SESSION #3

Applications for Sustainable Land Management Decisions: Early Warning and Alert Systems

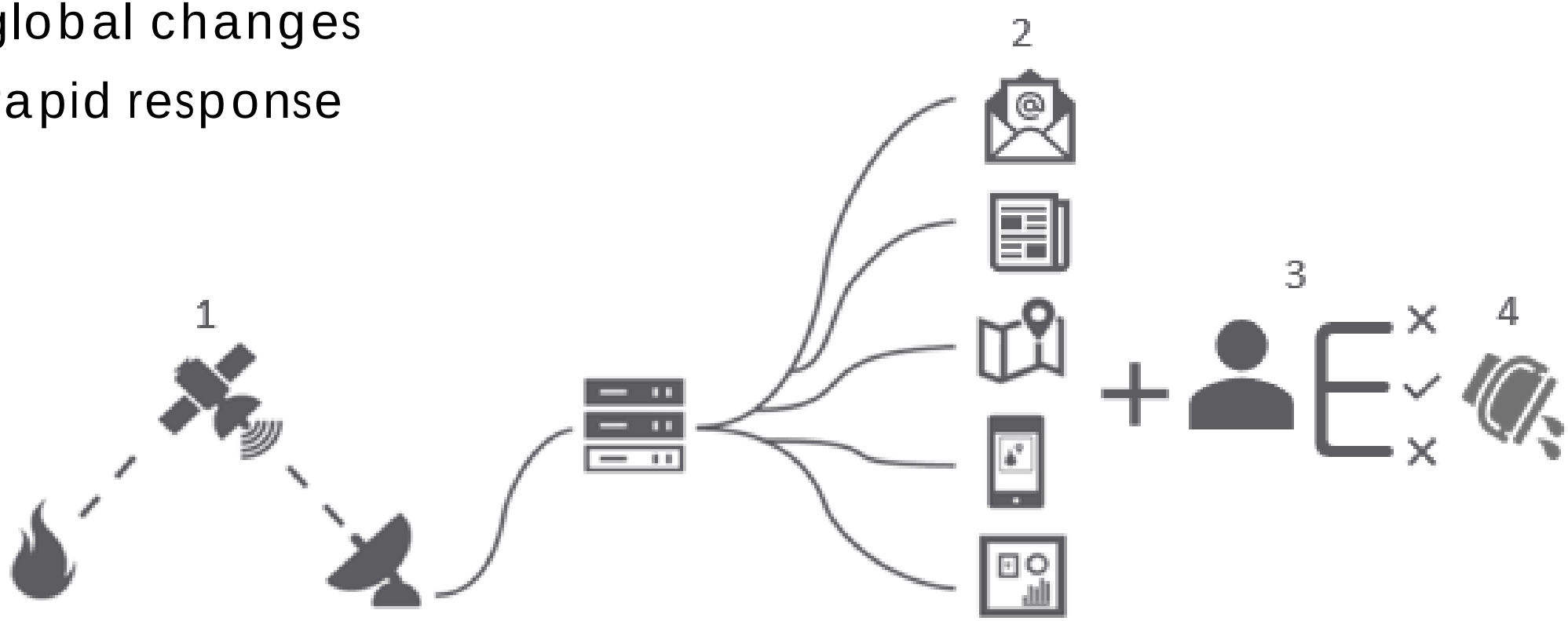
Presenters: Jenny Hewson & Karyn Tabor

Session #3 Outline

- Using near real-time data for tracking global change
- Discussion of the top five applications for early warning systems
- Introduction to relevant we-based and mobile applications

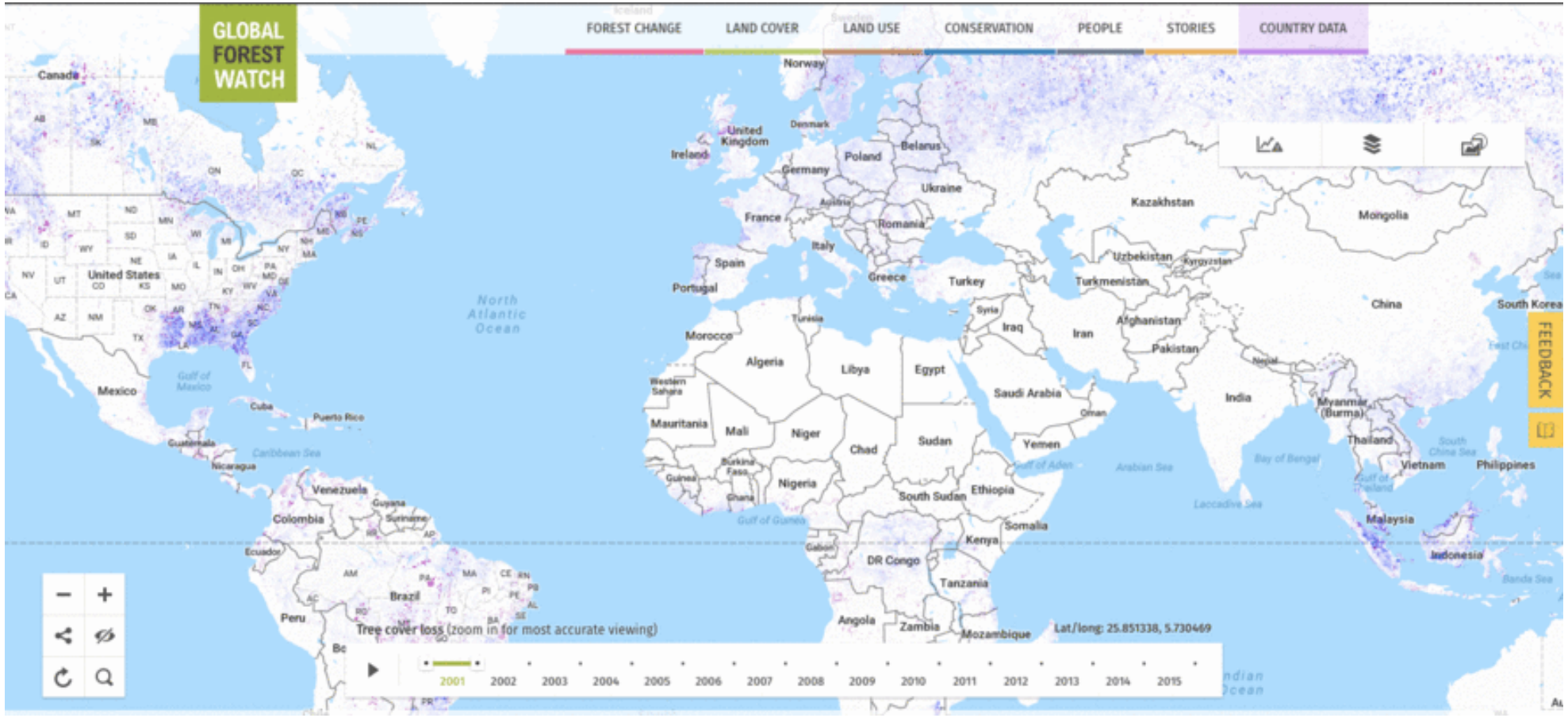
Near Real-time (NRT) Monitoring and Alert Systems

- Information about ecosystem change detected by satellites is packaged and delivered to decision-makers
  - Repeated, low-latency monitoring of fires and forest disturbances
  - Tracking global changes
  - Enabling rapid response



Tracking Global Change – Daily Fires

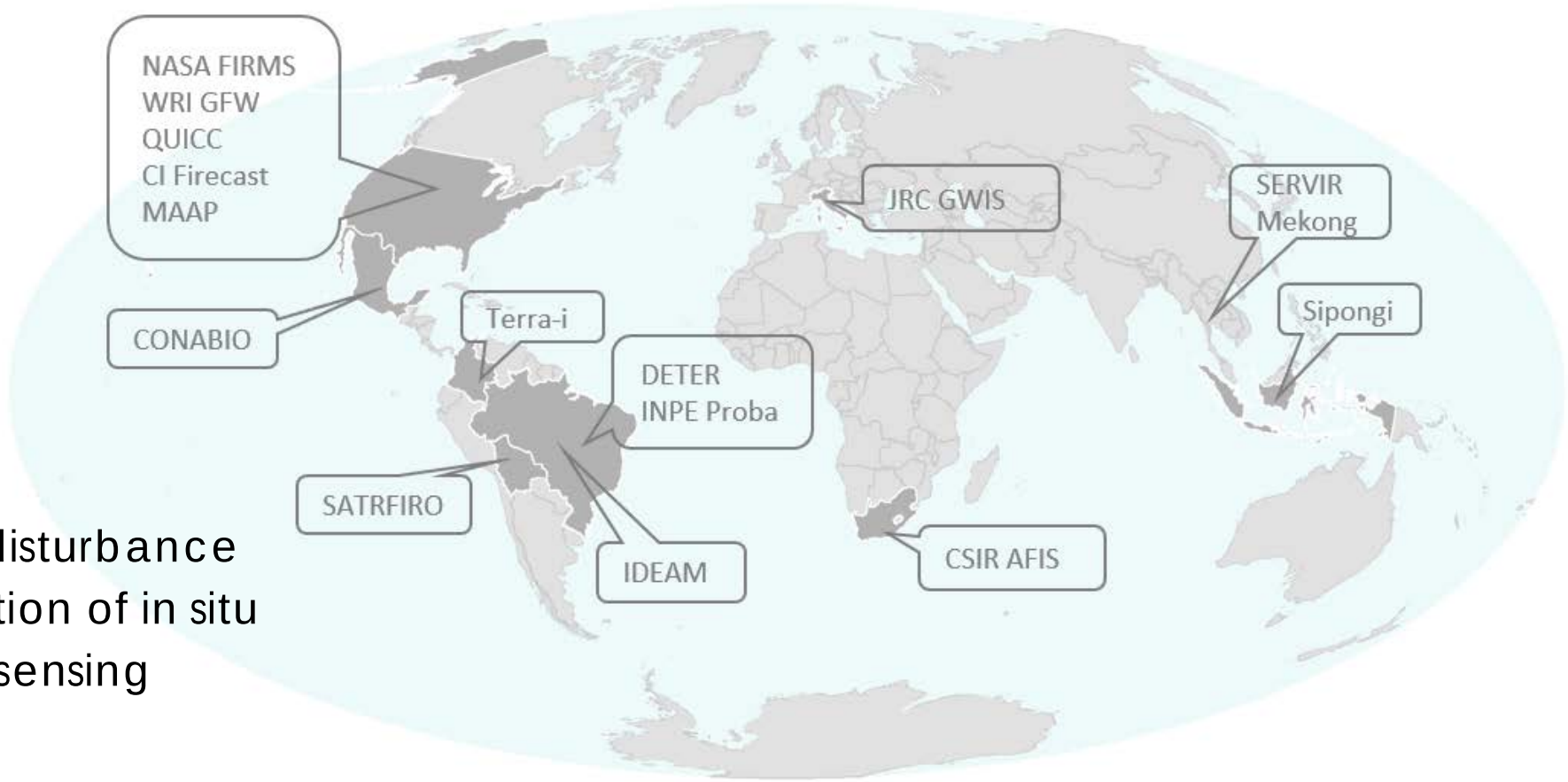
Tracking Global Change – Annual Deforestation



NRT Monitoring and Alert Systems Supporting Tropical Forest Management

- **2002**
  Development of first NRT monitoring and alert systems used for conservation (MODIS)

- **2019**
  Dozens of NRT monitoring and alert systems (MODIS, VIIRS, Landsat, Sentinel, ...)
  Higher resolution forest disturbance alerts, nanosats, integration of in situ monitoring and remote sensing



