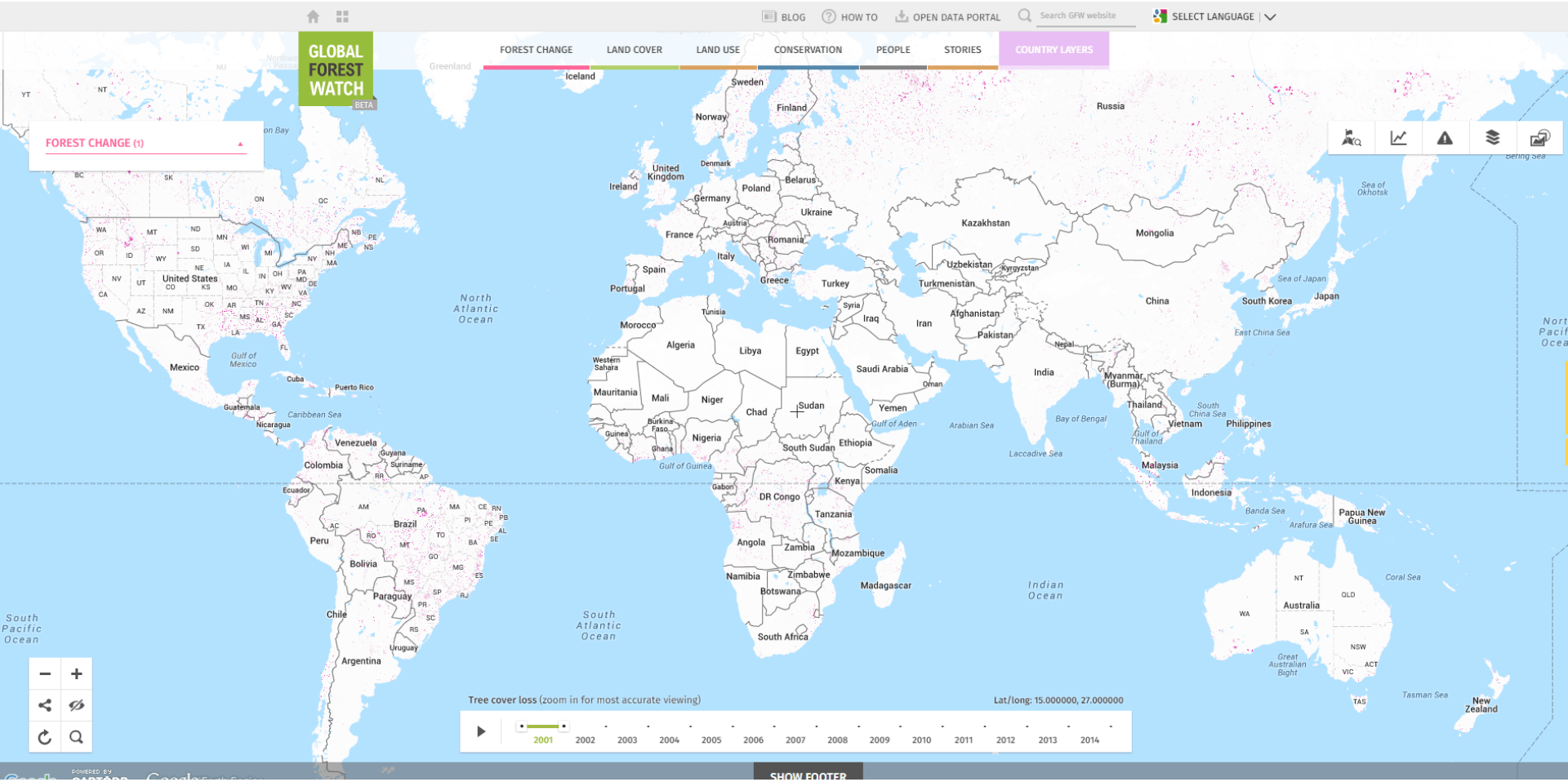
EARLY WARNING: GFW LESSONS LEARNED AND FUTURE DIRECTIONS

25 October 2017, Forest Governance Initiative Technical Session

RACHAEL PETERSEN, ACTING DIRECTOR

- Overview of existing early warning activities
  - What EW systems exist on GFW?
    - GLAD alert methods & accuracy
  - How are alerts used?
  - Ongoing user research: can we understand the impact of EW on forest governance?
- Lessons learned
- Future directions & recommendations


