Putting data to work

Challenges and practical approaches to bring remotely sensed data into land use planning in the developing world

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CMS Policy Speaker Series

NASA – Goddard

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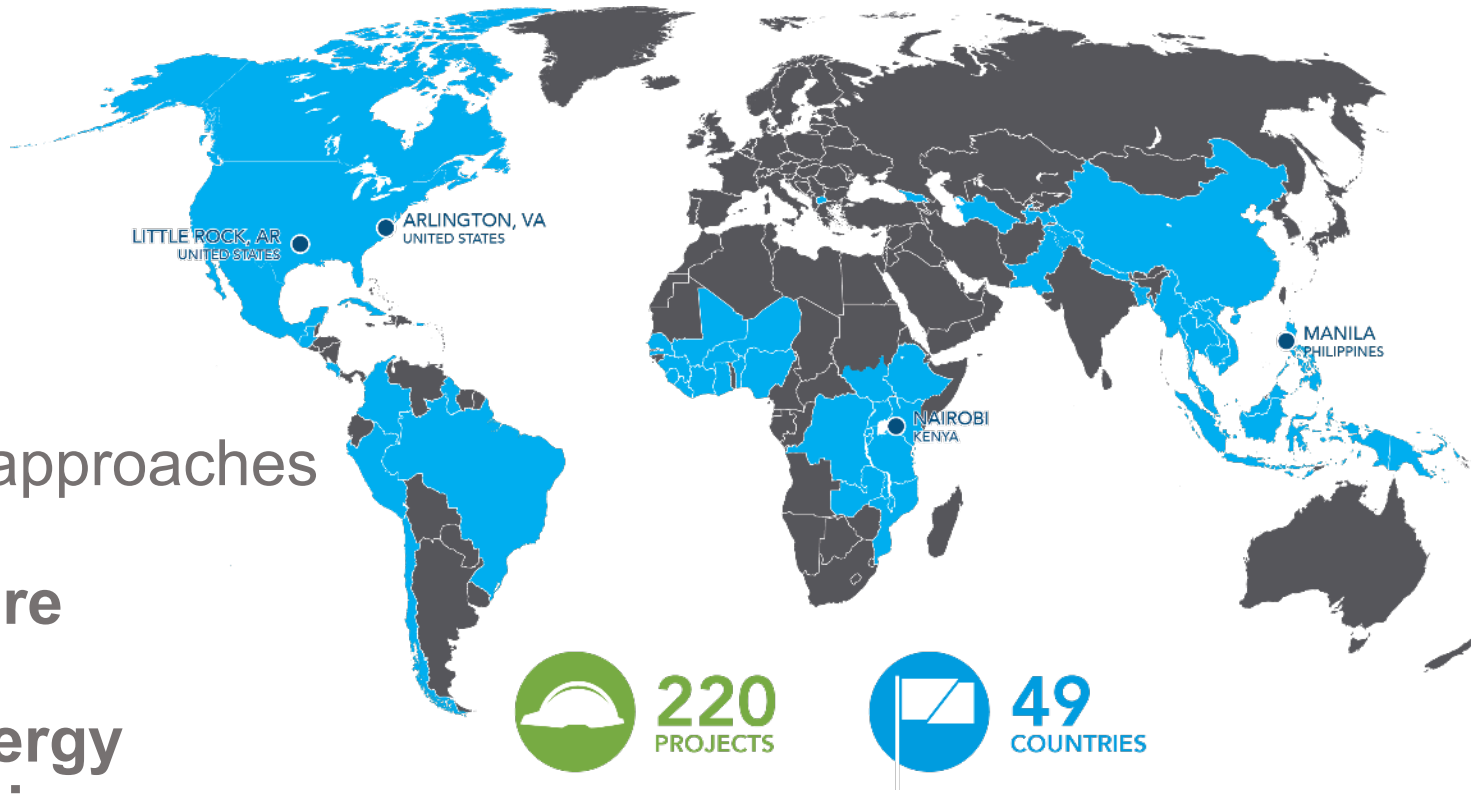
In this presentation

- Winrock International's mission
- Winrock's Ecosystem Service unit experience
- Challenges for spatial land use planning in developing countries
- Case studies and tools developed
  - Cambodia watershed ecosystem service tool
  - Malawi forest monitoring
  - Ghana ecosystem service awareness
- Winrock global tools
  - AFOLU carbon Calculator
  - REDD+ Decision Support Tool
- Conclusions

A Powerful Mission

Winrock's mission is to **empower the disadvantaged**, **increase economic opportunity** and **sustain natural resources** across the globe.