Top 5 Applications of Early Warning Systems

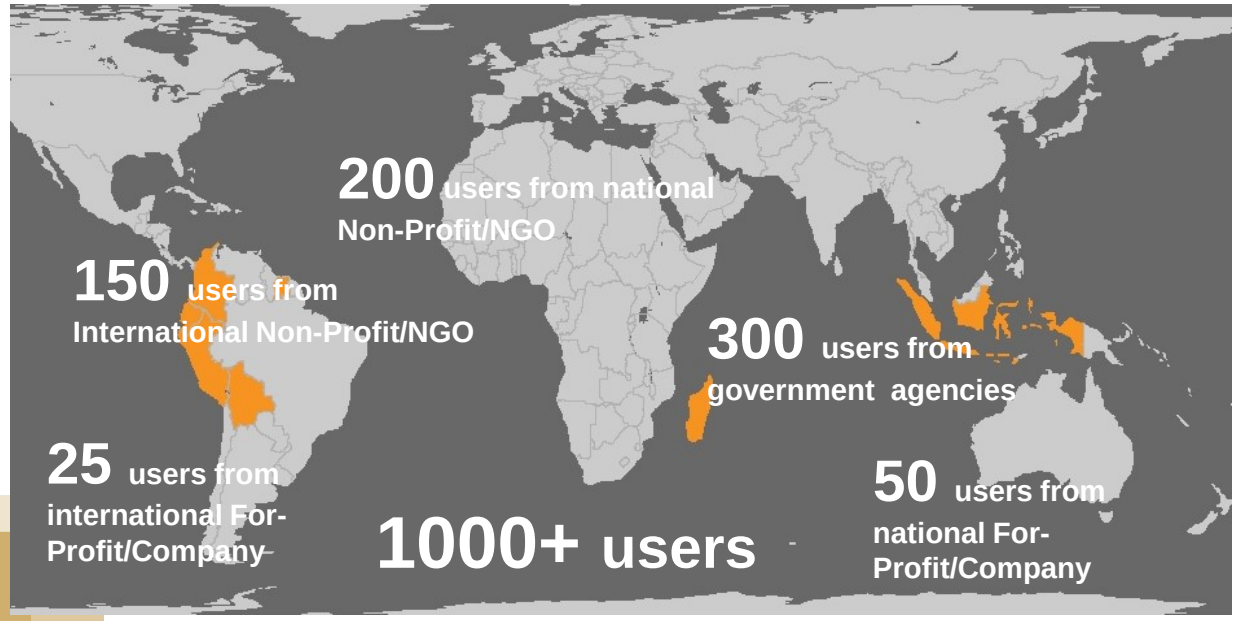
1. Protected area management
2. Forest surveillance
3. Supplement reports with maps & graphics
4. Inform conservation policies
5. Public awareness

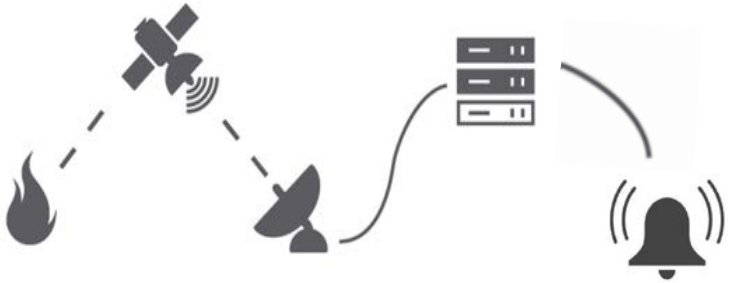
FIRECAST
A Near Real-time Satellite Monitoring and Alert System for Improved Forest Management in the Tropics

FIRECAST

- Conservation International's NRT monitoring and alert systems (est. 2002) aim to empower local stakeholders with timely monitoring and forecasting information from satellites to prevent the destructive effects of fires on natural habitats and human well-being.

FIRECAST

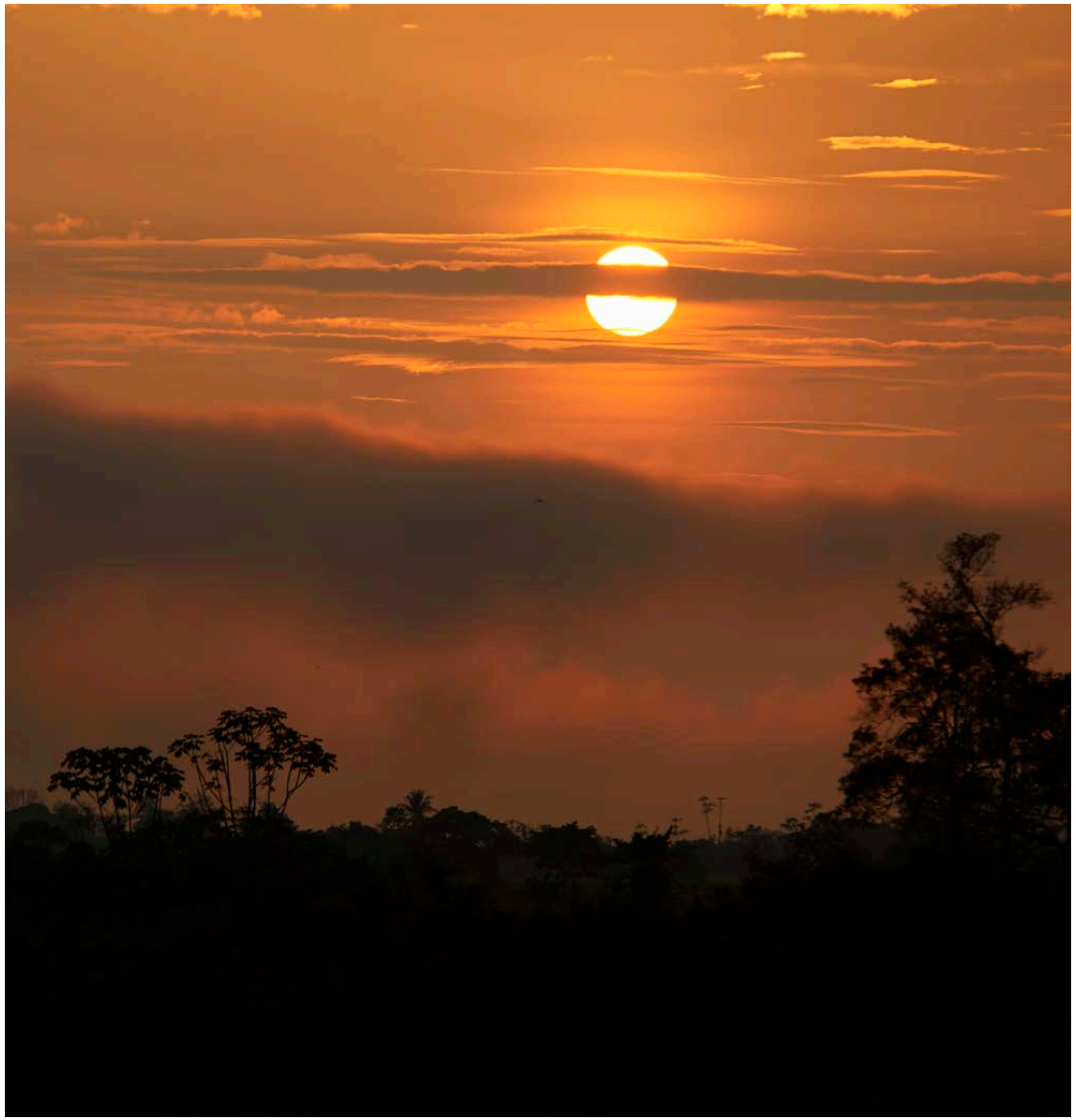




firecast.conservation.org

Peru – Success Story

- Peru's Alto Mayo reserve
  - Established in 1987 as part of the National System of Protected Areas
  - 182,000 hectares
  - Contains high biodiversity and many endemic plants and animals
  - Provides watershed protection & flow regulation
  - Yuracyacu River provides irrigation for rice cultivation for neighboring communities
  - 24 small village inside the reserve and Aguaruna native communities to the northeast



Peru – Success Story

- Peru's Alto Mayo reserve
  - High rates of deforestation
  - Road development
  - Increasing pressure from a growing migrant population
  - Expansion of conventional coffee farming
  - Illegal logging

Peru – Success Story

- Peru's Alto Mayo reserve
  - Now have NRT monitoring information
    - Fires from FIRECAST
    - Acoustic sensors for chainsaw alerts
    - Drones

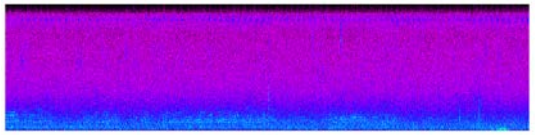
Nombre de la Suscripción: Alerta de presunta tala de árboles en Alto Mayo

Fecha **2018-08-28**

Este correo electrónico ha sido enviado por el sistema de alerta temprana de Conservación Internacional, Firecast. Haga clic en los siguientes enlaces para reproducir la alerta y descargar un archivo de imagen.

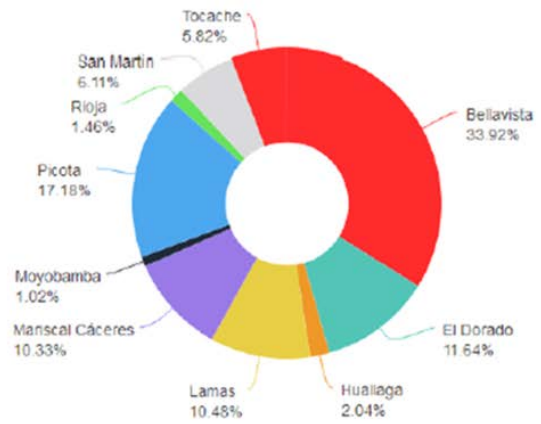
Se registraron 2 alertas acústicas en la zona de interés.

Guardian:	Tiwinza #1
LAT/LONG:	-5.97733,-77.3797
Fecha y hora inicial:	2018-08-28 16:42:36.071000 (America/Lima)
Fecha y hora final:	2018-08-28 16:44:06.071000 (America/Lima)
Intervalo de confianza:	0.993813
Archivo mp3:	https://assets.rfcx.org/audio/13c757df-6aac-44ac-8345-e3d310783825.mp3
Archivo png:	https://assets.rfcx.org/audio/13c757df-6aac-44ac-8345-e3d310783825.png



FIRECAST

Fire Counts for San Martín : 01/11/2018 - 05/18/2018 (VIIRS)



Name	Fire Count
Bellavista	233
El Dorado	80
Huallaga	14
Lamas	72
Mariscal Cáceres	71
Moyobamba	7
Picota	118
Rioja	10
San Martín	42
Tocache	40

Fire detections attributed to each Province for San Martín 01/11/2018 - 05/18/2018 (VIIRS)
Areas with no fires in this time frame are omitted from the chart for clarity.

CONSERVATION INTERNATIONAL NASA esri Powered by Logi ANALYTICS

Peru – Success Story

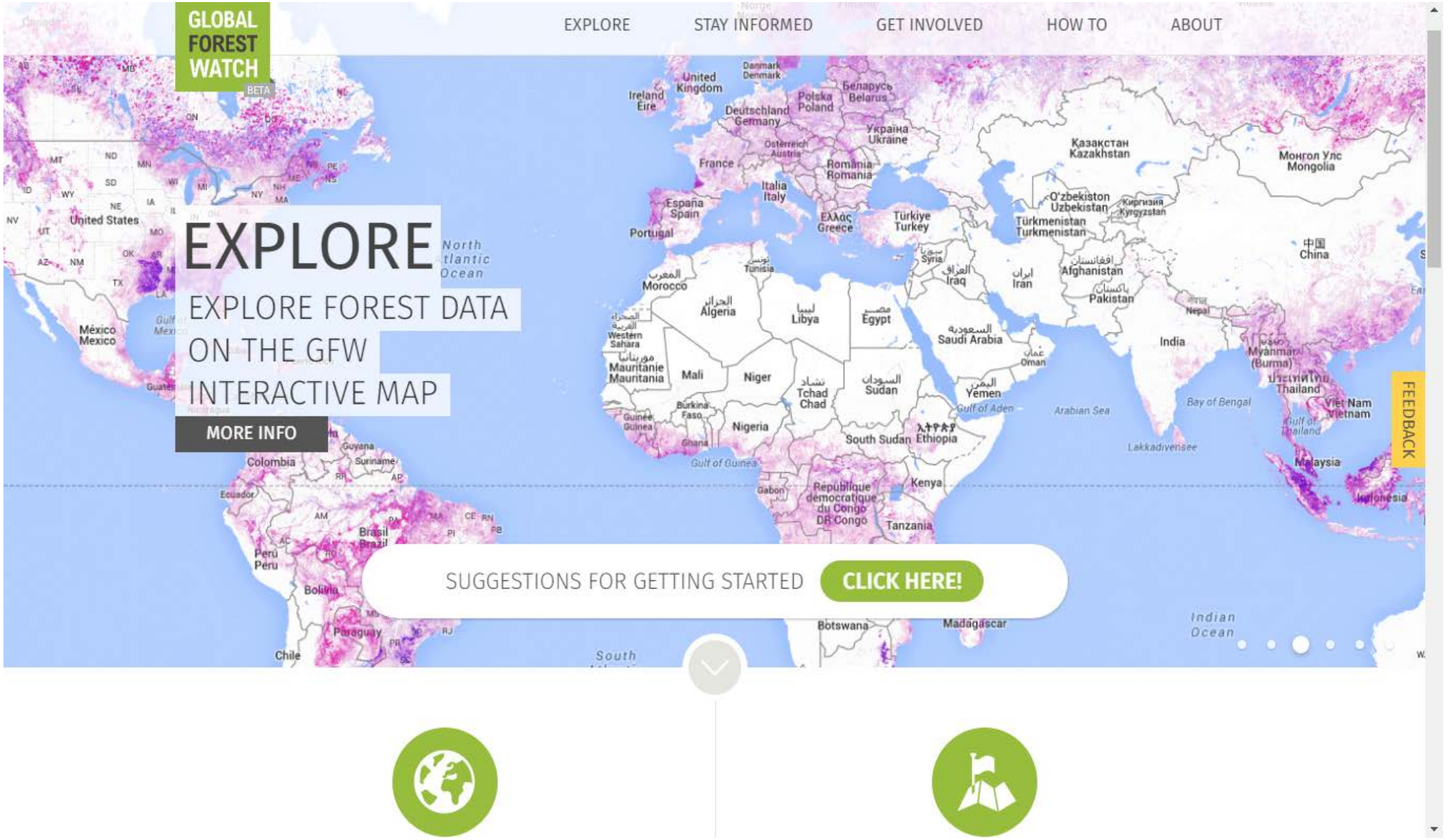
- November 17th, 2017: drone captured imagery of illegal logging in Peru's Alto Mayo Protected Forest
- The Alto Mayo indigenous community's chief and coordinator of the Control and Monitoring department in the Alto Mayo Protected Forest used drone information to ask authorities to take action
- Resulted in citation and fine for illegal logger

