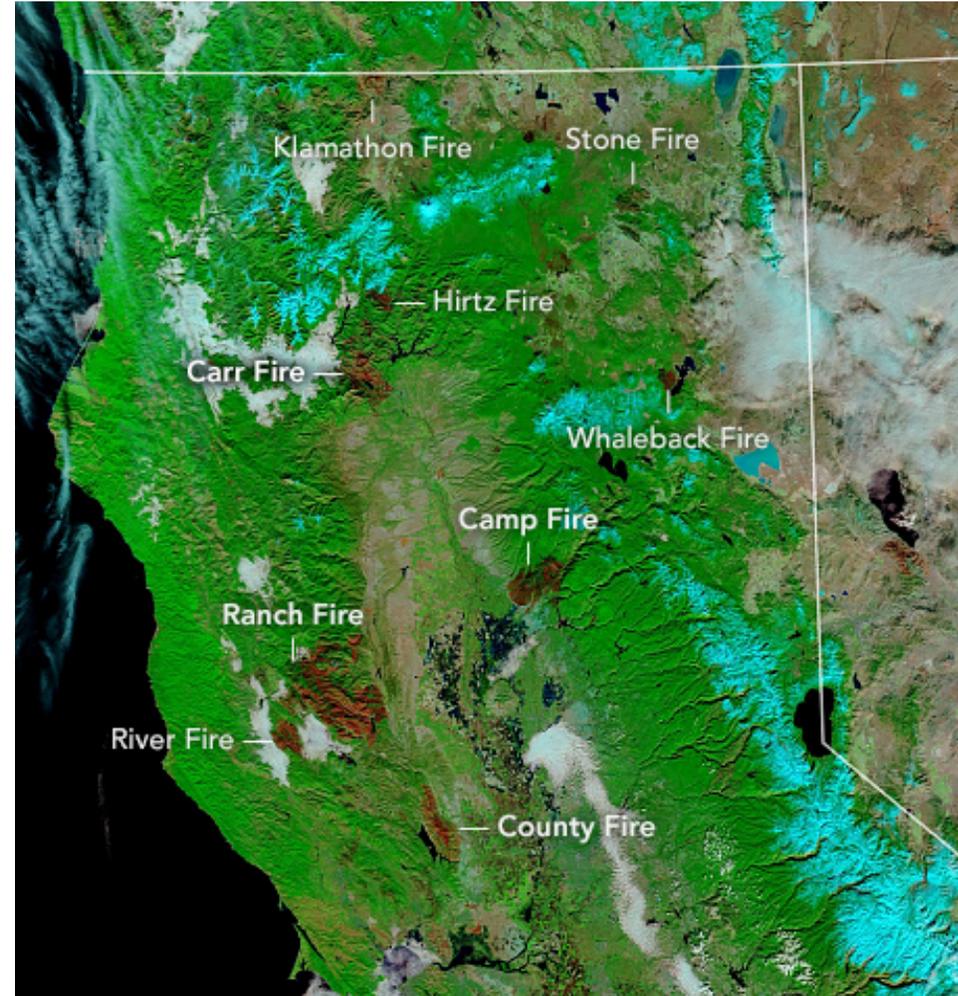
- **Moderate Resolution Imaging Spectroradiometer (MODIS)**
 - Onboard the Terra and Aqua satellites
 - Spatial Resolution
 - 250m, 500m, 1km
 - Temporal Resolution
 - Daily, 8-day, 16-day, monthly, quarterly, yearly
 - 2000–Present
 - Spectral Coverage
 - 36 bands (major bands include red, blue, near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

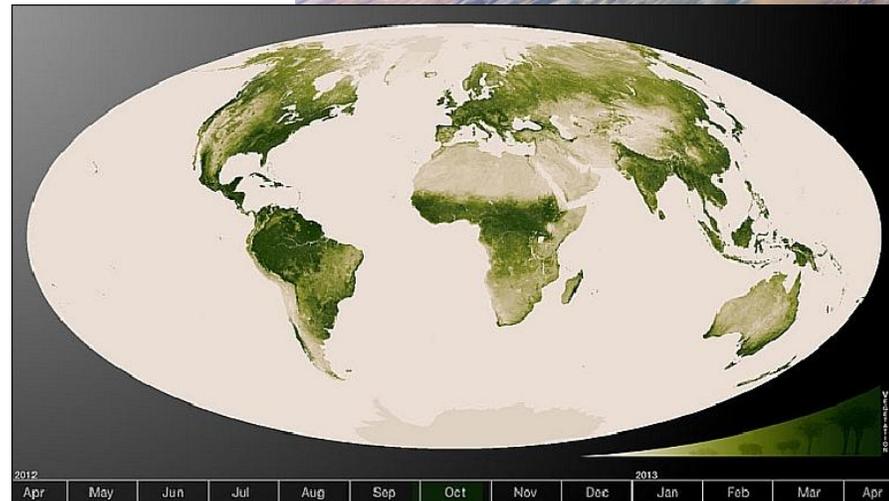


MODIS image of record-setting fire activity in 2018 fits with a longer trend of larger and more frequent California fires since 2000. Image Credit: [NASA](#)



Visible Infrared Imaging Radiometer Suite (VIIRS)