BLOG
HOW TO
OPEN DATA PORTAL
Search GFW website
SELECT LANGUAGE
GLOBAL FOREST WATCH
BETA
FOREST CHANGE
LAND COVER
LAND USE
CONSERVATION
PEOPLE
STORIES
COUNTRY LAYERS
FOREST CHANGE (1)
Tree cover loss (zoom in for most accurate viewing)
Lat/long: 15.000000, 27.000000
2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014
SHOW FOOTER
North Atlantic Ocean
South Atlantic Ocean
Indian Ocean
South Pacific Ocean
Gulf of Mexico
Caribbean Sea
Gulf of Guinea
Arabian Sea
Bay of Bengal
Laccadive Sea
Gulf of Aden
Gulf of Thailand
Banda Sea
Arafura Sea
Coral Sea
Tasman Sea
Great Australian Bight
Sea of Okhotsk
Sea of Japan
East China Sea
South China Sea
Russia
Kazakhstan
Mongolia
China
India
United States
Mexico
Canada
Brazil
Argentina
Chile
Peru
Colombia
Venezuela
Bolivia
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Ecuador
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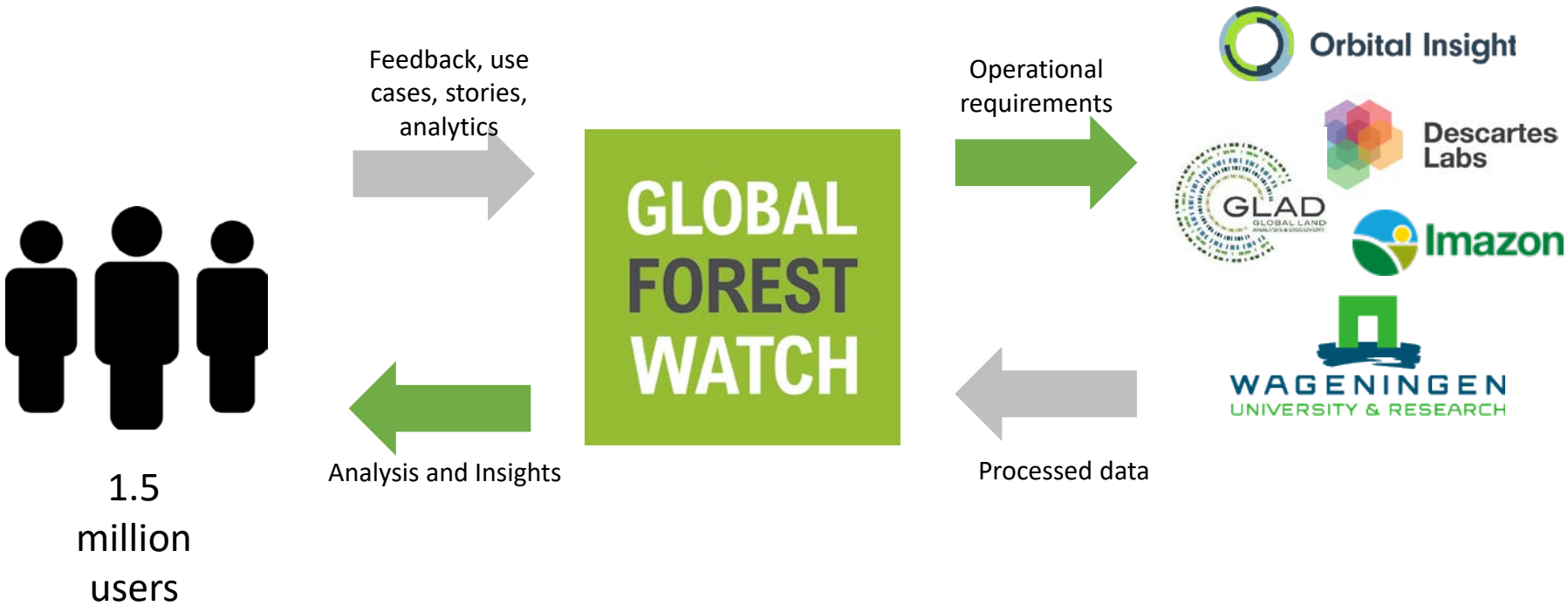
Turkmenistan
Iran
Iraq
Syria
Afghanistan
Pakistan
Nepal
Japan
South Korea
Myanmar (Burma)
Thailand
Vietnam
Philippines
Malaysia
Indonesia
Papua New Guinea
Australia
New Zealand
Morocco
Western Sahara
Algeria
Tunisia
Libya
Egypt
Mauritania
Mali
Niger
Chad
Sudan
Nigeria
Burkina Faso
Guinea
Ghana
Saudi Arabia
Oman
Yemen
South Sudan
Ethiopia
Somalia
Kenya
Gabon
DR Congo
Tanzania
Angola
Zambia
Mozambique
Namibia
Zimbabwe
Botswana
Madagascar
South Africa


ARLOS VALAREZO | FONDO REGIONAL DEL AGUA
1.5 million users
100+ partners
1,210 trained
16 governments
4000+ media stories
IMAGE: Carlos Valarezo, Fondo Regional Del Agua