Global Forest Watch and GLAD Alerts

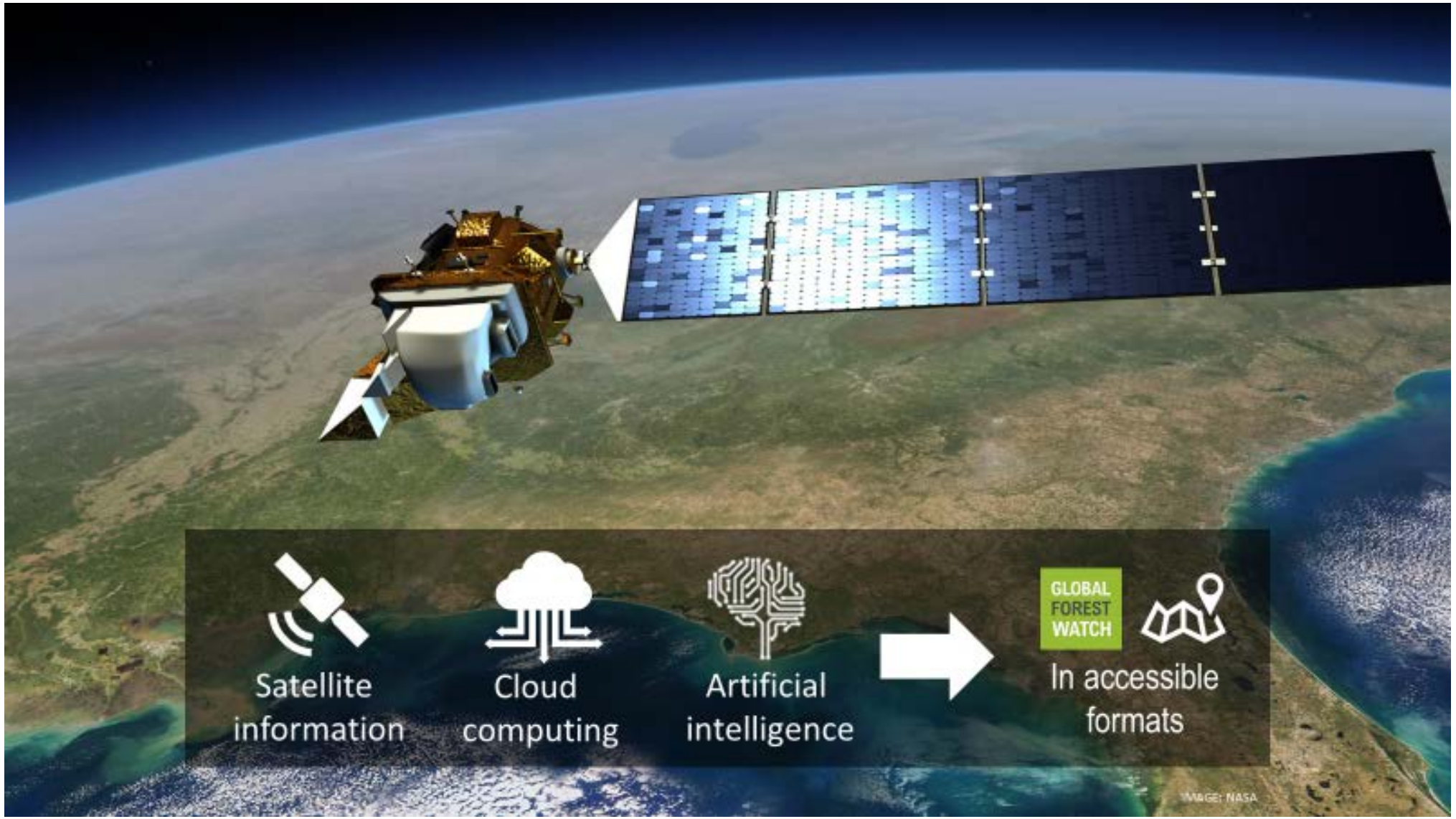
Global Forest Watch

globalforestwatch.org

Global Forest Watch

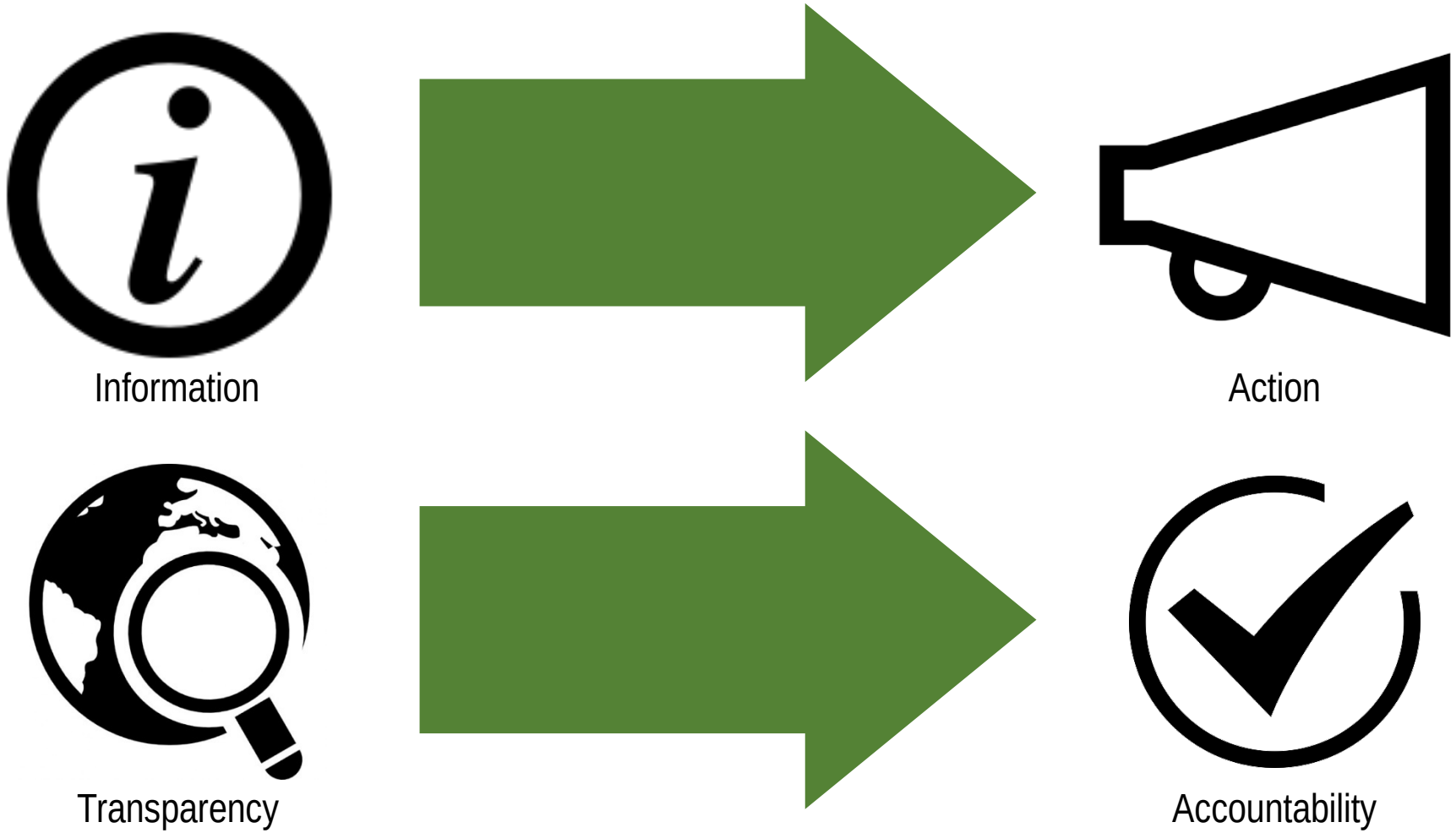


Global Forest Watch



Global Forest Watch

Impact-based approach

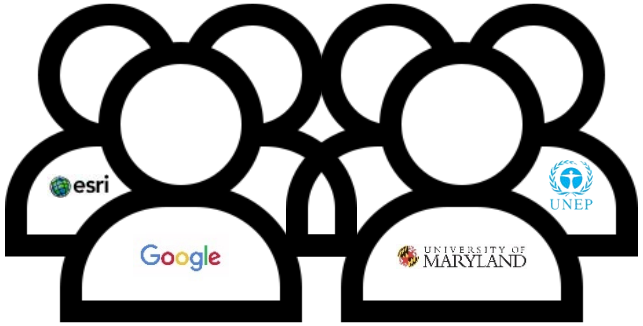


Global Forest Watch

Foundations

Information

Platform



Partnerships

GLAD Alerts

Weekly deforestation alerts from the University of Maryland

- Features:
  - Updated every week in GFW
  - Temporal availability depends on cloud cover
  - 30-meter spatial resolution
  - Available for all countries between 30 degrees N-S latitude