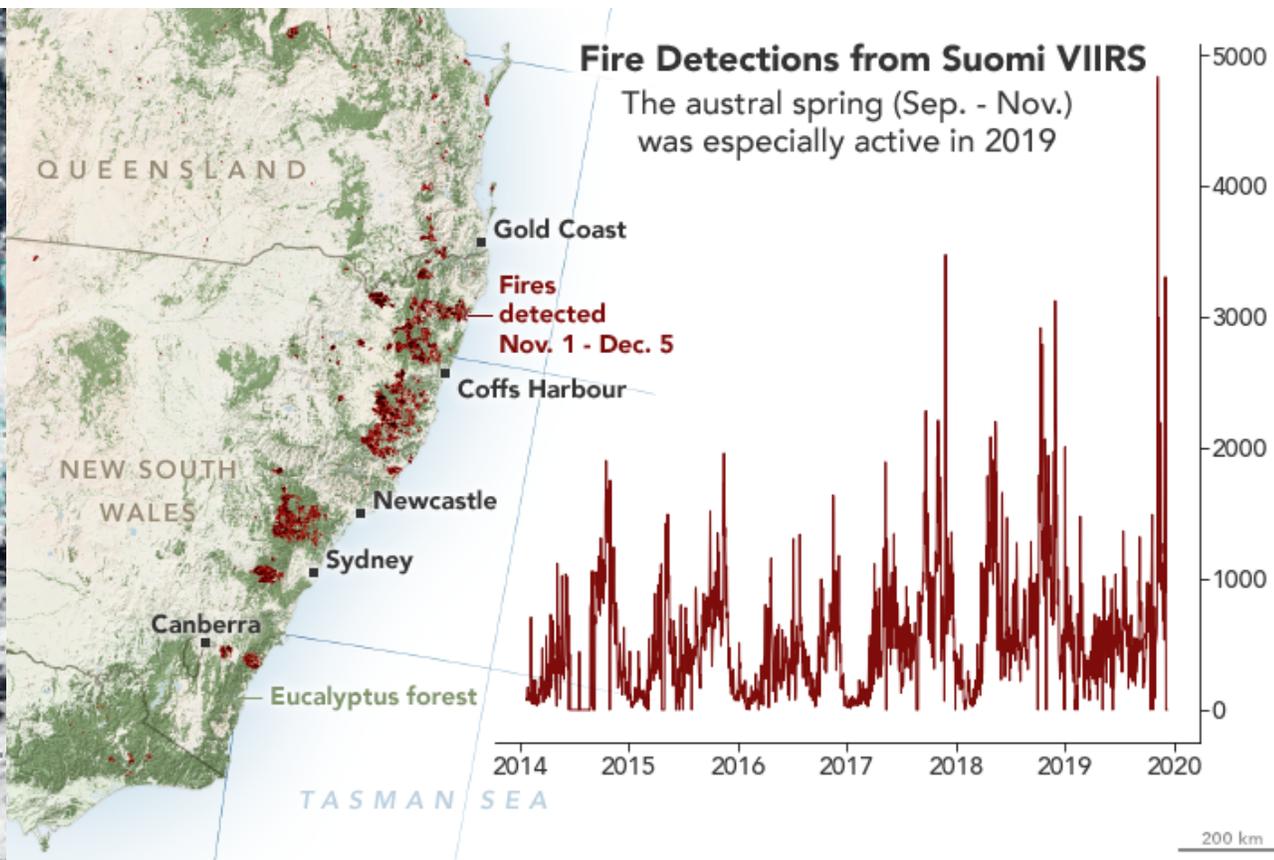
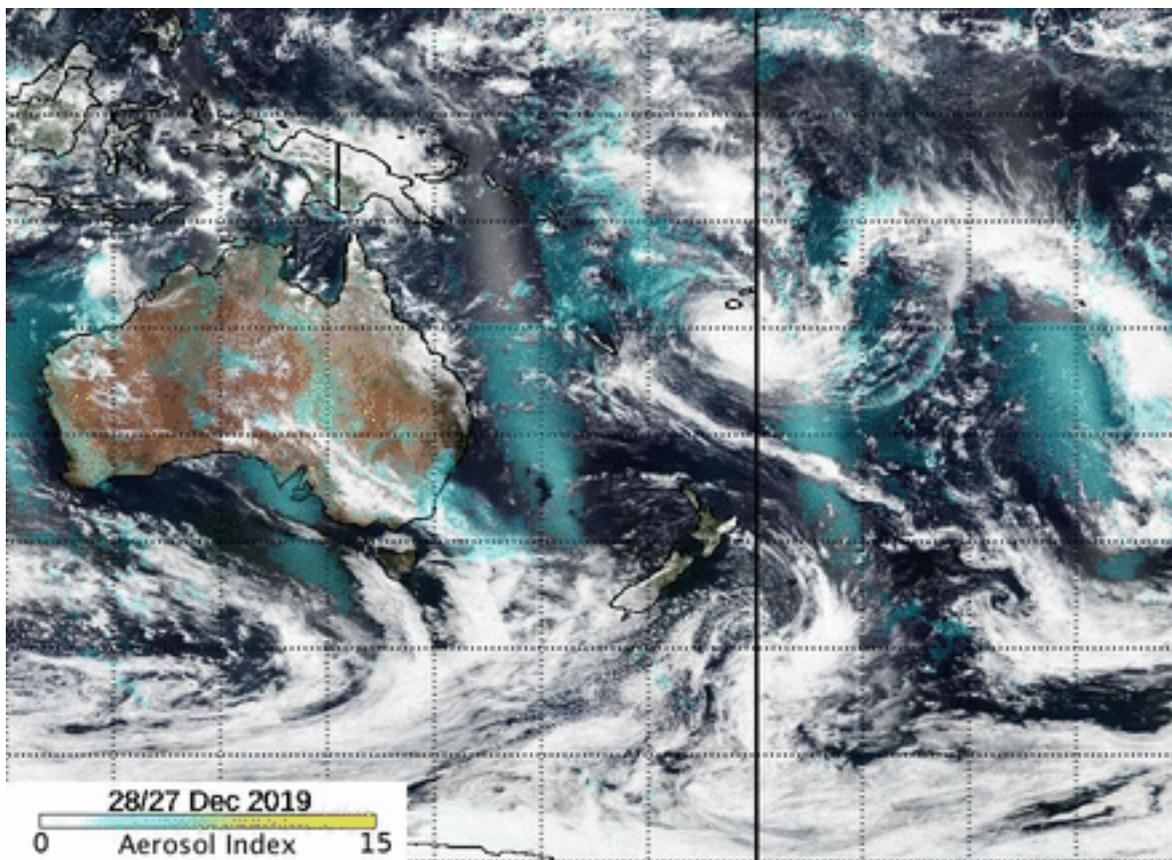
- A sensor onboard the Suomi National Polar-Orbiting Partnership (NPP)
- Data available globally from January 2012 to present
- Revisit Time: 1 day
- Spatial Resolution: 375m and 750m
- Similar to MODIS (with some differences)
- Visible, near-infrared channels (reflectance)
- Shortwave and longwave infrared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