GFW: CONVENER, COMMISSIONER, DISTRIBUTOR



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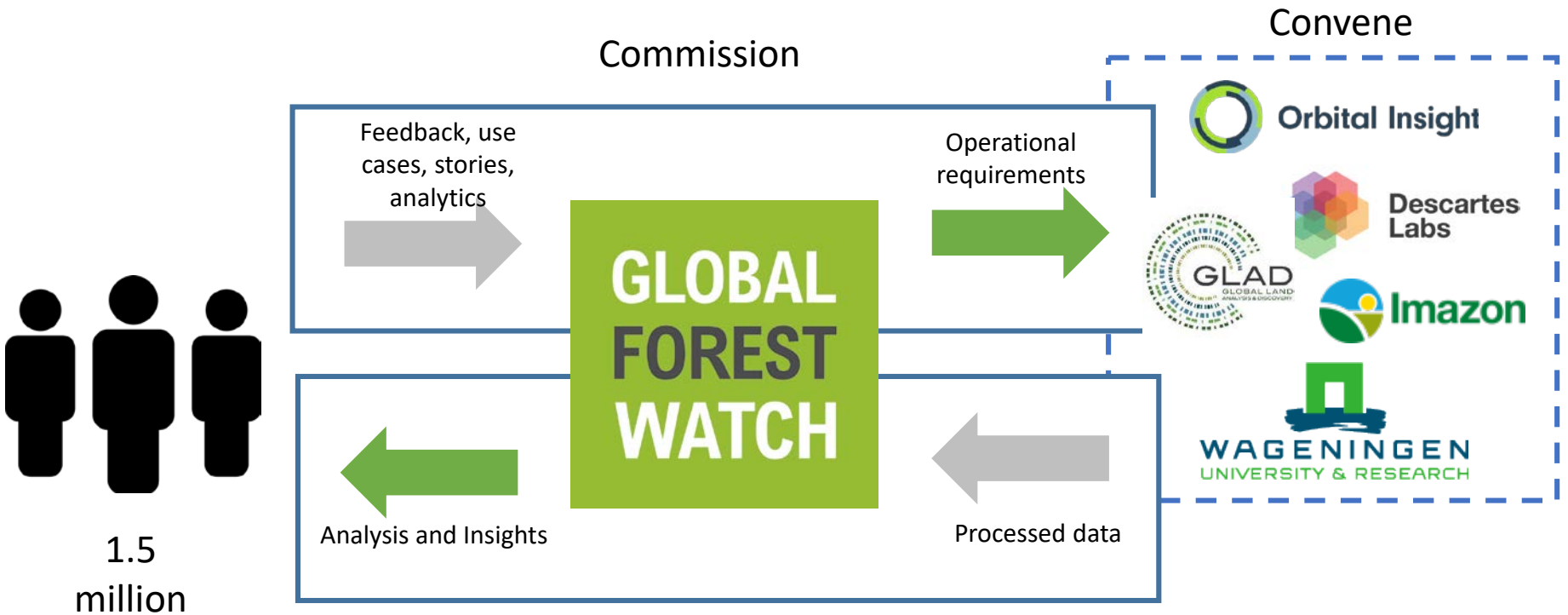

Distribute data via platform with built-in analysis, subscription, download and visualization tools

GFW OPERATIONAL EW PRODUCTS

	Source	Resolution	Frequency	Coverage
GLAD alerts	UMD	30 m (Landsat 7/8)	Weekly	Brazil, Peru; Burundi, Cameroon, CAR, DRC, Eq. Guinea, Gabon, ROC, Rwanda, Uganda; Brunei, Indonesia, Malaysia, Papua New Guinea, Timor Leste; Russia Far East
FORMA alerts	WRI, CGD	250 m (MODIS)	Biweekly	Pantropical
Terra-I alerts	CIAT	250 m (MODIS)	Monthly	Pantropical
SAD	Imazon	250 m (MODIS)	Monthly	Brazilian Amazon
Guyra	Asociación Guyra Paraguay	30 (Landsat)	Monthly	Grand Chaco
VIIRS active fires	NASA	375 m (VIIRS sensor)	Two times daily	global