Our Global Reach



Innovative approaches in

- **Agriculture**
- **NRM**
- **Clean energy**
- **Leadership development**.

Ecosystem Services Unit ('ECO')

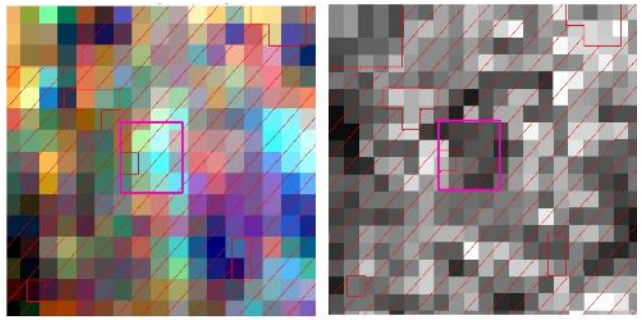
Cutting-edge **ecosystem services evaluation** from forests, watersheds, and agriculture.

Science-based approach to develop tools, build capacity, methodologies, and technical guidance for broad audiences.

- Ecosystem Services Assessment
- Pay for Services and for Performance
- Interactive Tool Development
- GHG Support
- Commodity Sustainability

How can remote sensing products be used in land use planning?

- Many remote sensing products exist—with loads of great data!
- These data can be useful for solving developing world land use problems
- However, they can be difficult to interpret for non-experts
- Need for translation between products and:
  - Governments + policy makers
  - Land use planners
  - Communities