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



VIIRS

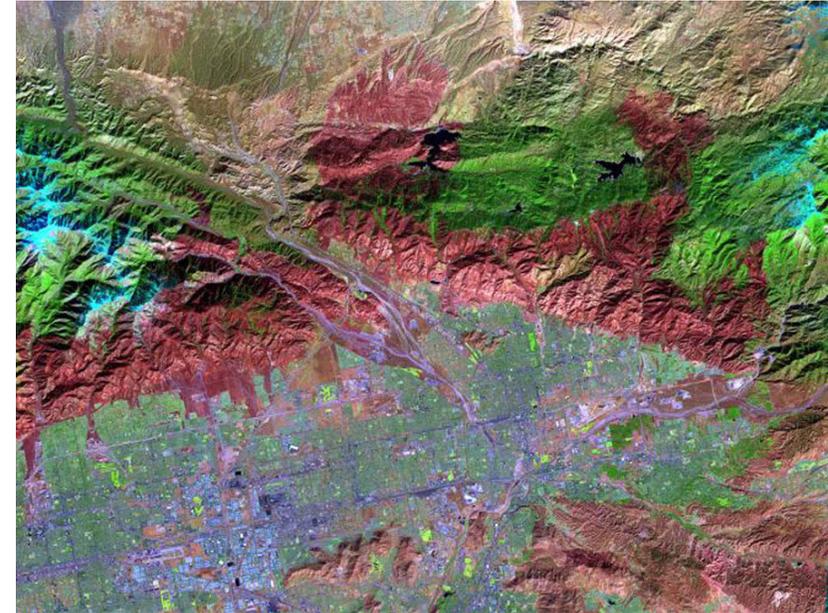


VIIRS and OPMs-NM instruments track the movement of aerosols from recent Australian fires ([left](#)); VIIRS detects active fire locations along eastern Australia ([right](#)). Image Credit: [NASA](#)



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](#)



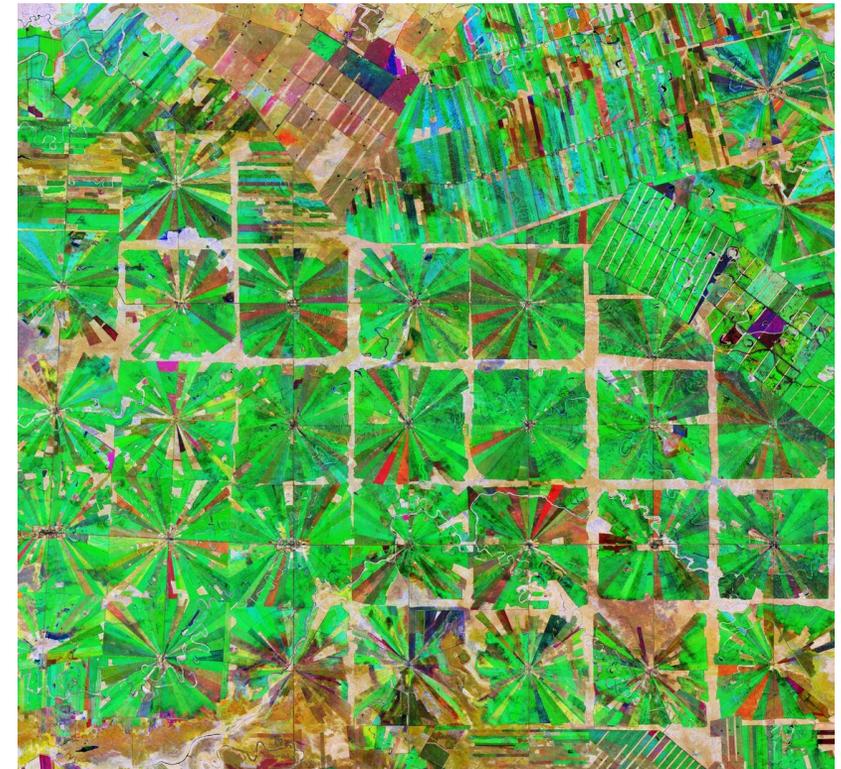
ESA Satellites and Sensors for Biodiversity