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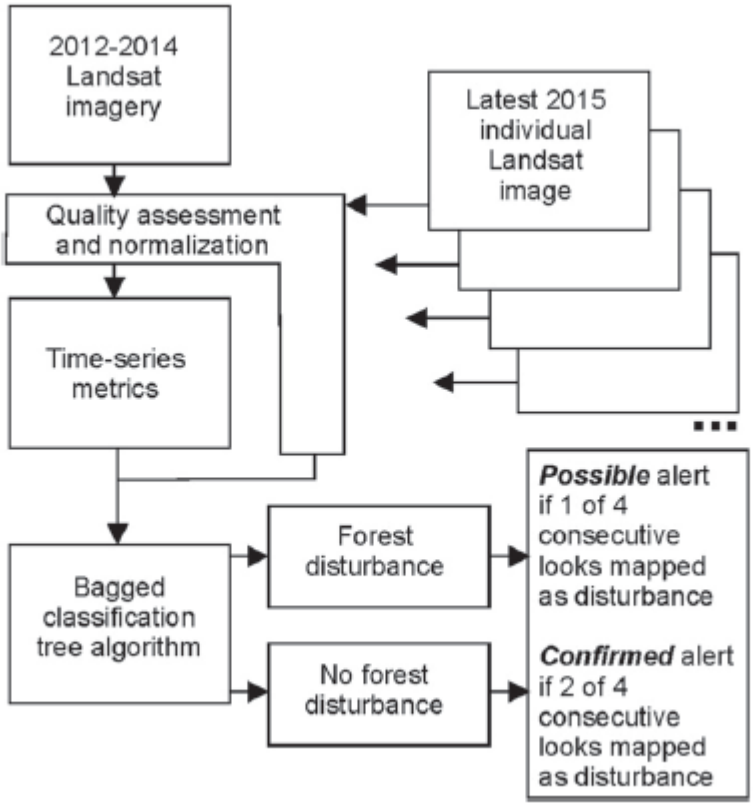
WEEKLY GLAD ALERTS

Function	Identifies areas of likely tree cover loss in near-real time
Resolution	30 x 30 meters
Frequency	Imagery updated every 8 days; processed daily
Date of content	July 2015 - present
Satellite	Landsat 7 and Landsat 8
Geographic Coverage	**South America**: Brazil, Peru; Ecuador, Venezuela, Colombia, Suriname, Guyana, French Guyana **Central Africa**: Burundi, Cameroon, Central African Republic, Democratic Republic of the Congo, Equatorial Guinea, Gabon, Republic of the Congo, Rwanda, Uganda **Southeast Asia**: Brunei, Indonesia, Malaysia, Papua New Guinea, Timor Leste

Hansen, M.C., A. Krylov, A. Tyukavina, P.V. Potapov, S. Turubanova, B. Zutta, S. Ifo, B. Margono, F. Stolle, and R. Moore. 2016. Humid tropical forest disturbance alerts using Landsat data. *Environmental Research Letters*, 11 (3).

METHODOLOGY

- "Forest cover": > 5 m tall trees with a canopy closure exceeding 60%
- An alert is defined as any Landsat pixel that experiences a canopy loss in excess of 50% cover
- Alerts are based on the latest single good observation
- Two types of alerts: confirmed and unconfirmed
  - Alerts remain unconfirmed until two or more out of four consecutive observations are labelled as loss



Flowchart of forest disturbance alert method.

Hansen, M.C., A. Krylov, A. Tyukavina, P.V. Potapov, S. Turubanova, B. Zutta, S. Ifo, B. Margono, F. Stolle, and R. Moore. 2016. Humid tropical forest disturbance alerts using Landsat data. *Environmental Research Letters*, 11 (3).