glad.umd.edu

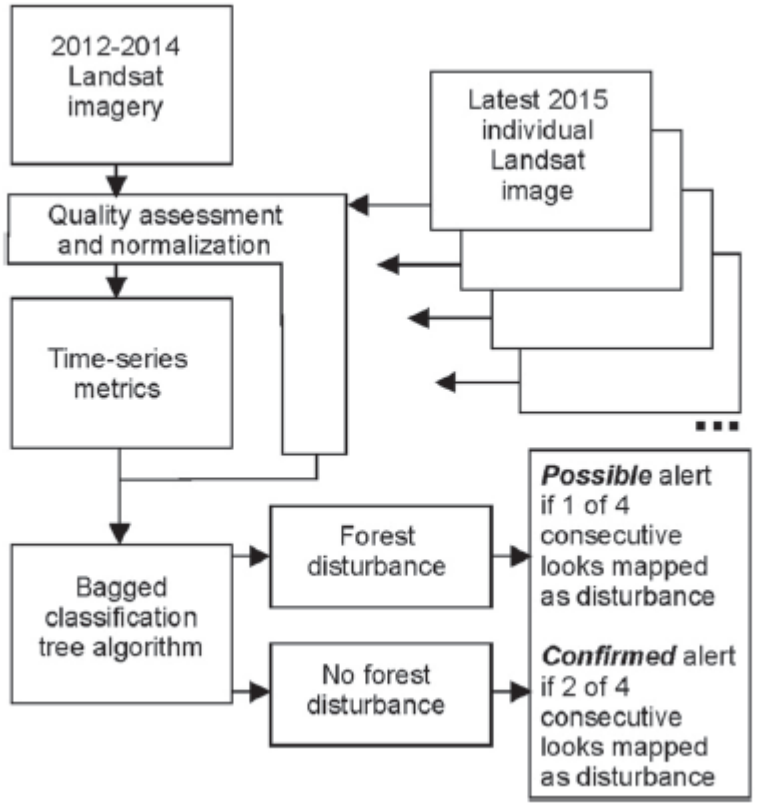
GLAD Alerts

Methodology

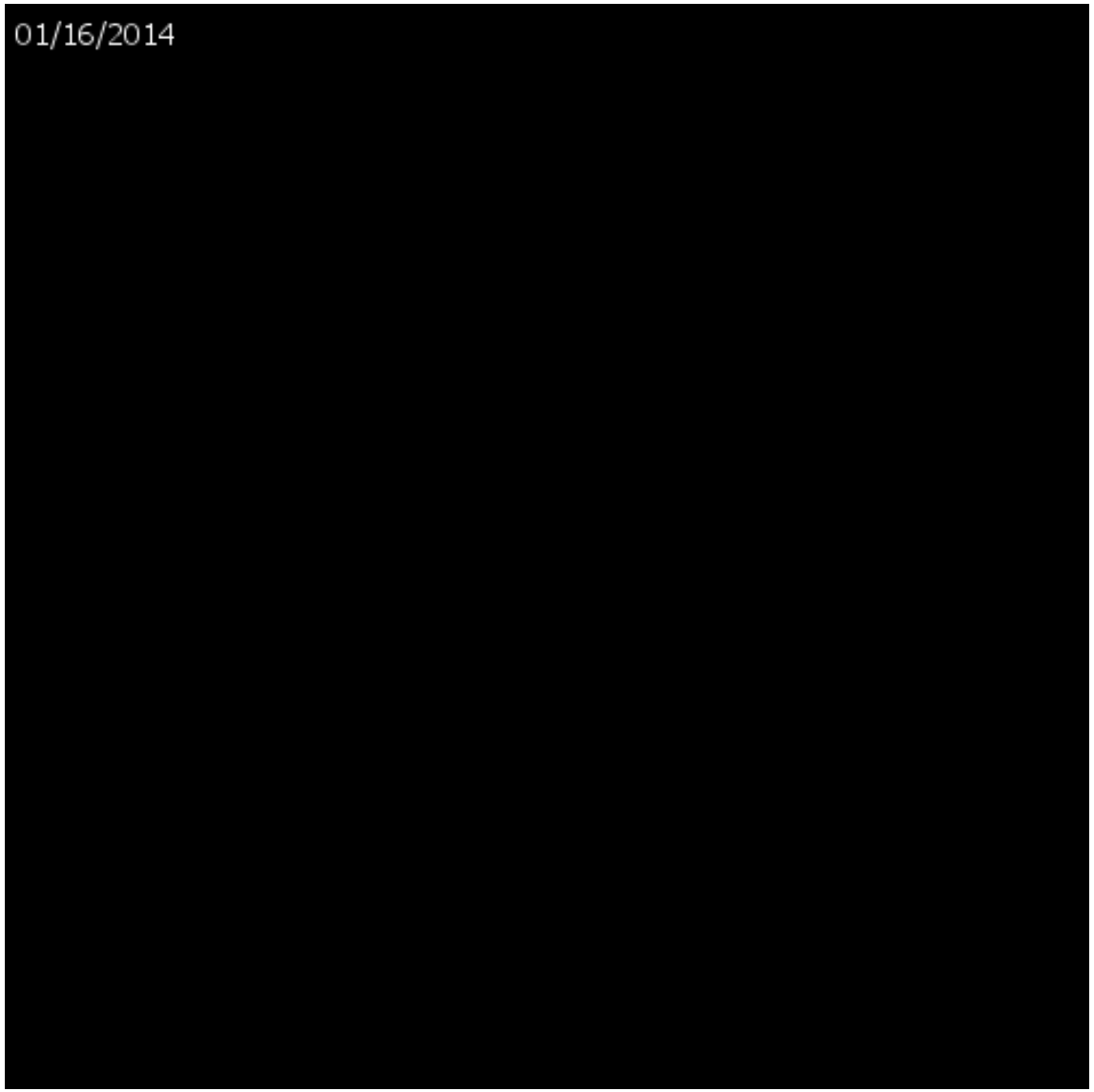
- "Forests" are defined here as areas with trees at least 5 meters high and a forest canopy density of at least 60%
- An alert is defined as any pixel with at least 50% forest canopy loss
- Alerts are based on the last clear Landsat observation
- Two types of alerts: confirmed and unconfirmed
  - Alerts remain unconfirmed until at least two observations indicate loss in the pixel

GLOBAL FOREST WATCH

UNIVERSITY OF MARYLAND



GLAD Alerts



GLAD Alerts

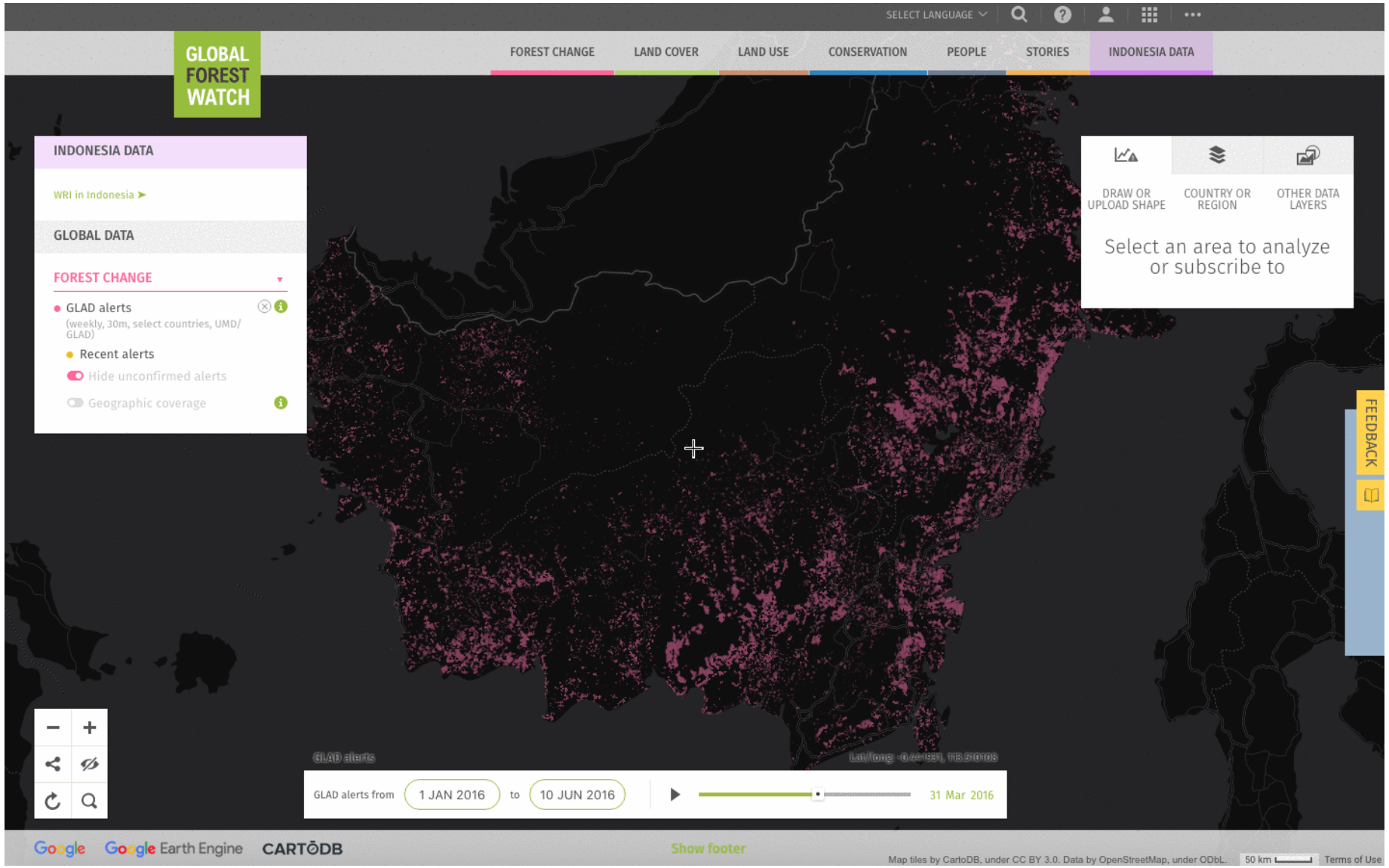
Accuracy and Limitations

- False positives (all alerts): 13.5%
  - Most (9.5%) occur on the boundaries of other changes
- False positives (only confirmed alerts): 1%
- False negatives: 33%
- Alerts are generally conservative
- Cloud cover can cause delays of weeks or even months in detecting changes

GLOBAL FOREST WATCH

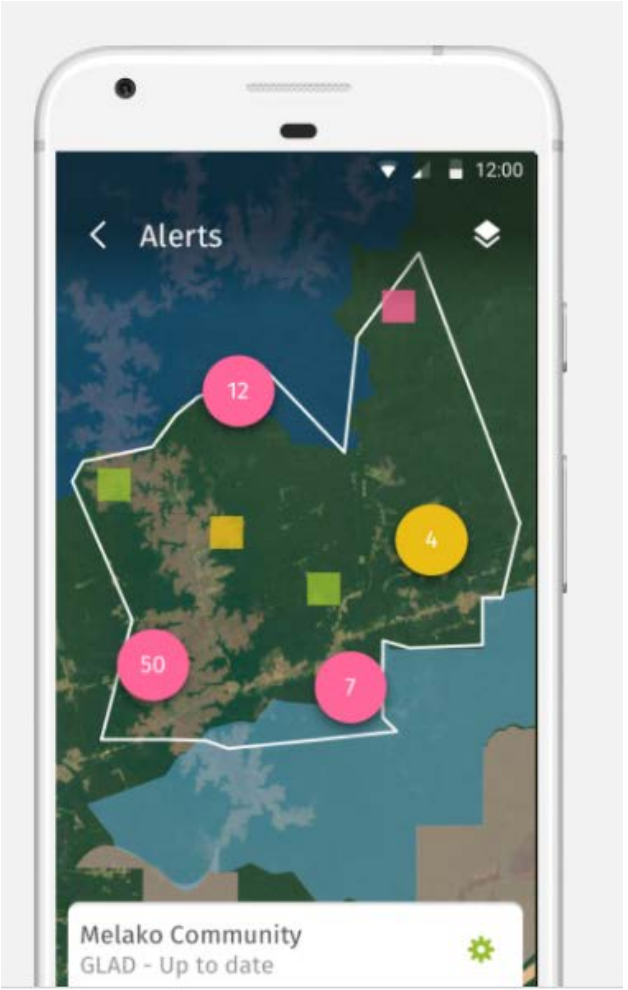
UNIVERSITY OF MARYLAND

GLAD Alerts


SELECT LANGUAGE
GLOBAL FOREST WATCH
FOREST CHANGE
LAND COVER
LAND USE
CONSERVATION
PEOPLE
STORIES
INDONESIA DATA
INDONESIA DATA
WRI in Indonesia
GLOBAL DATA
FOREST CHANGE
GLAD alerts
(weekly, 30m, select countries, UMD/ GLAD)
Recent alerts
Hide unconfirmed alerts
Geographic coverage
DRAW OR UPLOAD SHAPE
COUNTRY OR REGION
OTHER DATA LAYERS
Select an area to analyze or subscribe to
FEEDBACK
GLAD alerts
GLAD alerts from
1 JAN 2016
to
10 JUN 2016
31 Mar 2016
Google
Google Earth Engine
CARTODB
Show footer
Map tiles by CartoDB, under CC BY 3.0. Data by OpenStreetMap, under ODbL.
50 km
Terms of Use

How to Access Alerts in GFW

- **Display** alerts on the interactive map
- **Analyze** alerts within an area of interest
- **Subscribe** to an area of interest and receive e-mails each time a new alert is detected
- **Download** alerts (shp, csv) or access them through the WMS or API
- **Use** the alerts offline with the Forest Watcher mobile application