- **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

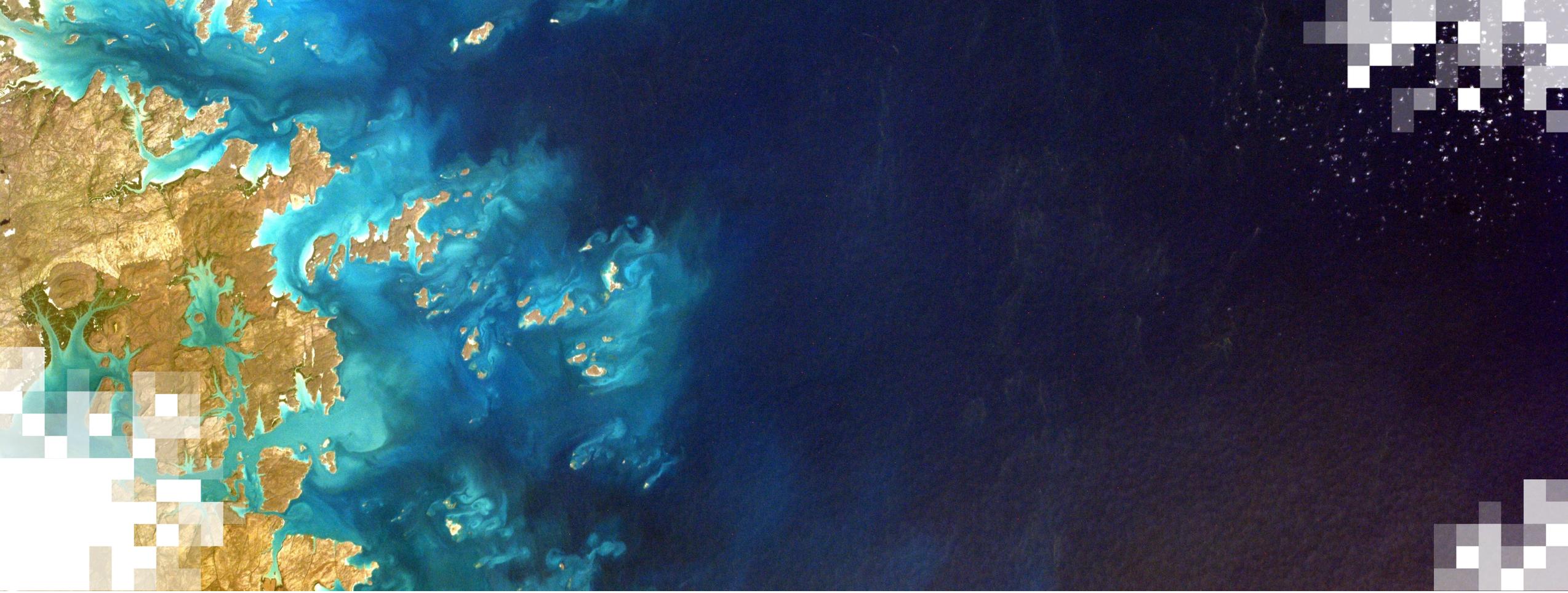
- **SPOT (multiple satellites)**

- 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](#)

An aerial photograph of a tropical coastline, showing a mix of green land, blue water, and white sand beaches. A dark, semi-transparent horizontal band is overlaid across the center of the image, serving as a background for the text.

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 $\frac{1}{4}$ of greenhouse gas emissions

CONFERENCIA DE LAS NACIONES UNIDAS SOBRE BIODIVERSIDAD

COP13 - COPMOP8 - COPMOP2 CANCÚN, MÉXICO 2016

INTEGRANDO LA BIODIVERSIDAD PARA EL BIENESTAR



Convenio sobre la
Diversidad Biológica



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

Secretario
de la Reunión

COP13
BIODIVERSIDAD



CANCÚN - MÉXICO 2016

Presidente

Secretaria

A man in a green t-shirt is pointing at a chalkboard. The chalkboard has several pieces of paper pinned to it with yellow clips. The papers contain handwritten text in various colors (white, red, black). One paper at the top right lists 'HUMAN DEVELOPMENT', 'SPIRITUAL DEVELOPMENT', 'PHYSICAL DEVELOPMENT', and 'COMMUNITY DEVELOPMENT'. Another paper in the middle right lists '1. SOCIAL DEVELOPMENT' with sub-points: '- DANCE', '- MUSIC', '- RELIGION', '- SPORTS', '- YOUTH', '- HEALTH', '- EDUCATION'. A third paper at the bottom right lists '3. POLITICAL DEVELOPMENT' with sub-points: '- COE', '- ...'. The man is looking at the papers and pointing towards the bottom right one.

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)

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

An aerial photograph of a dense, vibrant green forest. A dark, calm river winds through the center of the forest, reflecting the surrounding trees. The forest is thick and extends to the edges of the frame.

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

An aerial photograph of a river delta, showing a complex network of waterways and land. The top portion of the image is overlaid with a dark blue, textured pattern, possibly representing a satellite or data overlay. The main body of the image shows the intricate branching of the river system into smaller channels and distributaries, with varying shades of brown, tan, and green indicating different land and water features.

SPATIAL DATA CAN PLAY A POWERFUL ROLE FOR NATURE AND CLIMATE

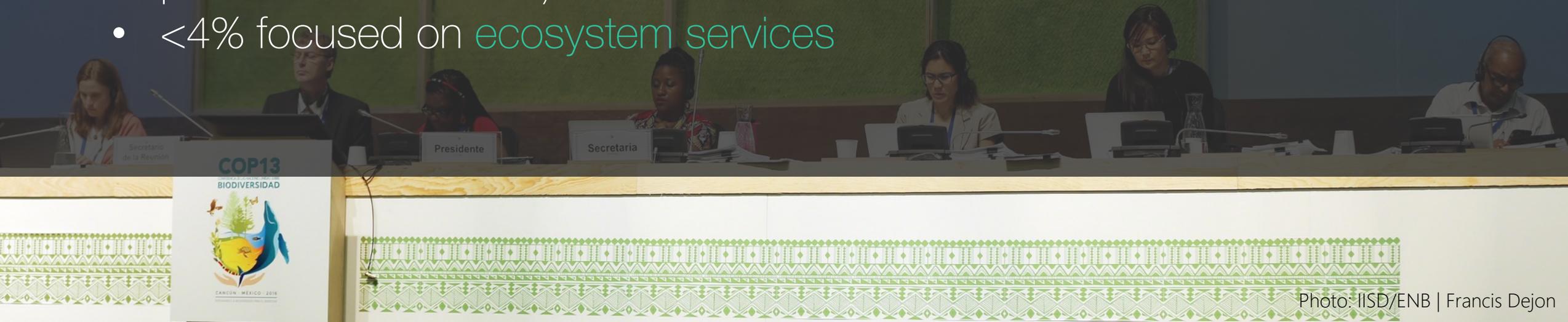
- Identify *WHERE & HOW* to take action on nature for *biodiversity, climate, and sustainable development*
- Support monitoring & transparency for the *CBD, UNFCCC, and nature-based Sustainable Development Goals*



CONFERENCIA DE LAS NACIONES UNIDAS SOBRE
BIODIVERSIDAD
COP13 -COPMOP8-COPMOP2
CANCÚN, MÉXICO 2016

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





2. UNDP SUPPORT TO BUILD SPATIAL DATA CAPACITY



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

An aerial photograph of a tropical coastline, showing a mix of green land, blue water, and white sand beaches. A dark horizontal band is overlaid across the center of the image, containing the text.