01/16/2014

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ACCURACY AND LIMITATIONS

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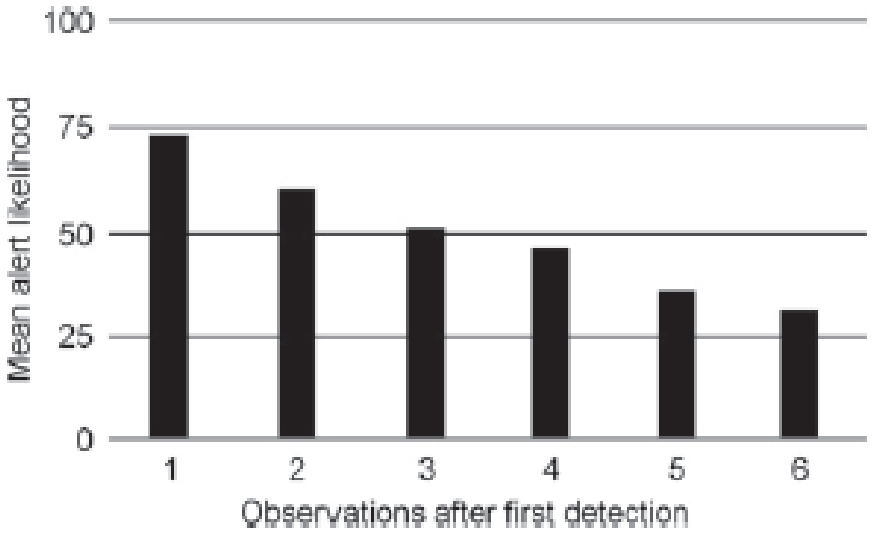
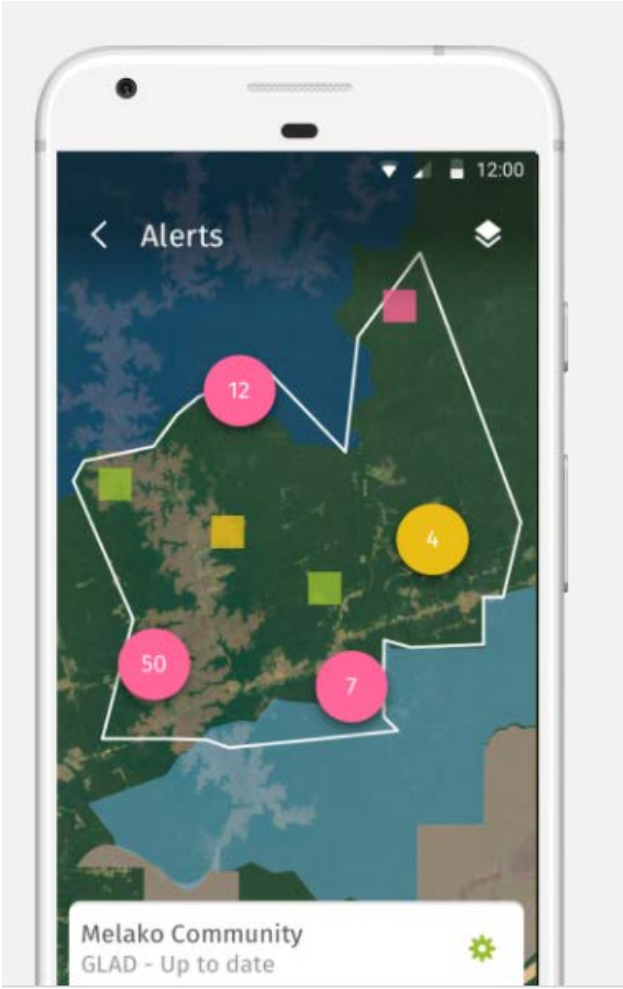
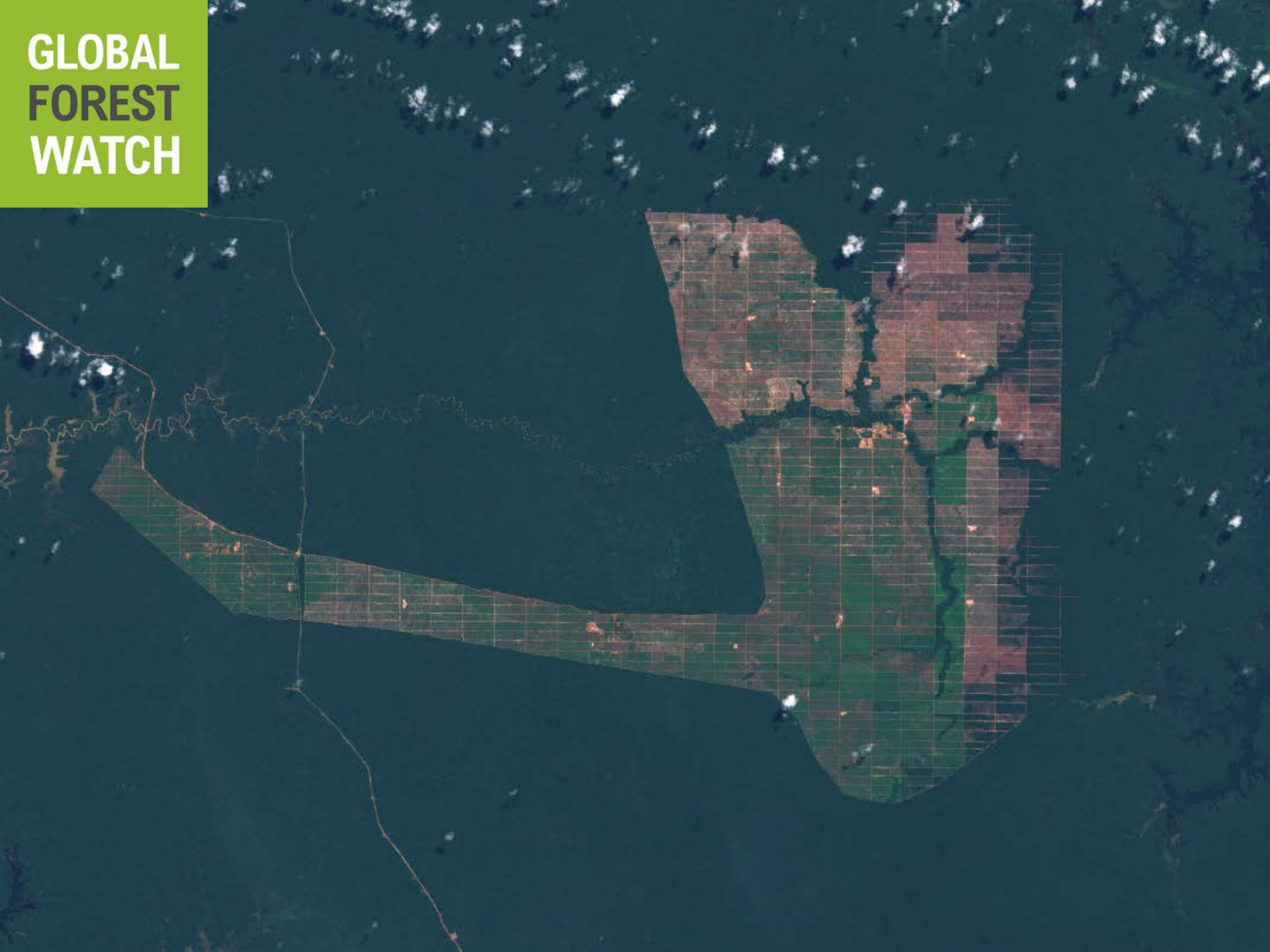
- False positive rate (all alerts): 13.5%
  - Majority (9.5%) occur on the edges of clearings
- False positive rate (confirmed only): 1%
- False negative: 33%
- Conservative nature of algorithm reflective of intended end uses
- Persistent cloud cover means date of detection could be weeks to months after date of clearing