Expanding data availability

- Medium-resolution land multispectral options

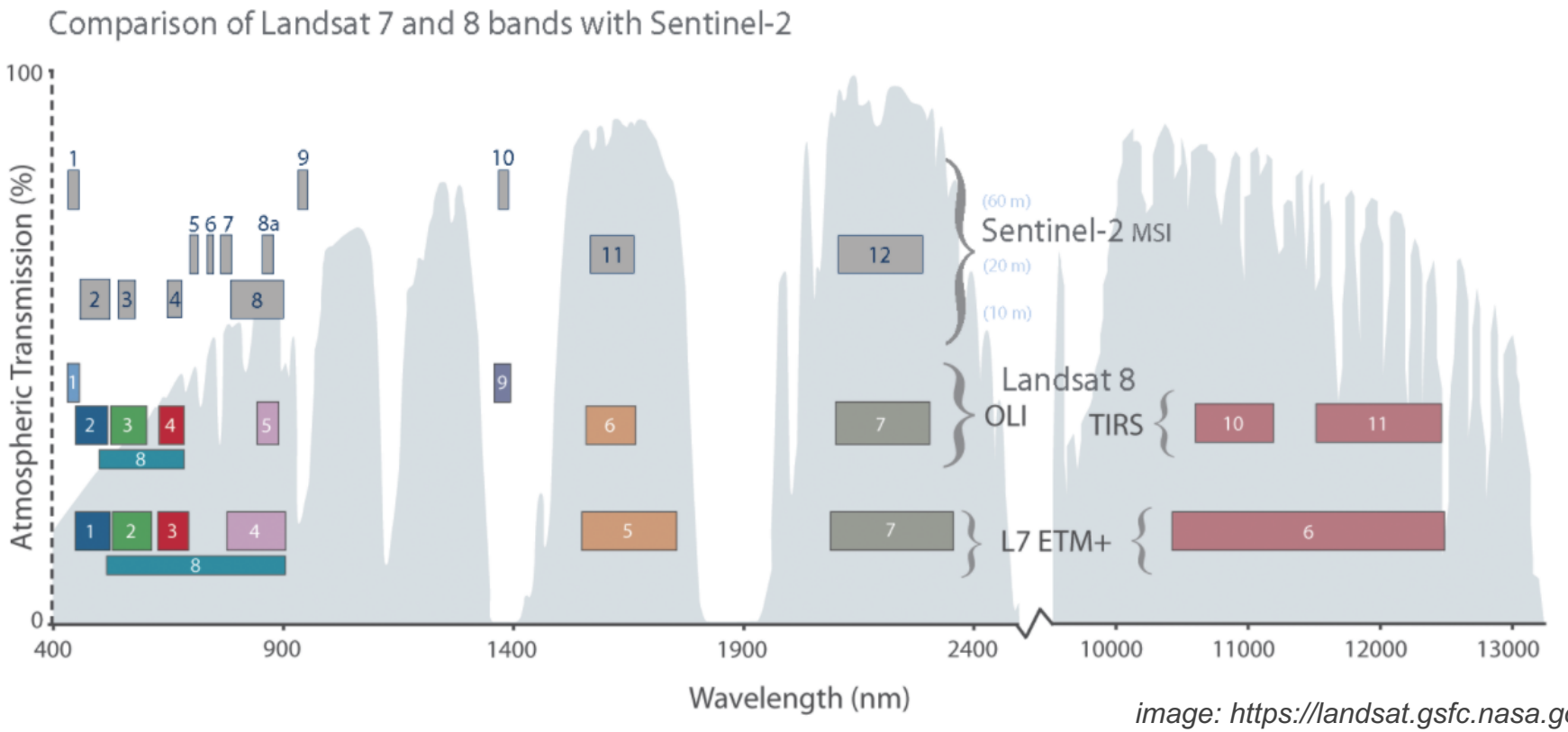


image: https://landsat.gsfc.nasa.gov

Expanding data availability

- New SAR/Radar options

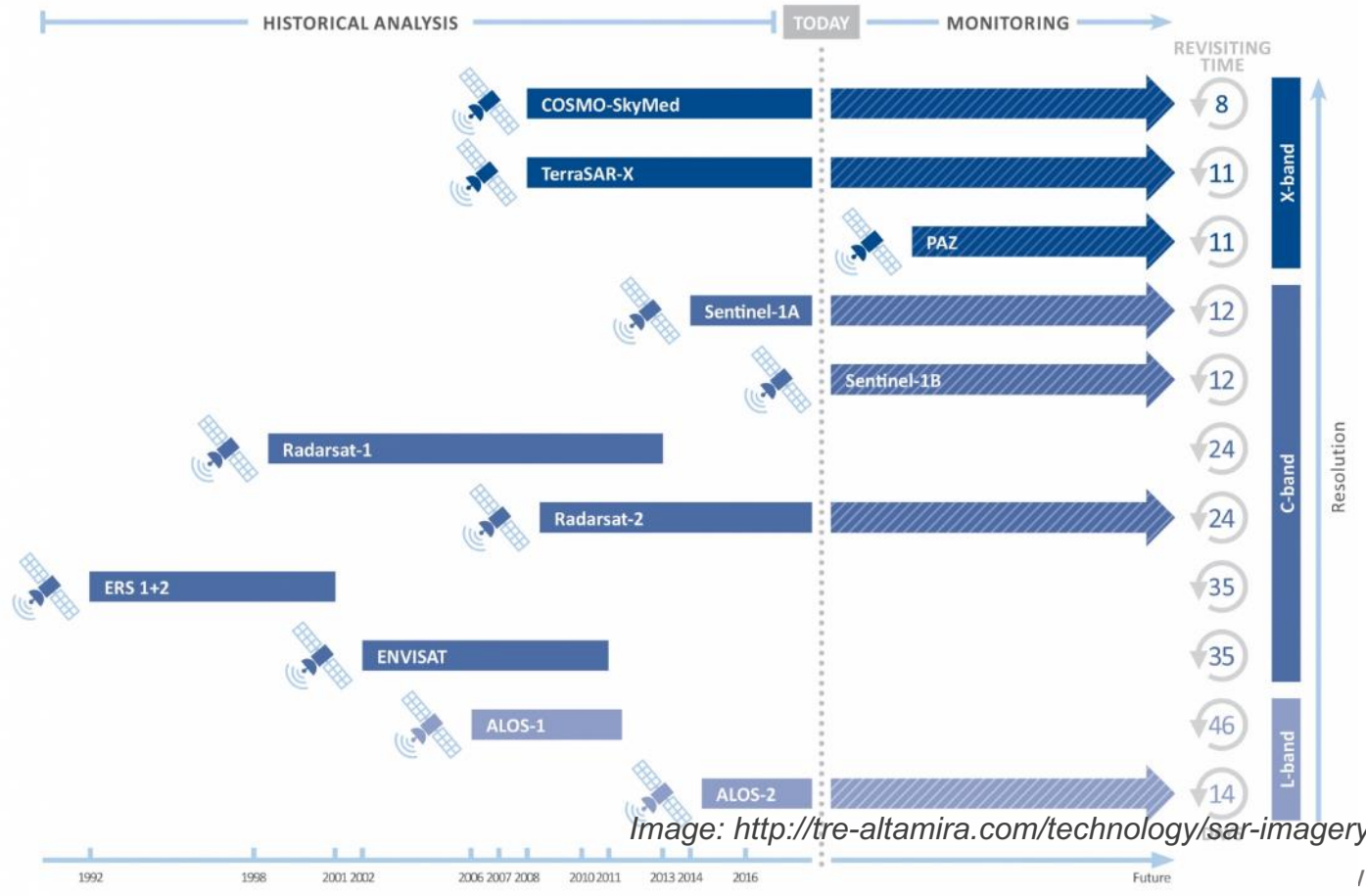


Image: http://tre-altamira.com/technology/sar-imagery/

Expanding data availability

- FireSat
- GPM - Global Precipitation Measurement
- GEDI; ADLAN (space-borne LiDAR)
- ECOSTRESS
- *Not to mention numerous new ultra-high resolution commercial optical platforms…*