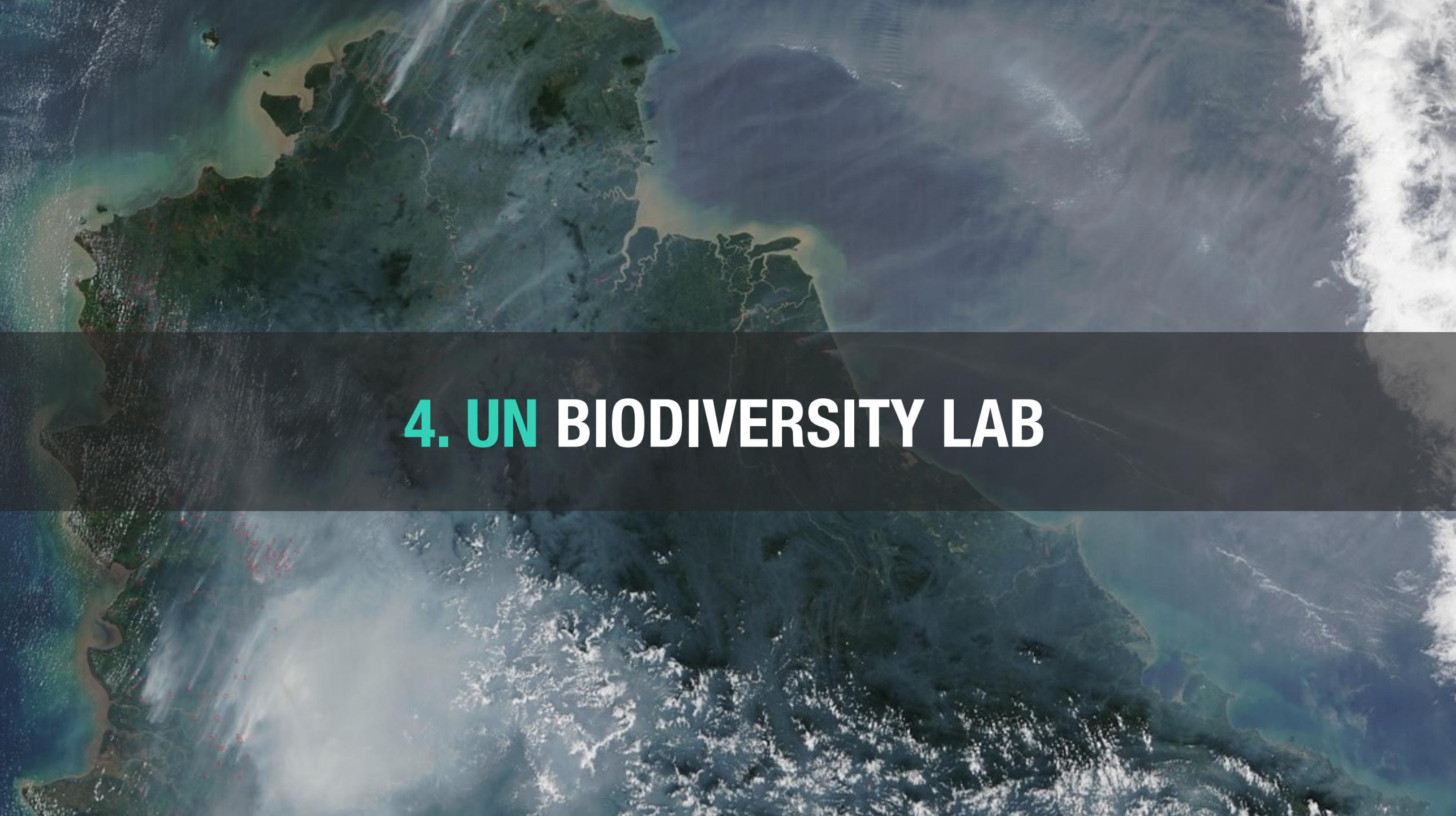
3. NATIONAL BIODIVERSITY SUPPORT

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](#)

An aerial photograph of a coastal region, likely a delta or estuary, showing intricate water channels and landmasses. The water is a mix of deep blue and light turquoise. A dark, semi-transparent horizontal band runs across the middle of the image, containing the text '4. UN BIODIVERSITY LAB'.

4. UN BIODIVERSITY LAB

UN BIODIVERSITY LAB



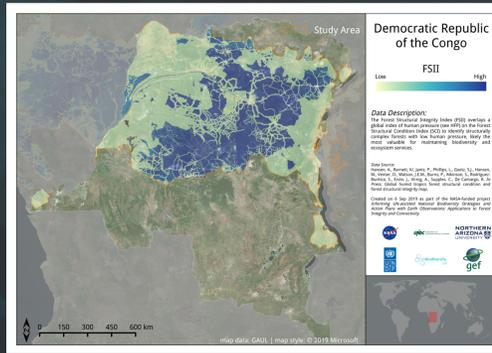
WHAT IS UN BIODIVERSITY LAB?