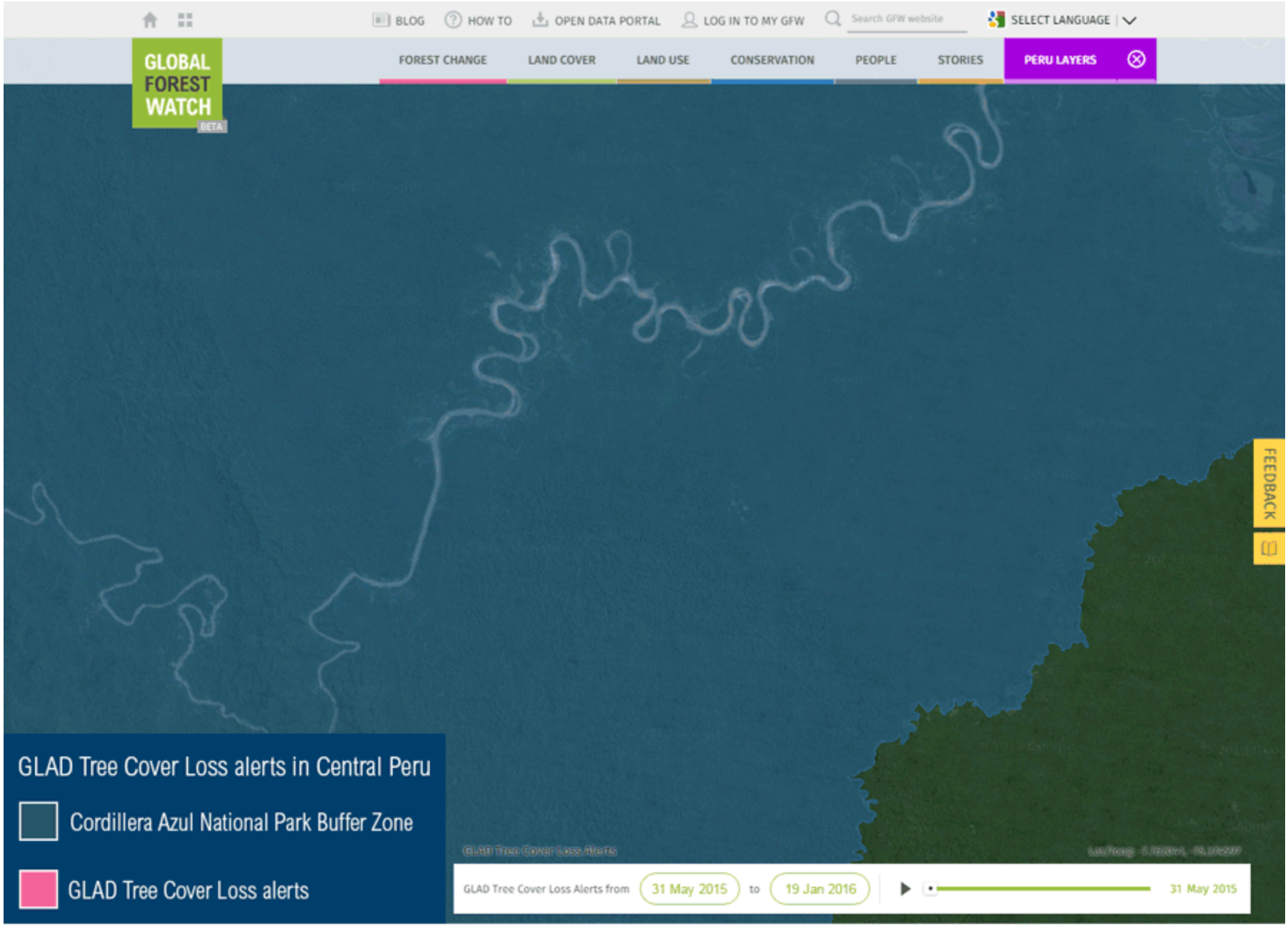


ACCESSING ALERTS VIA GFW

- **Visualize** on interactive map
  - Select recent Sentinel-2 imagery by date and cloud cover for verification
  - Overlay other AOIs such as concessions, species ranges, national parks, etc
- **Analyze** alerts by drawing, selecting or uploading an AOI.
- **Subscribe** to an area and receive email notifications when new change is detected
- **Download** alerts (shp, csv) or access via WMS and GFW API
- **Access offline** through Forest Watcher mobile app




GLOBAL
FOREST
WATCH



LEARN MORE: bit.ly/GLADalerts

WORLD RESOURCES INSTITUTE

HOW ARE ALERTS USED?

1. **Governments**
   - improve protected areas management and enforcement
   - prioritize investigations of suspected illegal clearing
2. **Civil society (journalists, activists)** highlight concerning hotspots
3. **Local communities** identify threats in their territories
4. **Commodity companies** monitor compliance with zero-deforestation supply chains

CAN WE UNDERSTAND THE ULTIMATE IMPACT OF EW ON FOREST GOVERNANCE?

EW Phases