GLAD Alerts

Uses of alerts

Investigate unlawful activities

Manage protected areas

Empower local people

Execute conservation compensation programs

Raise public awareness

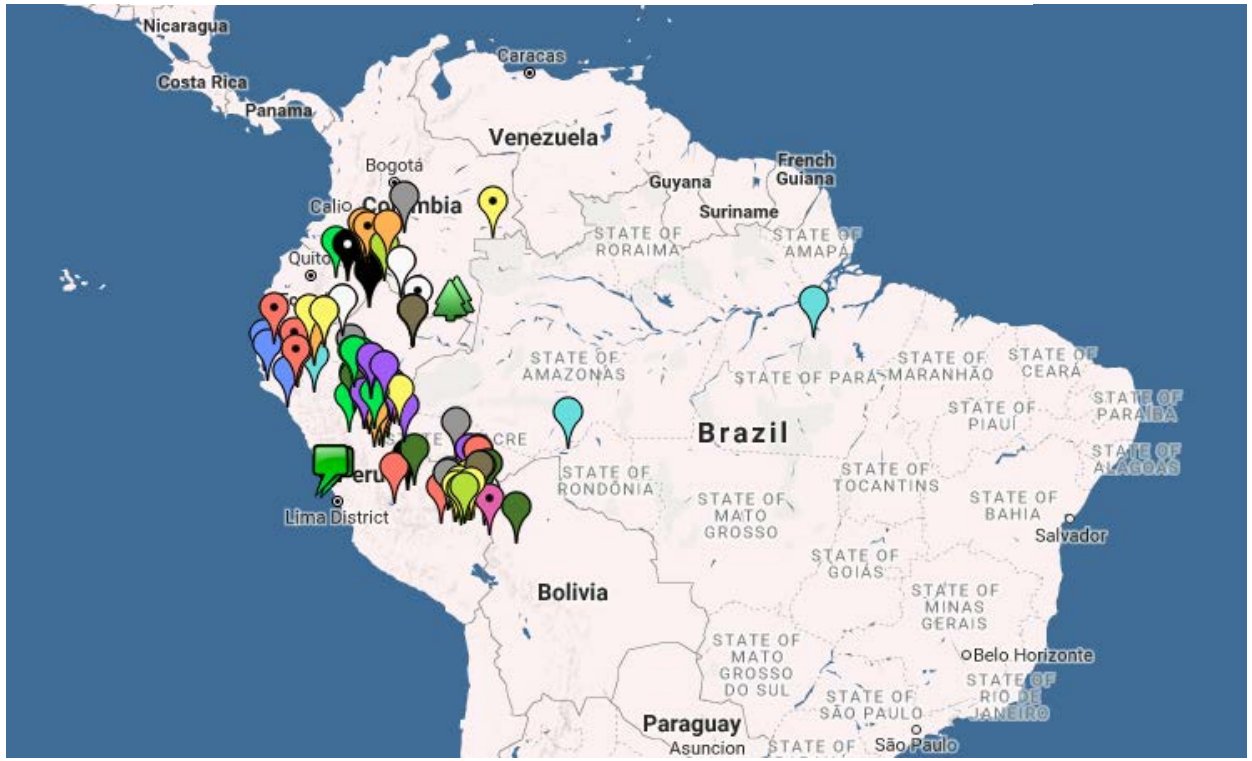
MAAP Alerts

maaproject.org

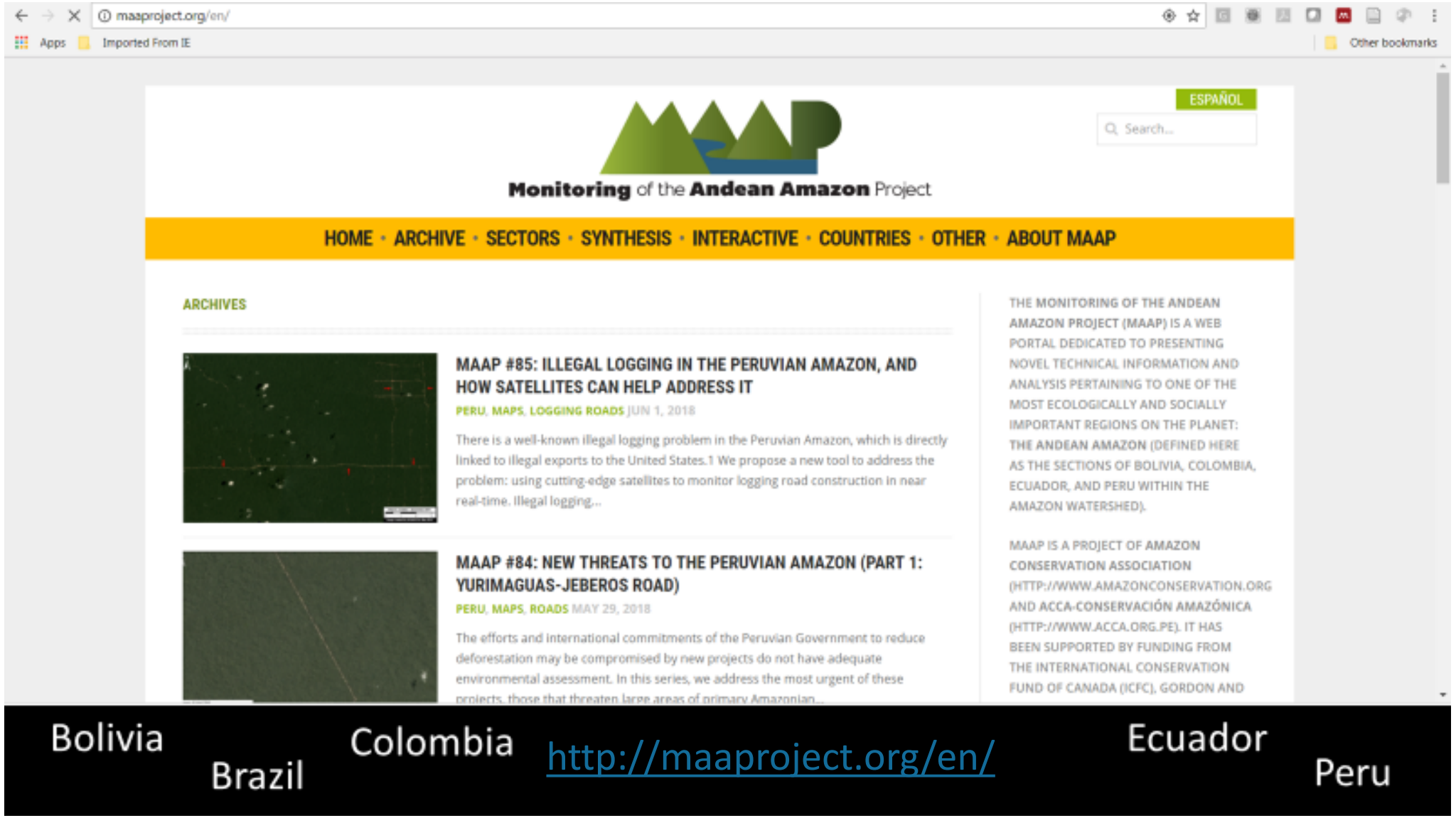
MAAP Alerts

- MAAP (Monitoring of the Andean Amazon Project) is organized by the Amazon Conservation Organization
- This project provides near real-time deforestation monitoring in Peru, Brazil, Colombia, Ecuador, and Bolivia
- To do this, MAAP uses data from five satellite systems: Landsat, Planet, DigitalGlobe, Sentinel, and PeruSat
- Their goal is to allow for easy access and distribution of deforestation information to policy makers, researchers, the media, and the public

Monitoring of the Andean Amazon Project



MAAP Alerts


maaproject.org/en/
Apps
Imported From IE
Other bookmarks
ESPAÑOL
Search...
Monitoring of the Andean Amazon Project
HOME · ARCHIVE · SECTORS · SYNTHESIS · INTERACTIVE · COUNTRIES · OTHER · ABOUT MAAP
ARCHIVES
MAAP #85: ILLEGAL LOGGING IN THE PERUVIAN AMAZON, AND HOW SATELLITES CAN HELP ADDRESS IT
PERU, MAPS, LOGGING ROADS JUN 1, 2018
There is a well-known illegal logging problem in the Peruvian Amazon, which is directly linked to illegal exports to the United States.1 We propose a new tool to address the problem: using cutting-edge satellites to monitor logging road construction in near real-time. Illegal logging...
MAAP #84: NEW THREATS TO THE PERUVIAN AMAZON (PART 1: YURIMAGUAS-JEBEROS ROAD)
PERU, MAPS, ROADS MAY 29, 2018
The efforts and international commitments of the Peruvian Government to reduce deforestation may be compromised by new projects do not have adequate environmental assessment. In this series, we address the most urgent of these projects, those that threaten large areas of primary Amazonian...
THE MONITORING OF THE ANDEAN AMAZON PROJECT (MAAP) IS A WEB PORTAL DEDICATED TO PRESENTING NOVEL TECHNICAL INFORMATION AND ANALYSIS PERTAINING TO ONE OF THE MOST ECOLOGICALLY AND SOCIALLY IMPORTANT REGIONS ON THE PLANET: THE ANDEAN AMAZON (DEFINED HERE AS THE SECTIONS OF BOLIVIA, COLOMBIA, ECUADOR, AND PERU WITHIN THE AMAZON WATERSHED).
MAAP IS A PROJECT OF AMAZON CONSERVATION ASSOCIATION (HTTP://WWW.AMAZONCONSERVATION.ORG AND ACCA-CONSERVACIÓN AMAZÓNICA (HTTP://WWW.ACCA.ORG.PE). IT HAS BEEN SUPPORTED BY FUNDING FROM THE INTERNATIONAL CONSERVATION FUND OF CANADA (ICFC), GORDON AND
Bolivia
Brazil
Colombia
http://maaproject.org/en/
Ecuador
Peru

MAAP Alerts

Monitoring of the Andean Amazon (MAAP)

Data & resolution: WRI FORMA, Terra-i deforestation alerts

Data Source: MODIS, Landsat

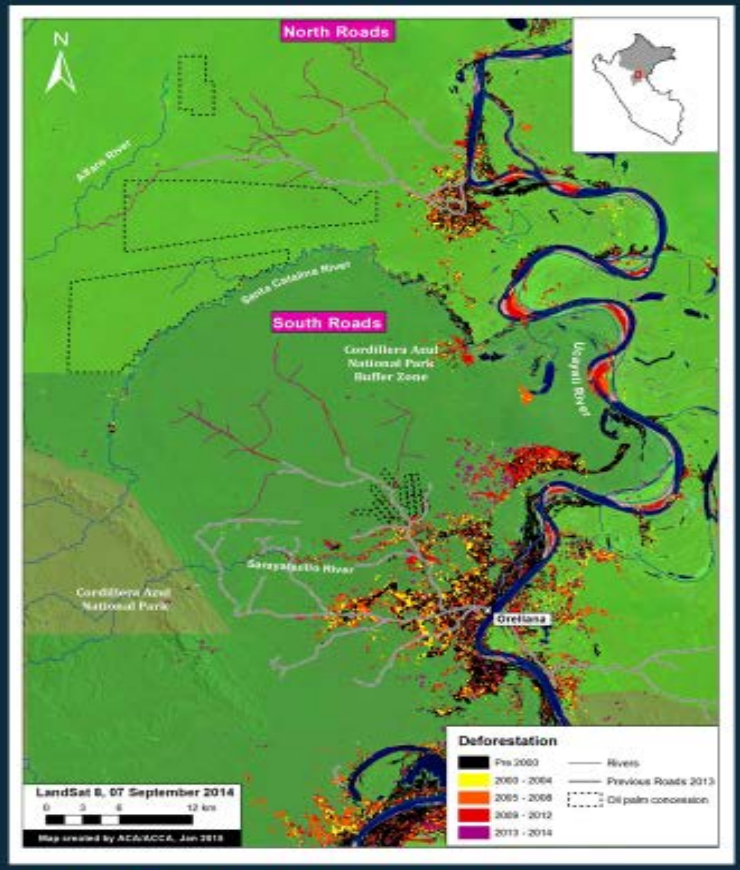
Geographic Coverage: Amazon

Focus: mining, logging, pol palm plantations, hydroelectric dams, oil and gas development, coca cultivation

Information delivery: web portal, "image of the week"