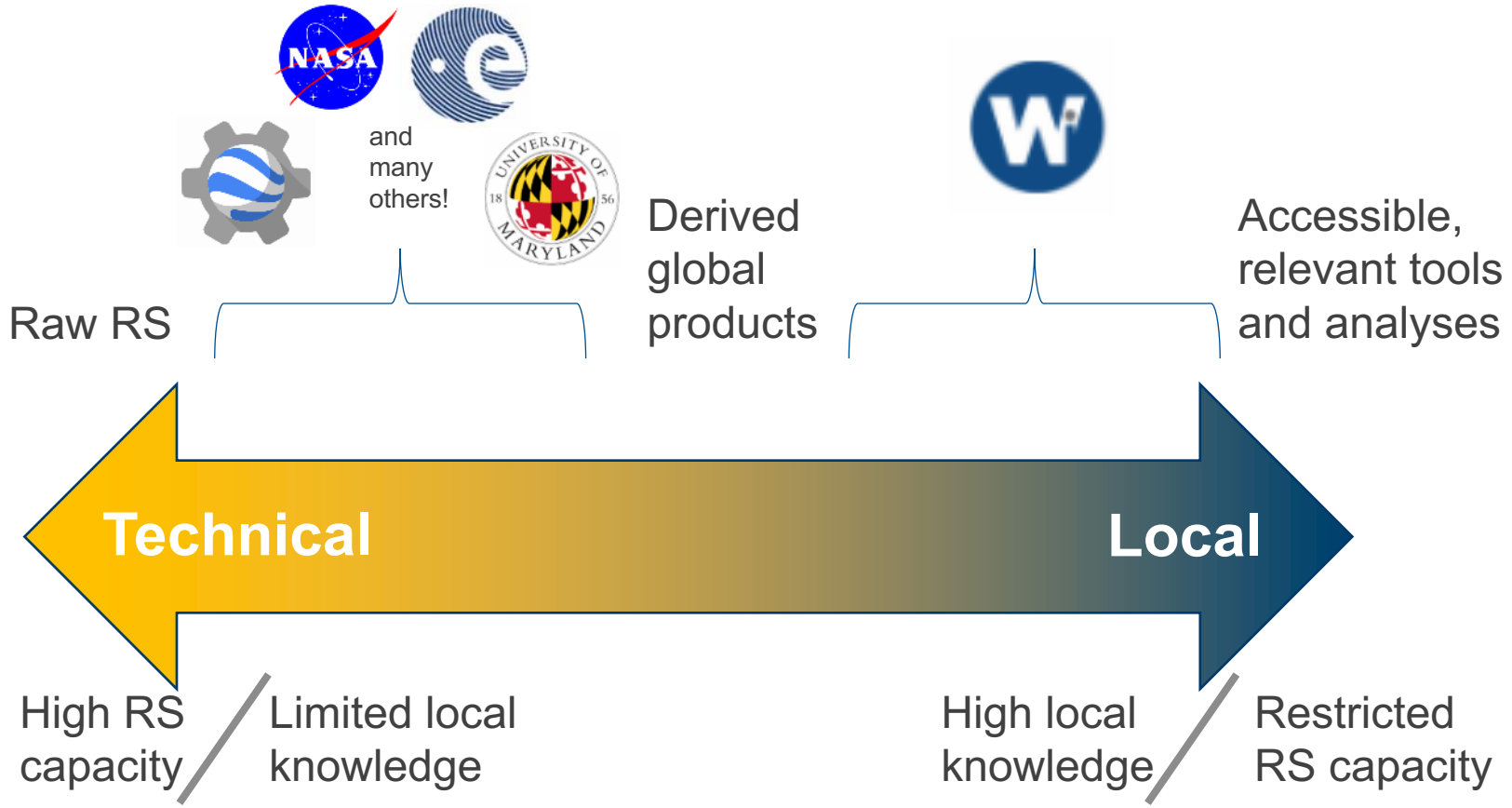
Developing country context

- Limited technical capacity
- Lack dedicated funding to projects – donor-driven priorities
- RS/GIS talent must stretch attention across multiple initiatives, departments
- Limited opportunities to update skills
- Analyst and QA/QC roles conflated to single position

Developing country needs for RS

- Focused assessments
  - Understand current “state of” the landscape
- Ongoing monitoring
  - Compare baselines to performance of initiatives
- What data characteristics are needed?
  - Repeatability and time series consistency
  - Relate to real land planning needs
  - Automated updating
  - Approaches accepted by scientific community
  - Comparability across jurisdictions, countries (wall to wall)

Bridging scientific and local knowledge for RS in development



Case Study: Cambodia

- Issues at play
  - High dependence on natural resources for basic subsistence (forest, fish, agriculture)
  - Lack of land use planning → degradation of natural resources → lower resilience
  - Poor government coordination and transparency

- Priority Needs
  - Reliable monitoring of natural resources over time to improve development and act as warning system
  - Credible estimates of past/future impact from land cover change
  - Provide development options and decision-support

Cambodia: what is the goal?

- **Harness** tools that can assess environmental degradation in an integrated and timely fashion
  - Quantification that can lead to valuation ($) is a primary barrier to:
  - Incorporating ecosystem services in land use planning
  - Valuation of Natural Capital for PES
  - Adaptive planning in a changing climate
- Tools that can link farm scale to the larger region (country, watershed, etc.)

Watershed Ecosystem Service Tool (WESTool)

- Online interactive map-based tool
- Estimates historical and potential future impacts of land use change on **ecosystem services** in Cambodia
- Informs decision-making on **land use**, **sustainable development** and **climate change adaptation**
- Based on objective, science-based datasets
- Highly accessible
- No-GIS skills needed
- No modeling skills needed

https://www.winrock.org/westool/

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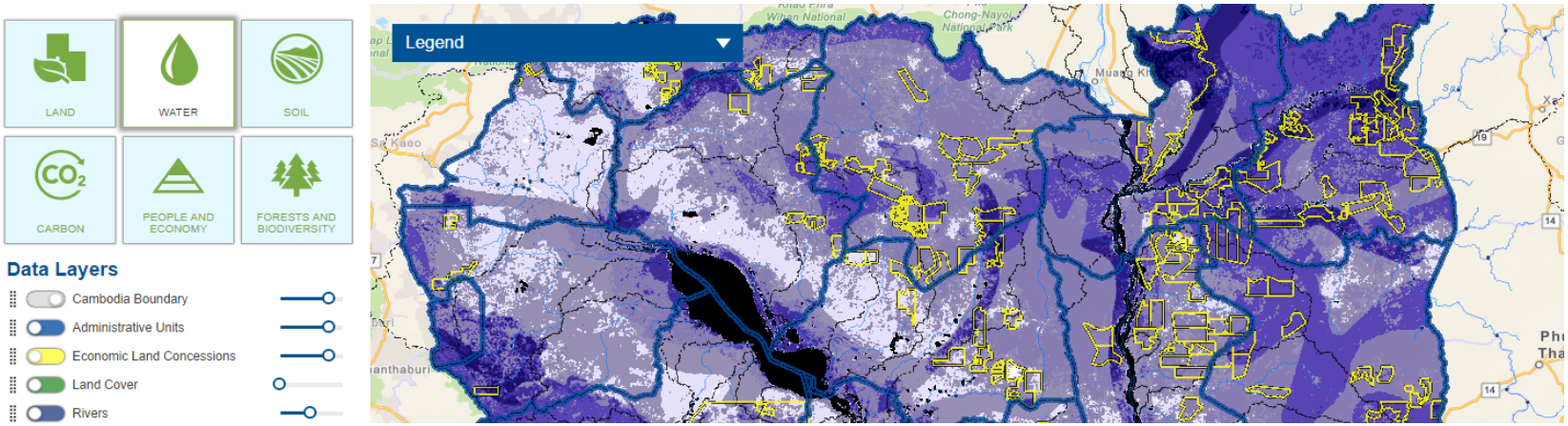
Audience

Who is the target audience for the tool?