Monitoring

- Early detection
- Data aggregation and analysis
- Verification
- Investigation
- Documentation

Response

- Arrests
- Fines or other penalties
- Court cases
- *Protests or boycotts*
- *Campaigns or reports*
- *Investigative journalism*

Impact

- Rate of deforestation
- Rate of illegal logging
- Introduction of new laws or policies

Hypotheses

EW data increases the effectiveness and efficiency of monitoring, which…

..Increases the number of response actions against illegal or unsustainable forest clearing, which…

..reduces rates of illegal or unsustainable forest clearing.

EW Phases

Monitoring

Response

Impact

- Resources
- Capacity
- Political willingness
- Inter-agency cooperation

- Institutional continuity
- Rule of law
- Lack of corruption

Hypotheses

EW data increases the effectiveness and efficiency of monitoring, which…

..Increases the number of response actions against illegal or unsustainable forest clearing, which…

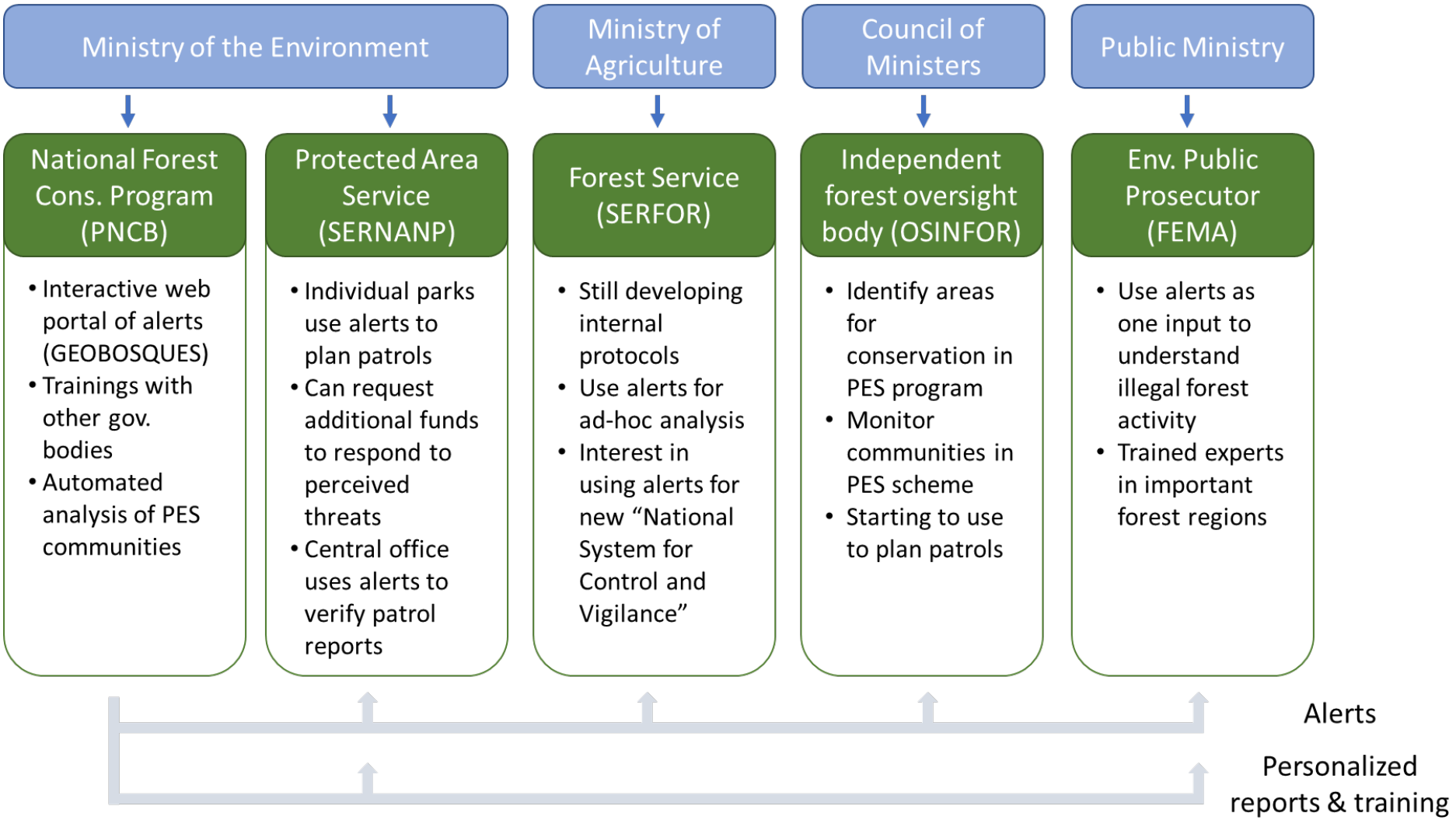
..reduces rates of illegal or unsustainable forest clearing.