- 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

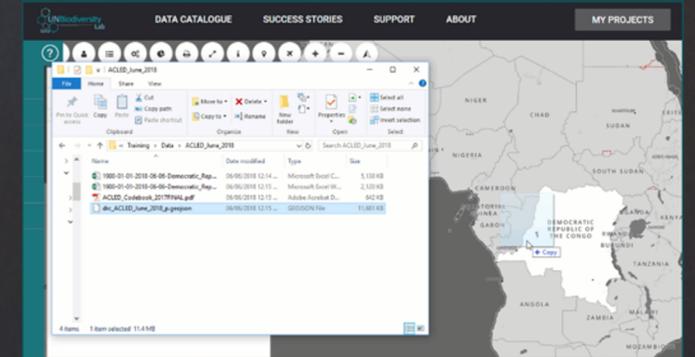
UN BIODIVERSITY LAB | FIVE KEY FEATURES



1. Access >100 global data layers



2. Visualize NASA project data



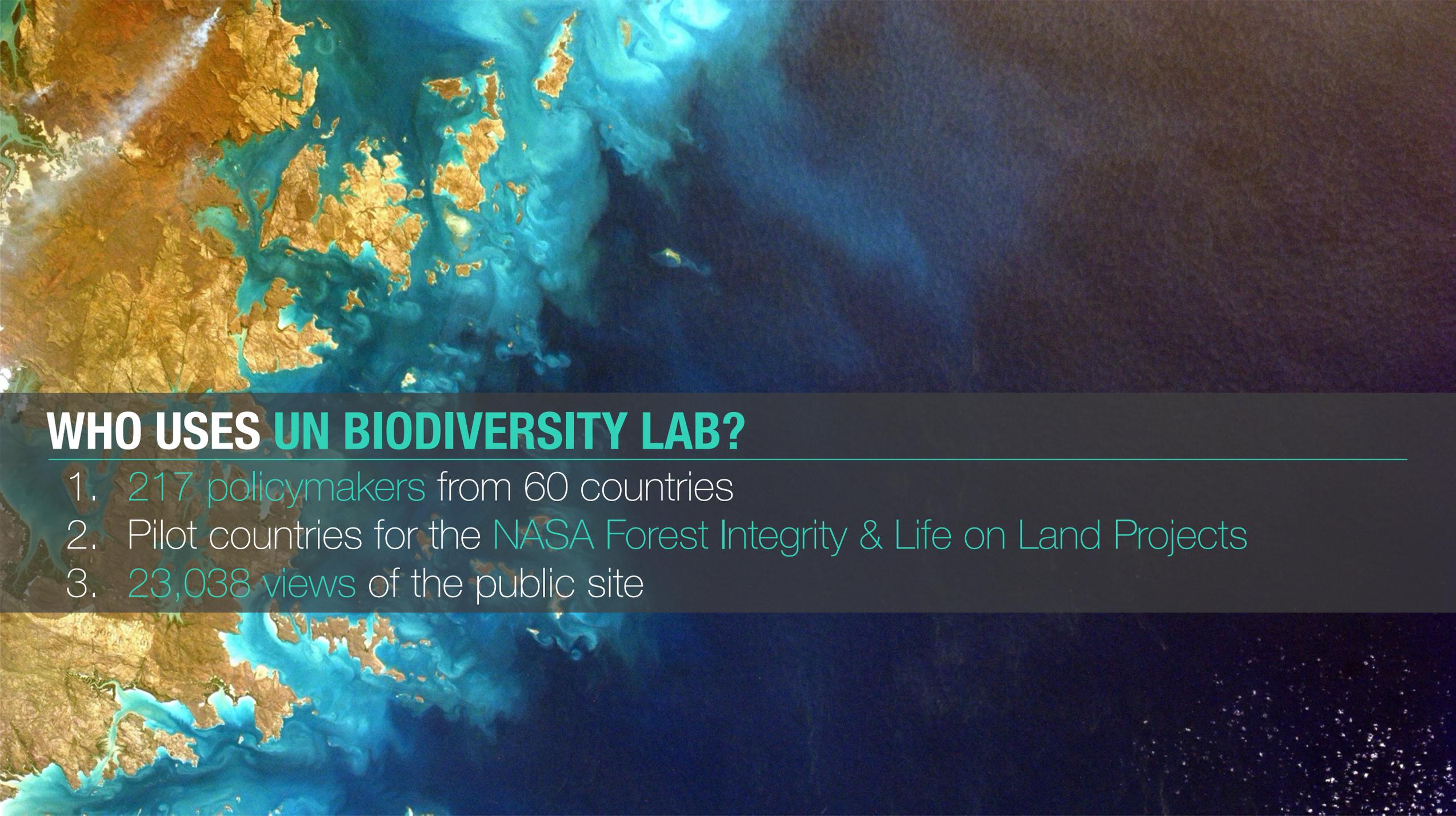
3. Govt access to private national projects



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

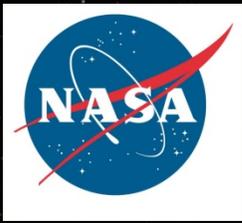


UN BIODIVERSITY LAB | WHAT SETS US APART?

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

A satellite view of Earth showing the Americas, the Atlantic Ocean, and parts of Europe and Africa. A dark horizontal band is overlaid across the center of the image, containing the text '5. NASA-SUPPORTED PROJECTS'.

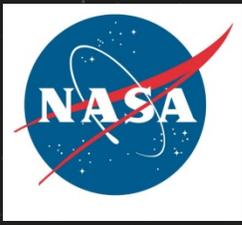
5. NASA-SUPPORTED PROJECTS



Empowered lives.
Resilient nations.