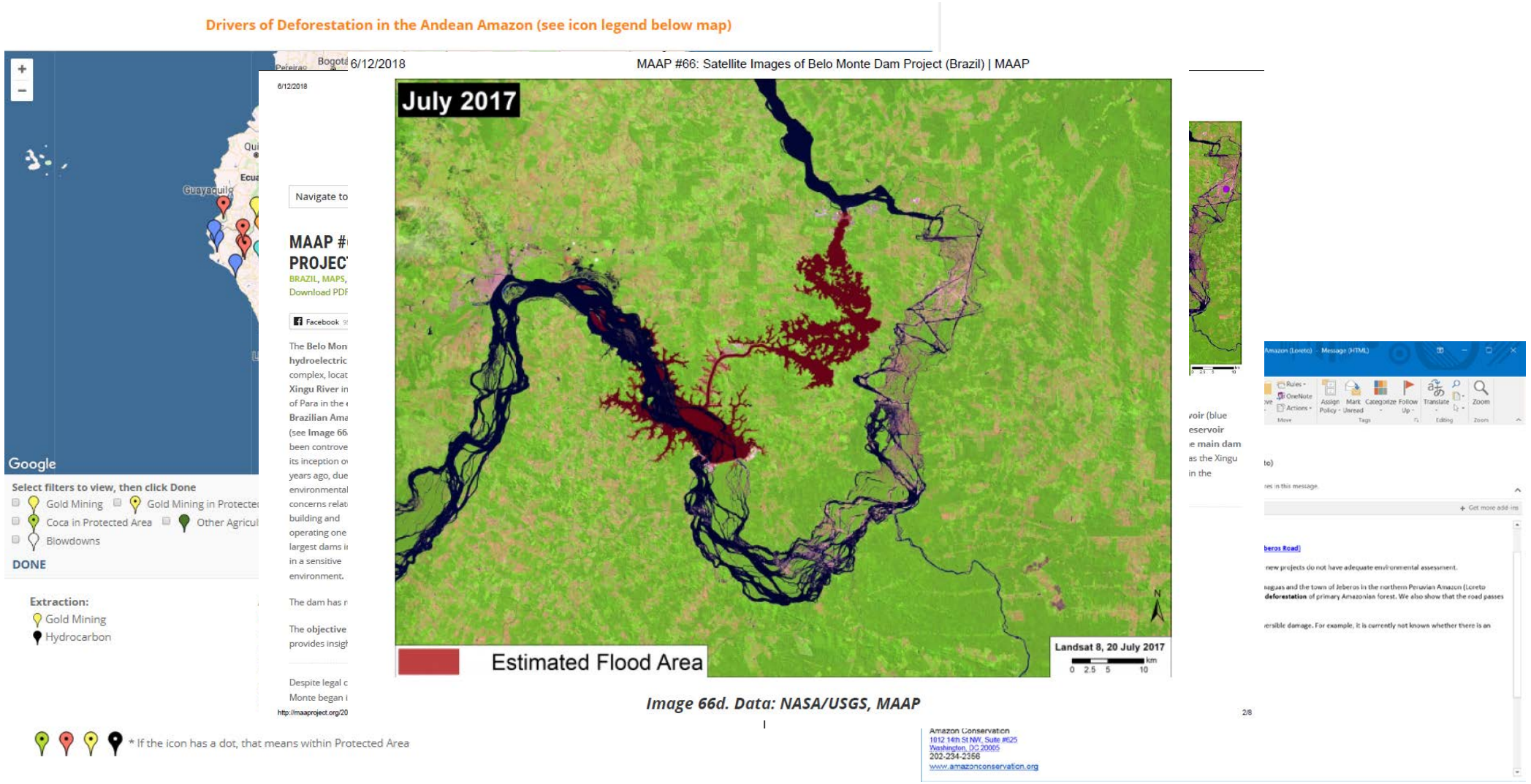
Target User: policy makers, civil society, media, public

Organization: Amazon Conservation Association



http://maaproject.org/en/

MAAP Alerts


Drivers of Deforestation in the Andean Amazon (see icon legend below map)
Google
Select filters to view, then click Done
Gold Mining
Coca in Protected Area
Blowdowns
DONE
Extraction:
Gold Mining
Hydrocarbon
* If the icon has a dot, that means within Protected Area
6/12/2018
Navigate to
MAAP #66: Satellite Images of Belo Monte Dam Project (Brazil) | MAAP
July 2017
Estimated Flood Area
Landsat 8, 20 July 2017
Image 66d. Data: NASA/USGS, MAAP
Amazon Conservation
1012 14th St NW, Suite #625
Washington, DC 20005
202-234-2366
www.amazonconservation.org

MAAP Alerts

MAAP #85: Illegal Logging in the Peruvian Amazon, and How Satellites Can Help Address It (https://maaproject.org/2018/illegal_log/**)**

MAAP Alerts

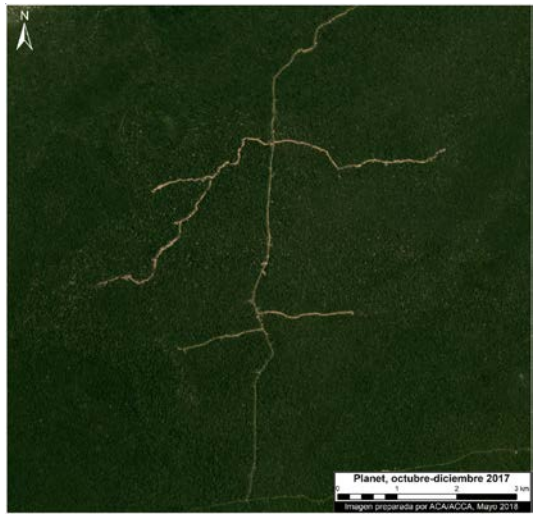
- The Peruvian Amazon comprises of 60% of the country's area
- This region provides countless ecosystem services to local groups, such as food, water, and timber
- It is also a biodiversity hotspot and a great carbon sink to help mitigate climate change

MAAP Alerts

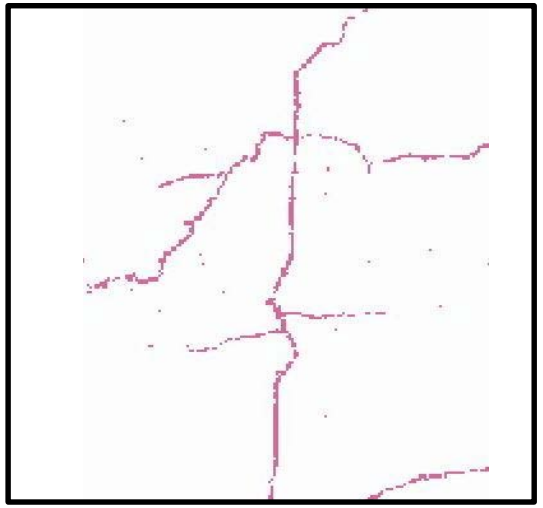
- Threat:
  - Countless resources available in the Amazon
  - Illegal extraction of these resources is common, particularly logging
  - Illegal logging is hard to detect because it is often small-scale selective logging and not large-scale clear cutting

MAAP Alerts

- Solution:
  - Remote sensing can be used to quickly detect these operations in near-real time
  - The Amazon Conservation Association used GLAD alerts, Sentinel-1 (radar satellites), and Planet (optical satellites) to observe new logging roads in the Peruvian Amazon between 2015 and 2017
  - Mapping of new logging roads (seen right) can help quickly identify new illegal logging sites

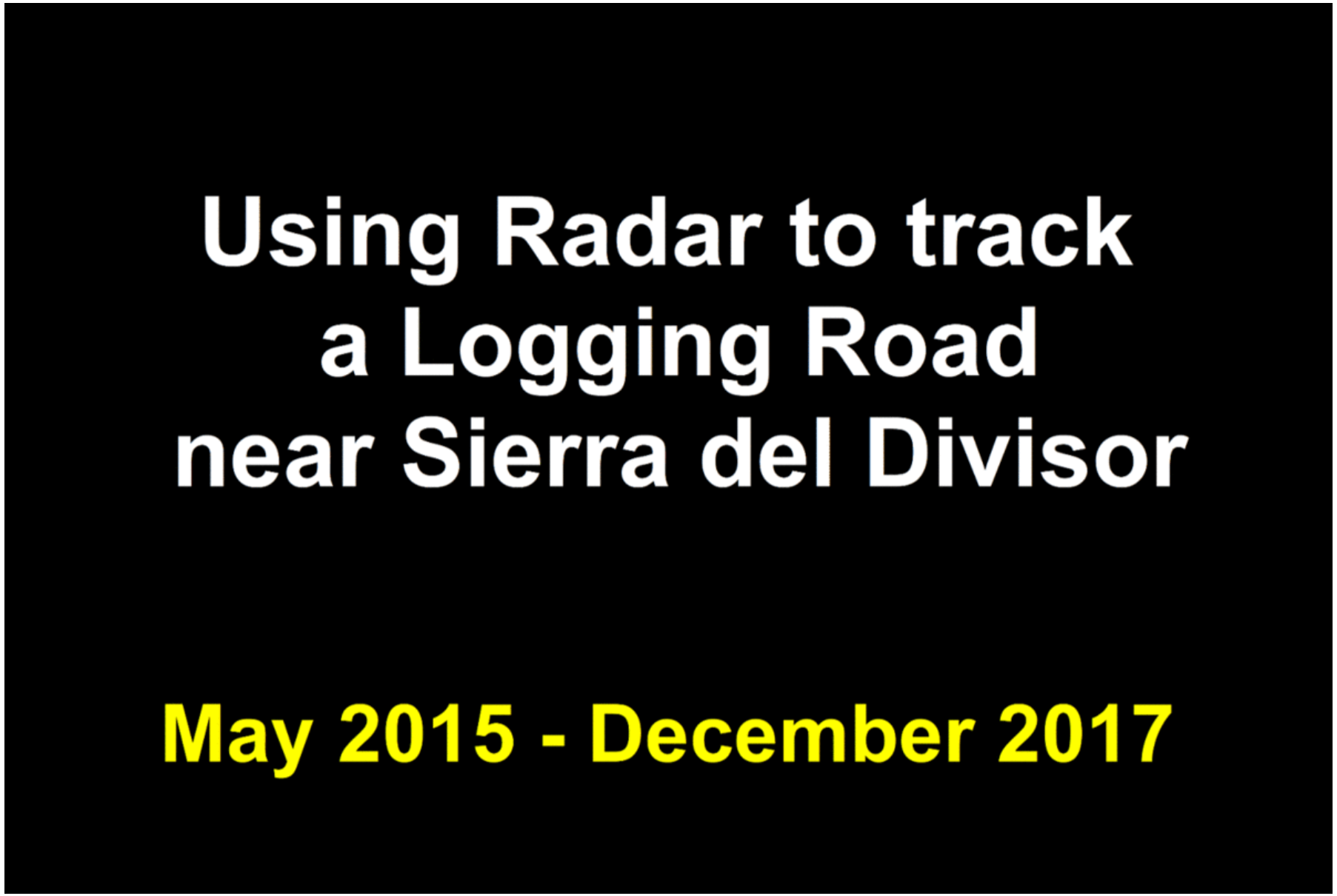


Landsat map of logging roads in the Peruvian Amazon



Map of logging roads in the Peruvian Amazon using GLAD Alerts

MAAP Alerts

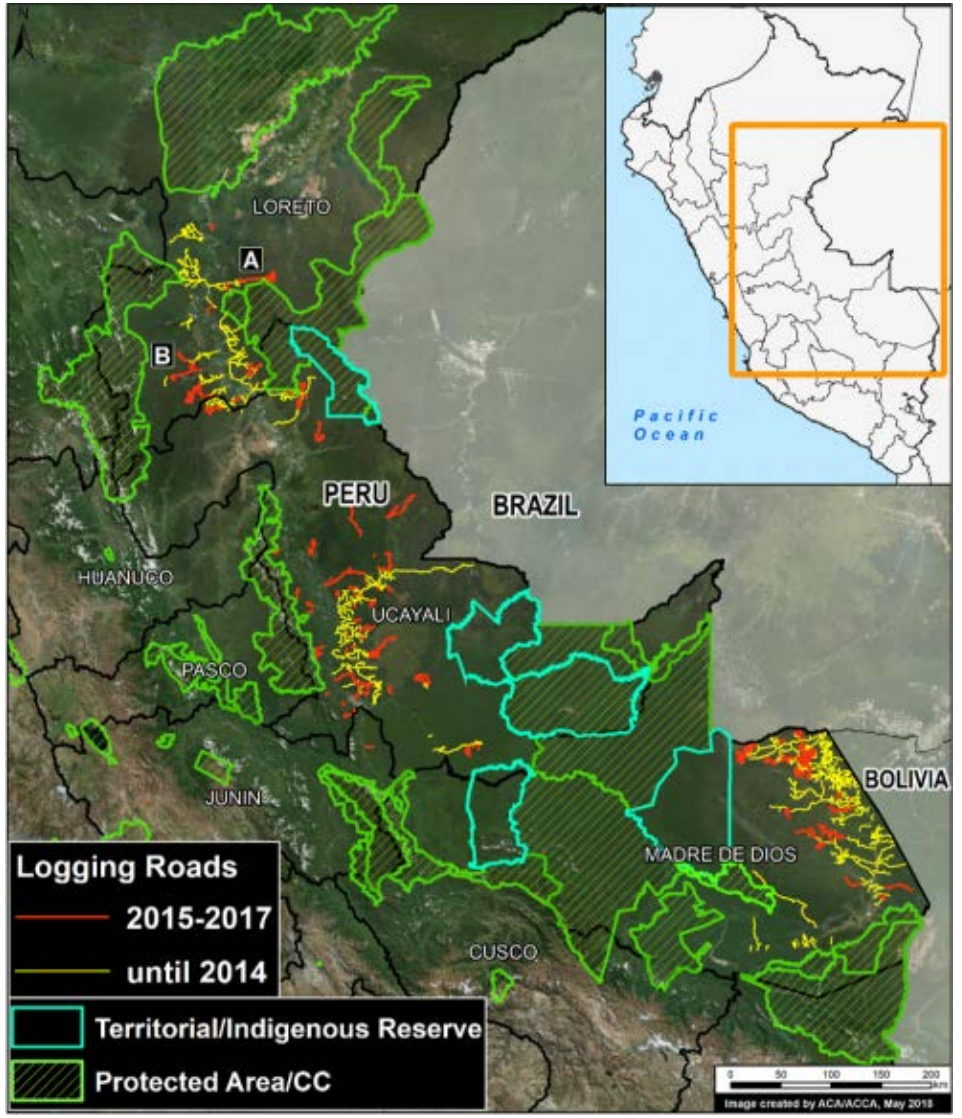

Using Radar to track
a Logging Road
near Sierra del Divisor
May 2015 - December 2017

MAAP Alerts


N
Planet, october - december 2017
km
0
1
2
3
Image created by ACA/ACCA, May 2018

MAAP Alerts

- Successes:
  - Between 2015 and 2017, 2,200 km of new logging roads were mapped (shown in red on the map)
    - Up to 2.5 km of new roads per week
  - Roads were concentrated in three zones:
    - Southern Loreto, between Cordillera Azul and Sierra del Divisor National Parks
    - Southern Ucayali
    - Northeast Madre de Dios
  - Successful projects like these show the potential for using near-real time for future identification of illegal extractives
  - This information allows proper reforms to be implemented



Map of logging roads in the Peruvian Amazon

Mobile Applications

Mobile Applications

A mobile solution to lack of connectivity

Forest Watcher

The Forest Watcher mobile app brings the dynamic online forest monitoring and alert systems of Global Forest Watch offline and into the field. Monitor areas of interest, view deforestation and fires alerts, navigate to a point to investigate, and collect information about what you find, regardless of connectivity.