EARLY WARNING USER NEEDS ASSESSMENT (PERU, INDONESIA, AND DRC)

- ***Accuracy***: alerts accurately detect clearing*.
- ***Completeness***: alerts cover relevant geographies and capture relevant biophysical changes*
- ***Timeliness***: alerts detect change within reasonable timescales after occurrence.
- ***Trust/ownership***: users trust the alerts.
- ***Usability***: alerts are provided in usable formats.
- ***Cost***: alerts are cost-effective to use.

* Target drivers vary by actor and geography

PERU: EW CASE STUDY



PERU: PRELIMINARY FINDINGS

- ***Accuracy***: Alerts are quite accurate – some individual pixels are wrong, but clusters are correct
- ***Completeness***: Would like to differentiate anthropogenic from "natural" forest cover disturbance
- ***Timeliness***: Cloud cover prevents alerts from being updated for months at a time
  - Agencies rely on date of detection for legal proceedings
  - 68% said cloud cover was a "major limitation"
- ***Trust/ownership***: GLAD alerts distributed through the Ministry of Environment. However, they recently started creating their own alerts to have more ownership over them.
- ***Usability***: Difficult for non-GIS users to access the data. Need offline solutions for field visits (mobile tech).
- ***Cost***: Alerts save many agencies time and costs of image interpretation – they can monitor larger areas


Stay tuned: early warning study to be published in 2018

FUTURE EW RESEARCH

- **Analysis:**
  - User Needs Assessment (published 2018)
  - Proposed: GLAD + JJ-FAST comparison
    - Visualize JJ-FAST in GFW?
  - Automated spatial analysis (roads, clusters)
  - Automated filtering and ranking of alerts with ancillary criteria
- **R&D:**
  - Incorporate S-2 to improve resolution
  - Prototype operational radar alerts (S-1 with Wageningen University)
  - Explore multi-sensor, optical/radar approaches

"Places to Watch" algorithm will identify GLAD alerts within PAs, primary forests, and Intact Forest Landscapes

RISKS AND OPPORTUNITIES OF EW

Confusion over proliferation of EW systems

- Coordinated communication to explain relative strengths
- Platforms to access all systems in one place

Increase in data volume will overwhelm users

- Improve data delivery systems to filter information
- AI methods to detect hotspots, roads, etc.

Monitoring technology evolves more quickly than capacity to use it

- Sustained focus on technical assistance and agency cooperation
- Resources for field investigations, prosecutions
- Country co-ownership of systems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A GROWING PARTNERSHIP
globalforestwatch.org/partners
Thank you!
www.globalforestwatch.org
Rachael Petersen
rpetersen@wri.org

DELETE: EARLY WARNING LESSONS LEARNED

- Cloud cover is the most significant limitation
- Need to ensure longevity and maintenance of these systems
- Link timber traceability / permitting systems with remote sensing data
- RS data is helpful in determining priorities and quickly acting on suspected illegal clearing. Not sufficient evidence for prosecutions
- Develop protocols for combining remote sensing data with ancillary info
- Governance and legal challenges are greater than technical challenges
- Government buy-in is key – GEOBOSQUES platform resulted in widespread uptake of alerts across the country
- Comprehensive training and capacity building is important
- Field verification visits build trust in the data
- Use of information needs to be institutionalized through formal protocols and processes
- Civil society can help put pressure on governments by publicizing areas of deforestation
- Alerts were most effective in organizations with field staff