- Cambodian gov. for initial environmental impact assessments
- Researchers reporters and NGOs interested in doing their own analysis
- Industries interested in assessing the impact that land use change could have on their business

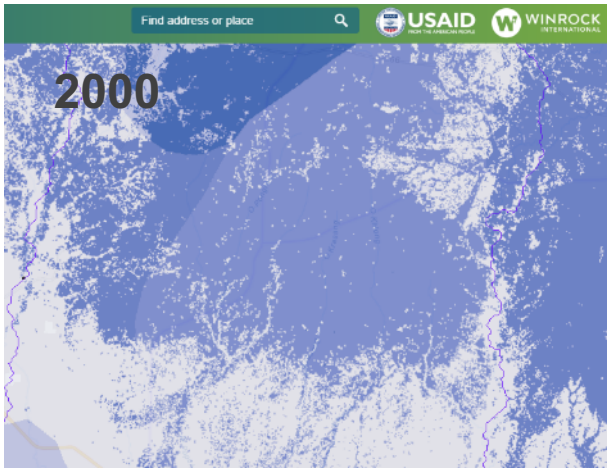
WESTool Capabilities

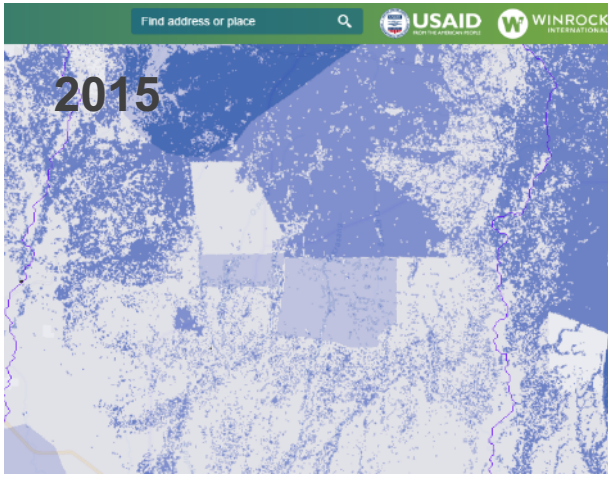
- Assess past and future impact on Ecosystem Services: Water – Soil – Carbon – Biodiversity
- Assess future Climate Change and areas vulnerable to Climate Change
- Provides information on population and economy

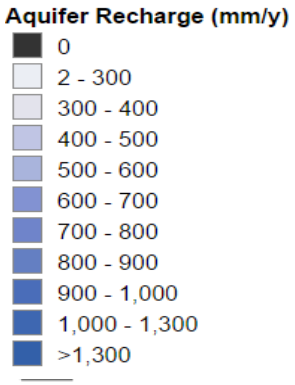


Water

- **Freshwater availability**
  - Forests regulate runoff to the river, pushing water into the ground to fill aquifers and slowly percolate across the landscape.
- **Regulation of flow**
  - Slower flow regulates floods during high rainfall and maintains water in the river and soil during the dry season.
- **Regulation of water quality**
  - Water that runs through the ground is filtered, trapping nutrients and pollutants in the soil and protecting surface water.