DATA INTO ACTION | NASA PROJECTS





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



M **MONTANA
STATE UNIVERSITY**



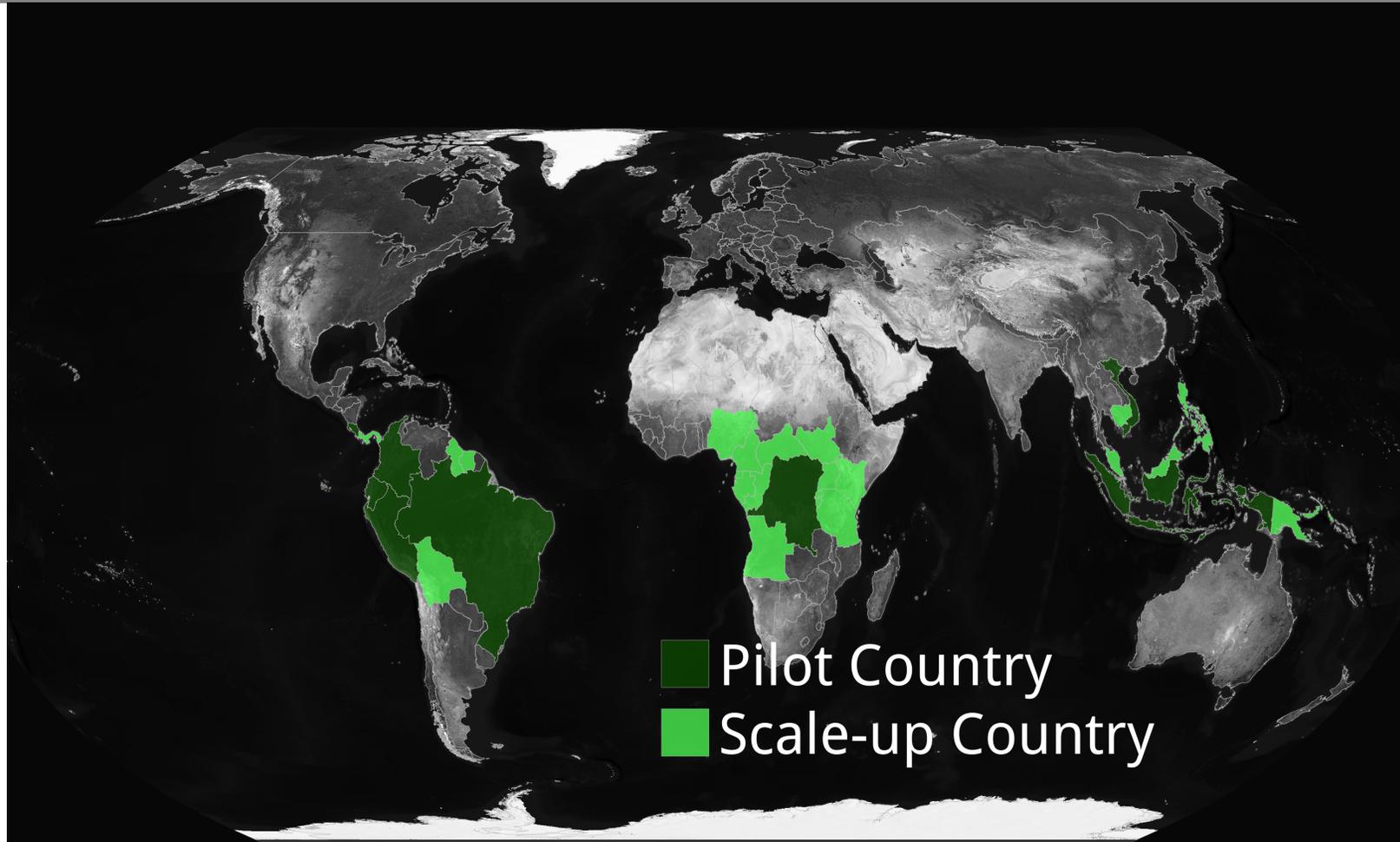
IMPORTANCE OF FOREST INTEGRITY ACROSS CONVENTIONS

- 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](#)

An aerial photograph of a wide, calm river flowing through a lush, dense tropical forest. The water is dark and reflects the surrounding greenery. The forest is composed of various shades of green, indicating a diverse ecosystem. The river curves gently through the landscape.

NASA FOREST INTEGRITY PROJECT

NASA FOREST INTEGRITY PROJECT COUNTRIES



■ Pilot Country
■ Scale-up Country

For more information visit: <https://www.unbiodiversity.org>

This map was created in Australia on 9 October 2019 using the Equal Earth Projection.

An aerial photograph of a wide, calm river winding through a lush, dense tropical forest. The water is dark and reflects the surrounding greenery. The forest is composed of various shades of green, indicating a rich biodiversity. The sky is not visible, as the forest canopy fills the upper portion of the frame.