Download on the App Store

GET IT ON Google play

Forest Watcher mobile is a complete application on its own. However accessing the desktop version application enables even more capabilities, including viewing and collecting reports, creating and assigning AOIs, and uploading your own contextual data.

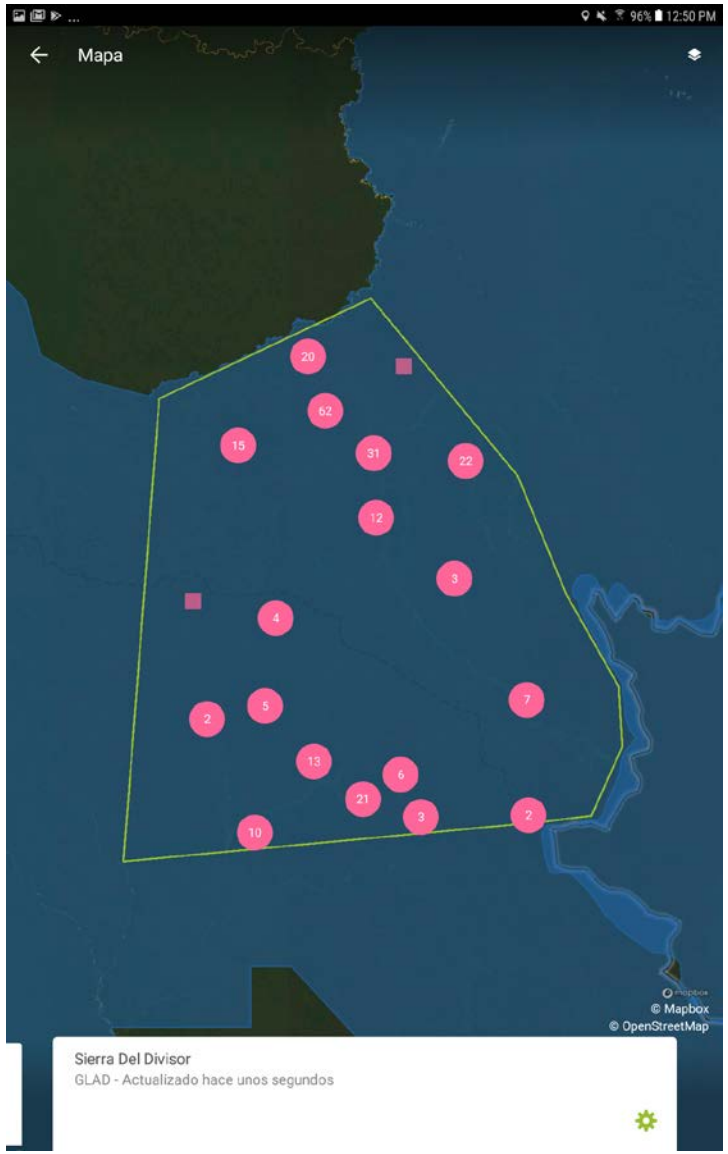
ACCESS DESKTOP APP

http://forestwatcher.globalforestwatch.org/

Forest Watcher

Features

- Download data on forest changes
- Collect information (points, photos), use customizable forms
- Navigation



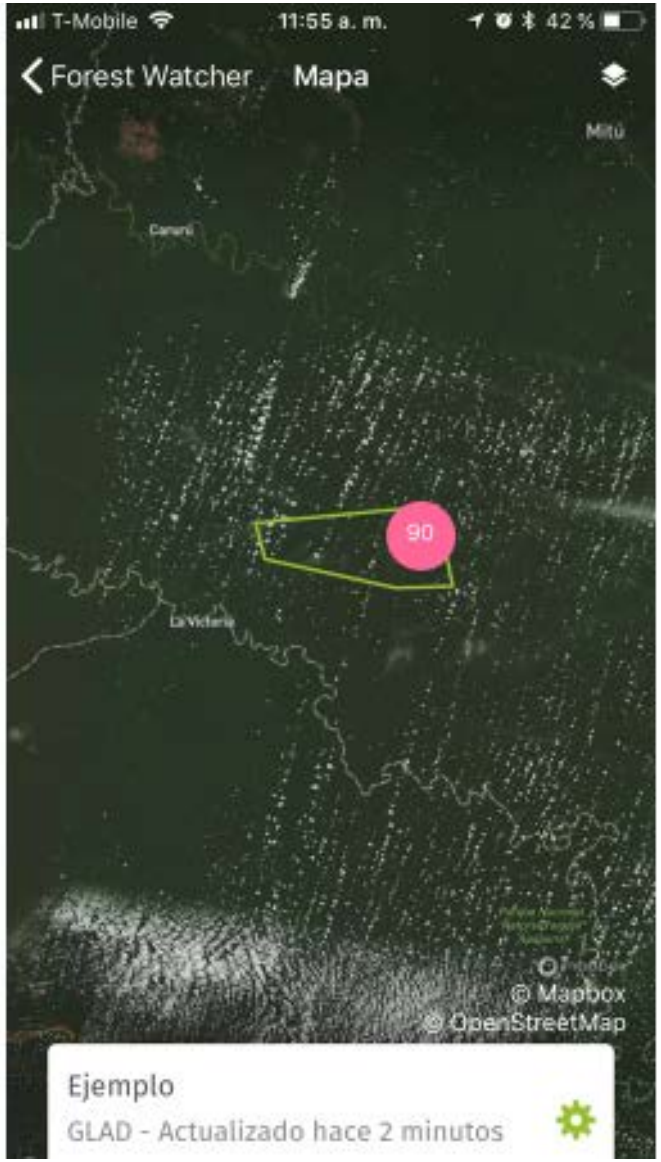
Forest Watcher

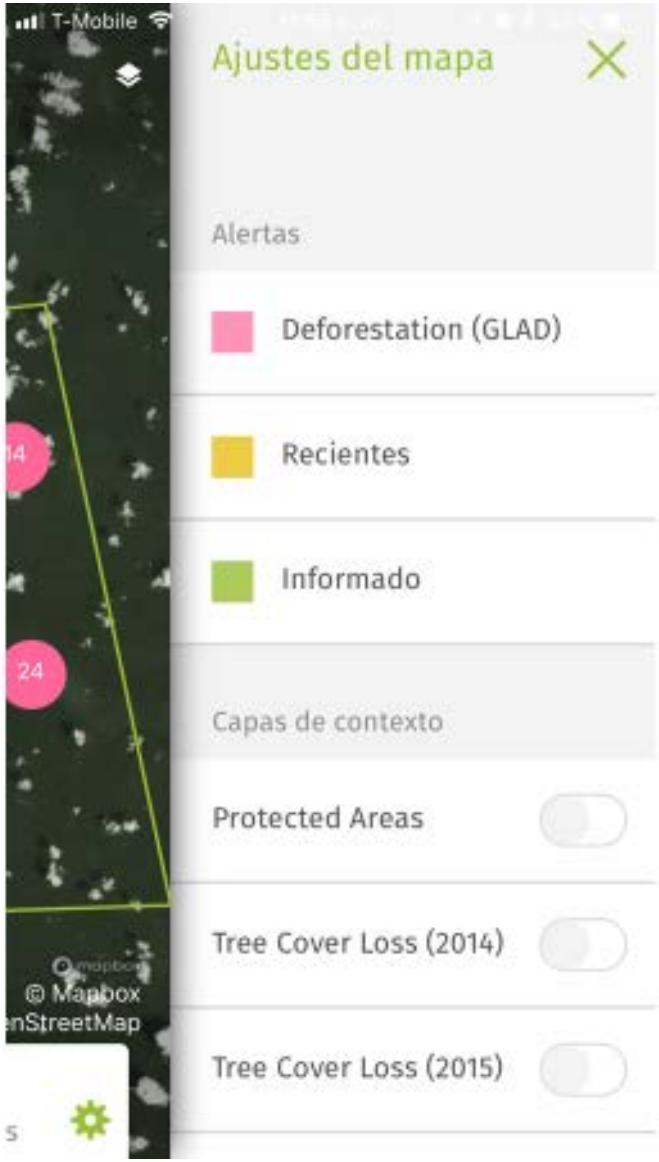
Users

- Conservation NGOs
- Forest administrators and rangers
- Control and surveillance personnel
- Local communities and indigenous peoples
- Scientists

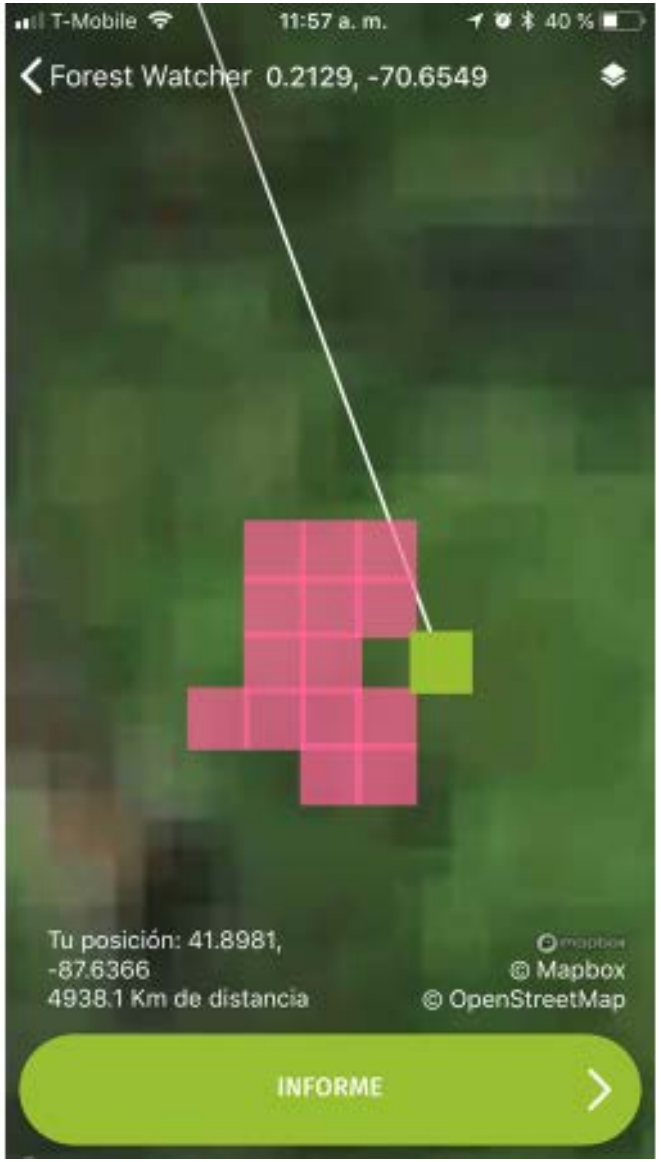
Forest Watcher

Forest Watcher





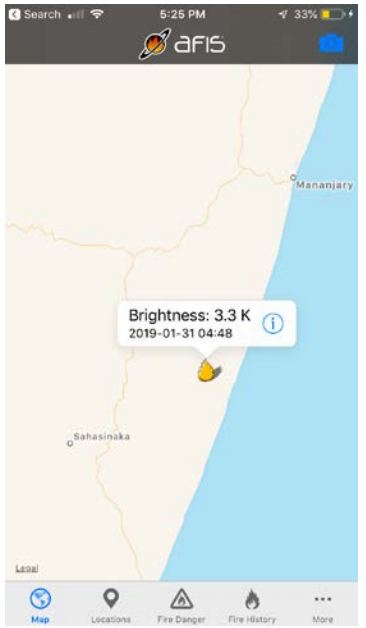
Forest Watcher



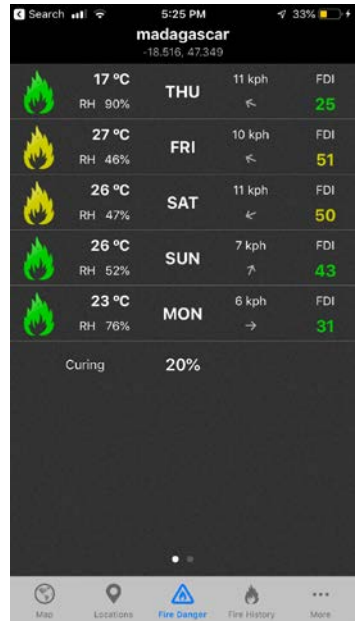
Advanced Fire Information System

- The council scientific and industrial research operates the Advanced Fire information Systems (AFIS)
- AFIS provides a free mobile application for both Andriod and iOS
- The application allows a user to set a location to monitor and view fire information
  1. Active fires
  2. Fire danger
  3. Fire history

1.