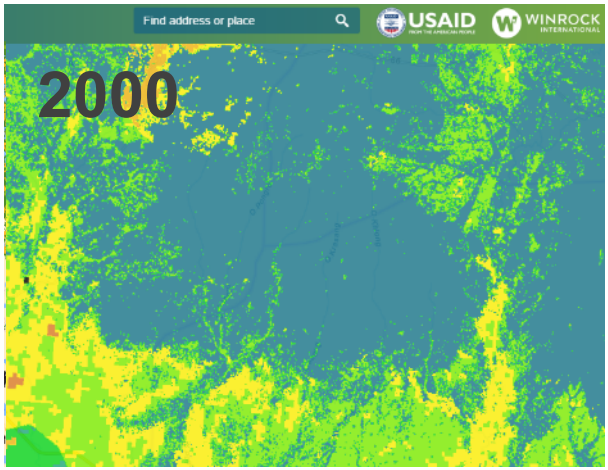


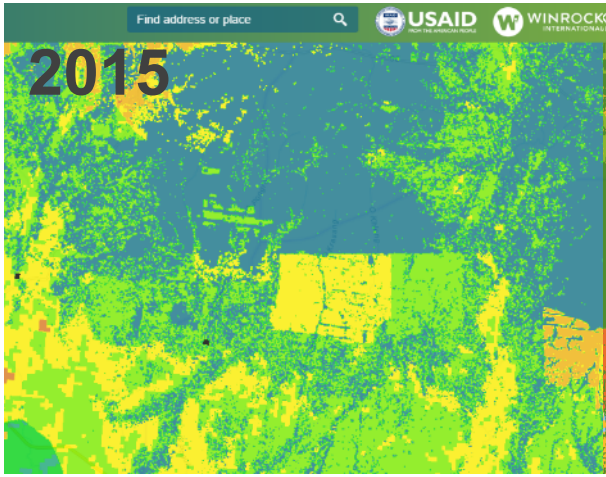




Soil and Nutrients

- When forests are converted the soil and is more prone to erosion.
  - agriculture,
  - plantation or
  - other development (roads mining urban areas)



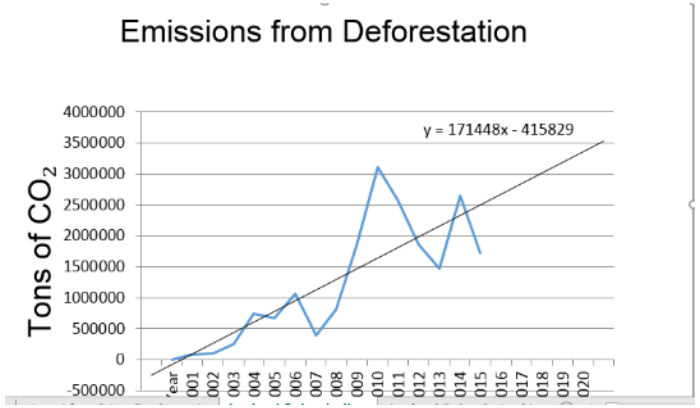


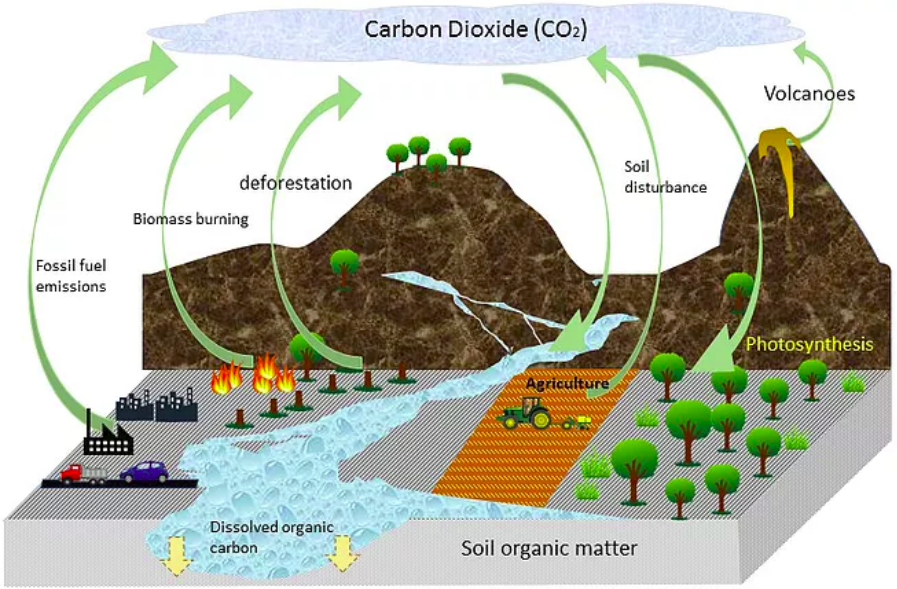
Sediment Loss (t/ha/y)

0
0.1 - 0.2
0.2 - 0.5
0.5 - 1
1 - 2
2.1 - 5
5 - 10
10 - 50
50 - 176.3

Carbon and GHG Emissions

- WESTool can be used for
  - GHG emission baseline for land use change
  - Assessing existing carbon stocks
  - Avoided GHG emission
  - Agricultural emissions