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



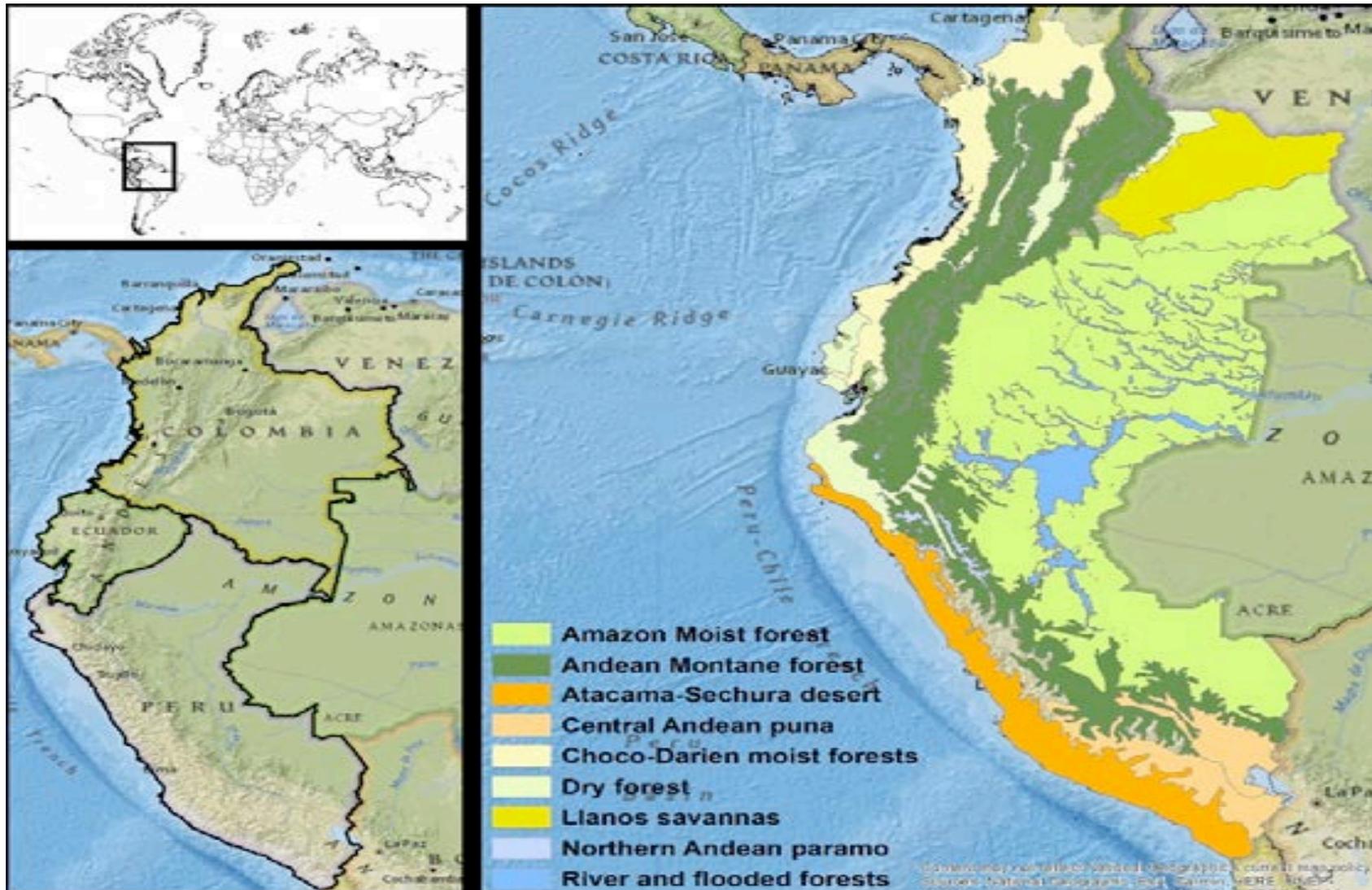
KEY DATA PRODUCED BY FOREST INTEGRITY PROJECT

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



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

An aerial photograph of a tropical coastline, showing a mix of green land, blue water, and white sand beaches. A dark, semi-transparent horizontal band is overlaid across the center of the image, containing the text '6. FINAL THOUGHTS'.

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!

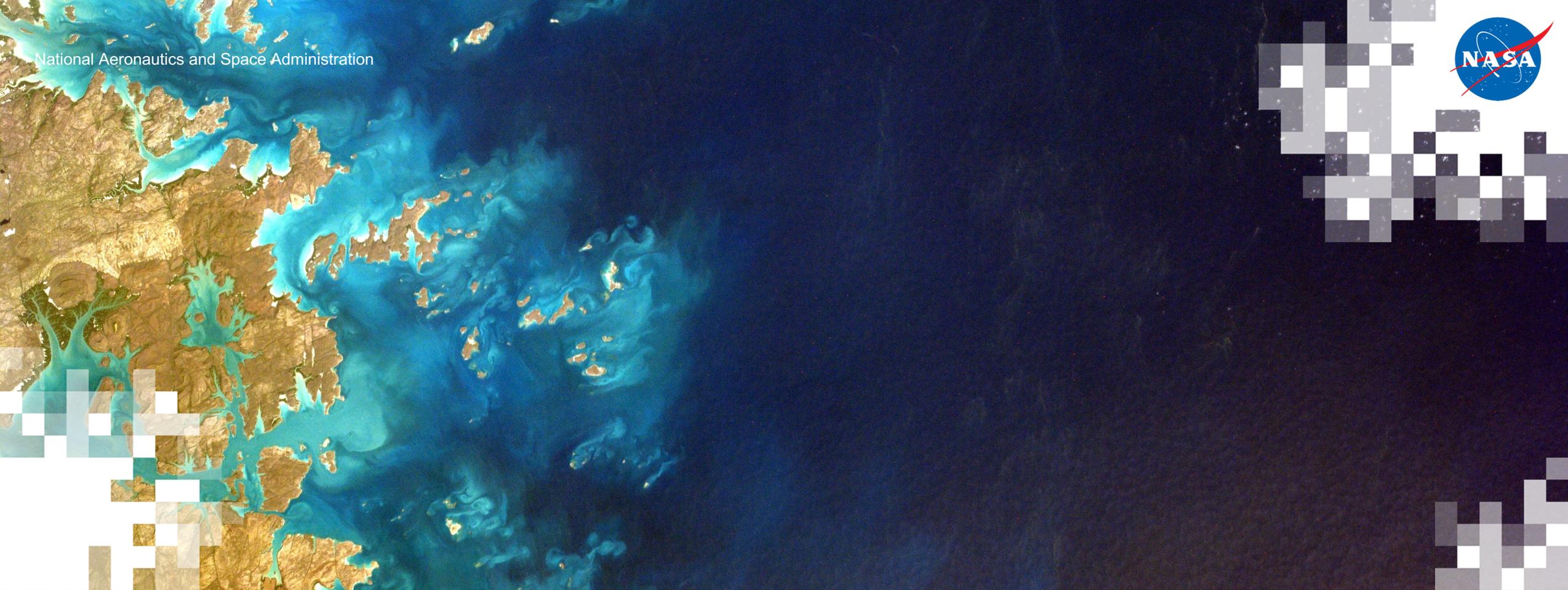
Christina Supples: christina.supples@undp.org

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





Thank You!