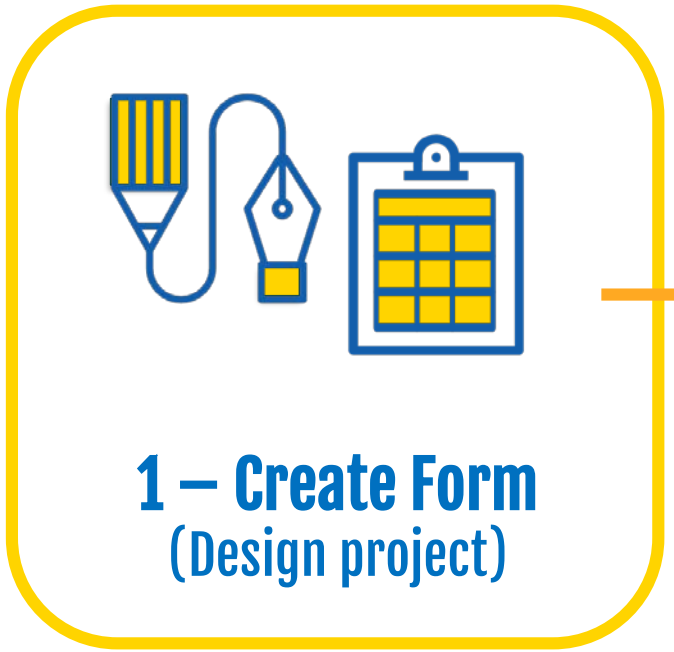
2.



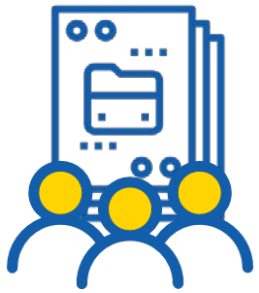
3.

https://afis.co.za

Survey123



1 – Create Form
(Design project)

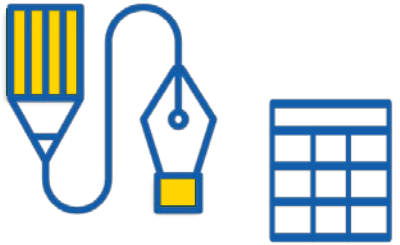


2 – Capture Data
(Field work & surveys)

3 – Make Decisions
(View & Analyze)

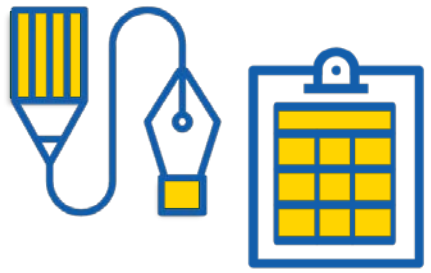
Survey123

Create Form

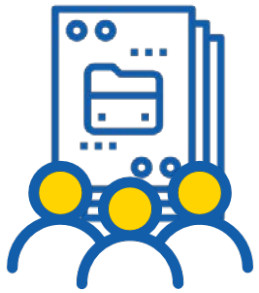


- Survey123 Web Designer:
  - Build smart forms graphically in a web browser
  - Easy to build
- Survey123 Connect:
  - A downloadable desktop tool. Works in combination with Microsoft Excel.
  - Complete smart form capabilities

Survey123



1 – Create Form
(Collect Information)



2 – Capture Data
(Field work & surveys)

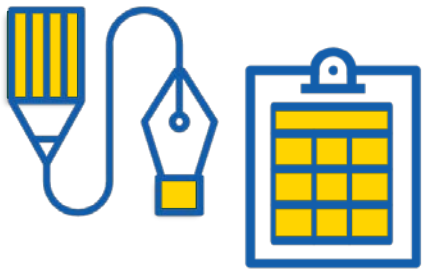
3 – Make Decisions
(View & Analyze)

Survey123

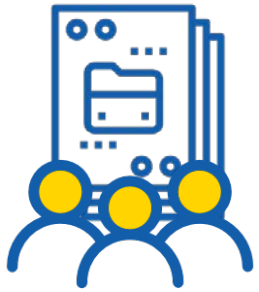
Capture Data

1. Survey123 Field App
   - Available for download (Google Play, iOS, Windows Mac)
   - Leverage device sensors (external GPS, camera etc.)
   - Can add new data and update existing features
2. WebForm in a web browser
   - Capture data from a web browser. Can be embedded within a website.
   - Nothing to install.
   - Online only. Add new data only.

Survey123



1 – Create Form
(Collect Information)



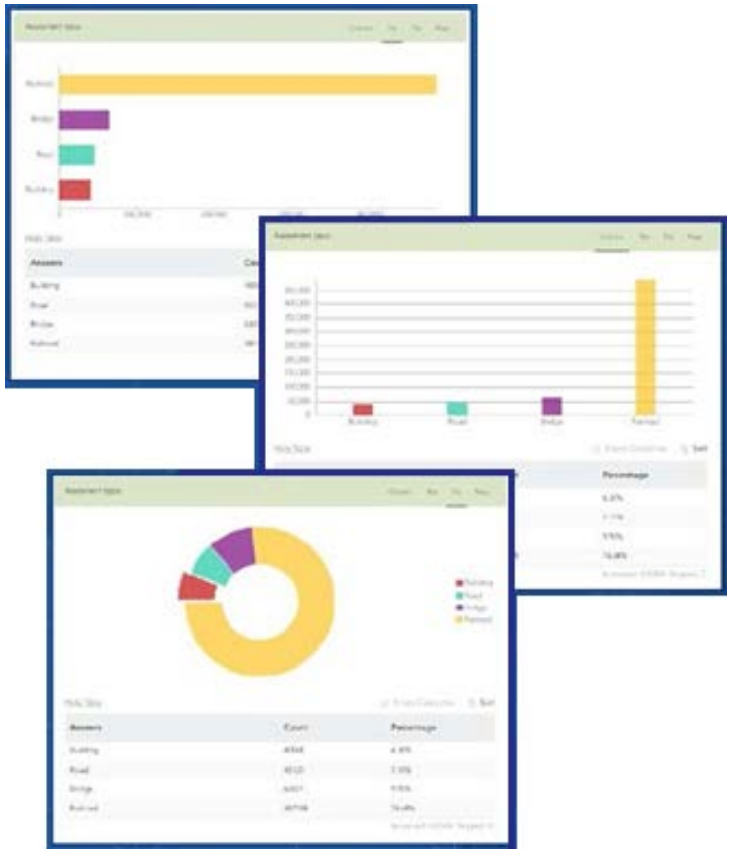
2 – Capture Data
(Field work & surveys)

3 – Make Decisions
(View & Analyze)

Survey123

Looking at Your Survey Results

- Survey123 website includes many built-in reporting capabilities
- Enables you to examine your data
- Potentially observe trends and patterns about
  - The survey collection process
  - The collected survey data
- All data results can be filtered by date and date ranges
- Helps in better decision making

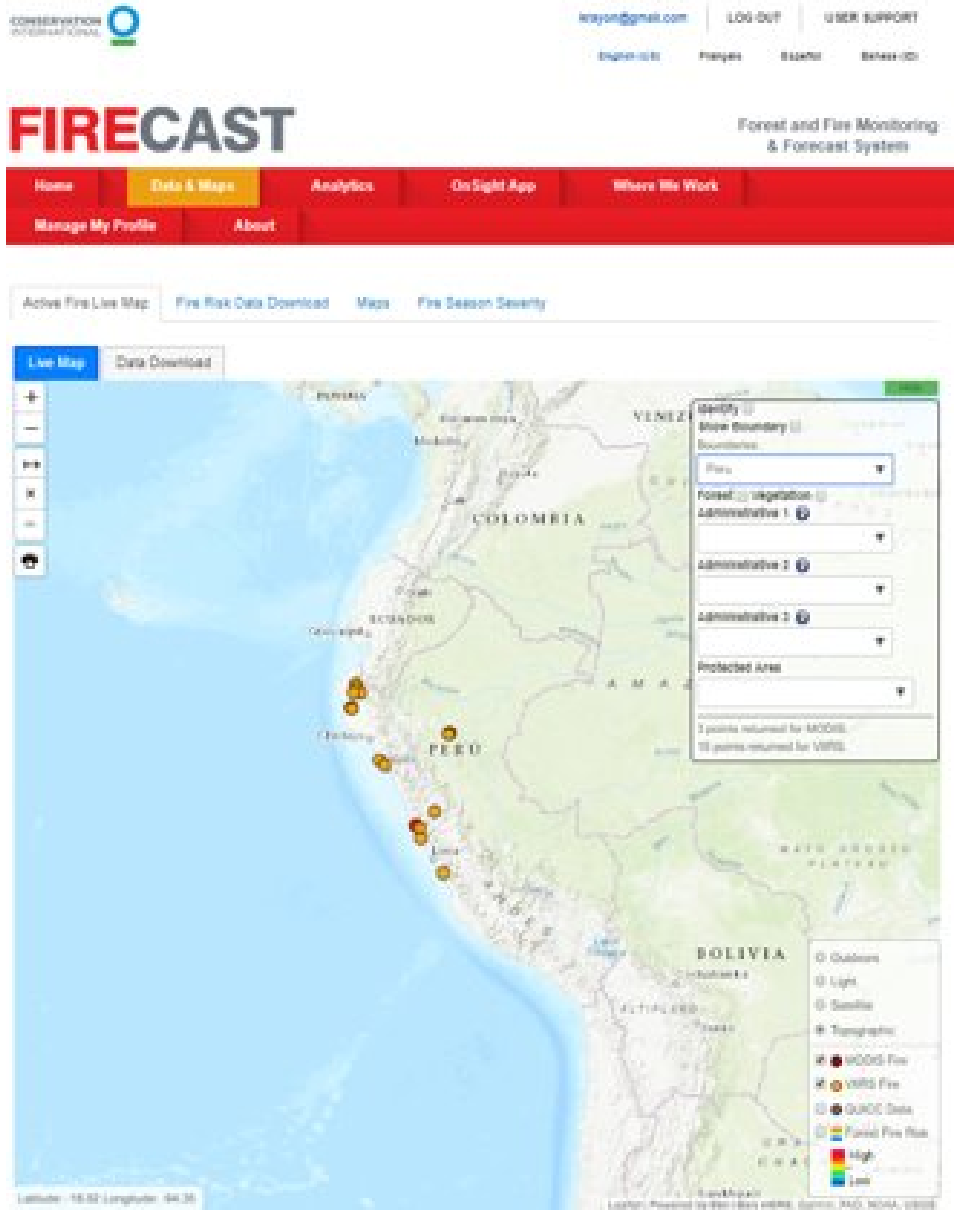


Summary of Session #3

- Introduction of near real-time monitoring and alert systems
- Discussion of important applications
- Examples of prominent near real-time alert systems
  - Firecast
  - Global Forest Watch
  - Glad Alerts
  - MAAP
- Introduction to useful mobile applications
  - Forest watcher
  - AFIS
  - Survey 123

Demonstration FIRECAST

- Create a fire alert for your area of interest
- https://firecast.conservation.org/



Summary of Course

- Reviewed satellite data and mapping tools available to inform sustainable land management decisions
  - Maps, GPS, GIS, Participatory GIS, Participatory Mapping, create a map in Google Earth
- Reviewed basic concepts of remote sensing, satellite sensors, and image interpretation relevant to sustainable land management
  - Principles of remote sensing with satellites and drones, spectral signatures, resolutions, satellite sensors, data portals, software, esri earth explorer
- Reviewed mobile apps and systems for early warning and alerts
  - Web-based tools for a variety of applications and skill-levels
  - useful mobile applications for GIS and participatory mapping