Climate Change Adaptation Features

- Projected Climate Change c.2046-2064

Percent change in rainfall c.2046-2064

High : 10% increase

Low : 30% decrease

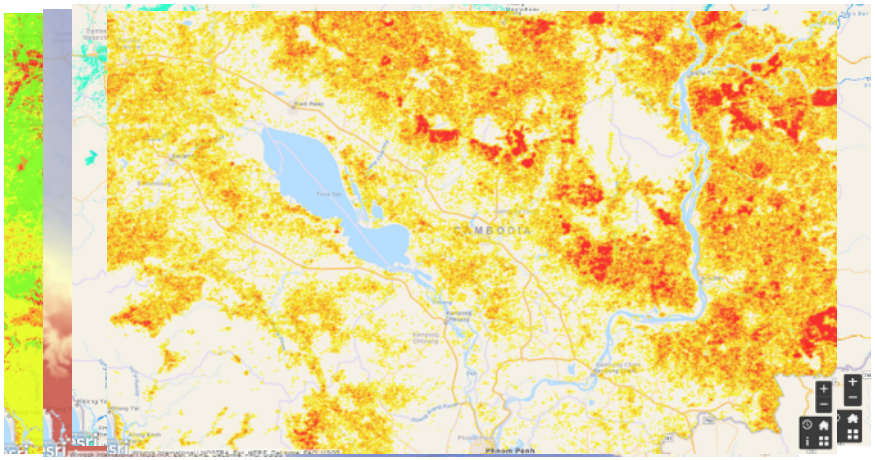
Percent change in temperature c.2046-2064

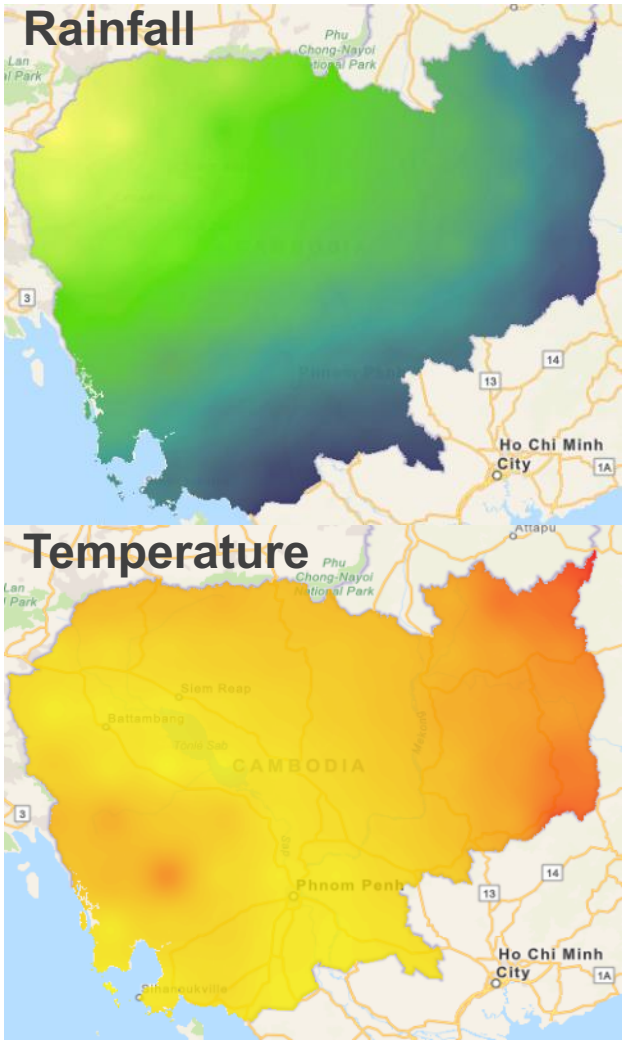
High : 9% increase

Low : 7% increase

- Estimated impacts of Climate Change

Overall vulnerability **Drought** **Flood** **Fire**





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What makes WESTool Unique?

- **Integrates assessment** of both ecosystem services and Climate Change
- **Farm-scale to country analysis** allowing for integrated planning anywhere in Cambodia
- **Online interactive interface**, accessible to all
- **Historical and potential future impacts** on ecosystem services and Climate Change
- **Offers analysis outputs in multiple formats**:
  - Online maps graphs and charts
  - Downloadable statistical tables, graphs, and charts (excel format)

Case Study: Malawi

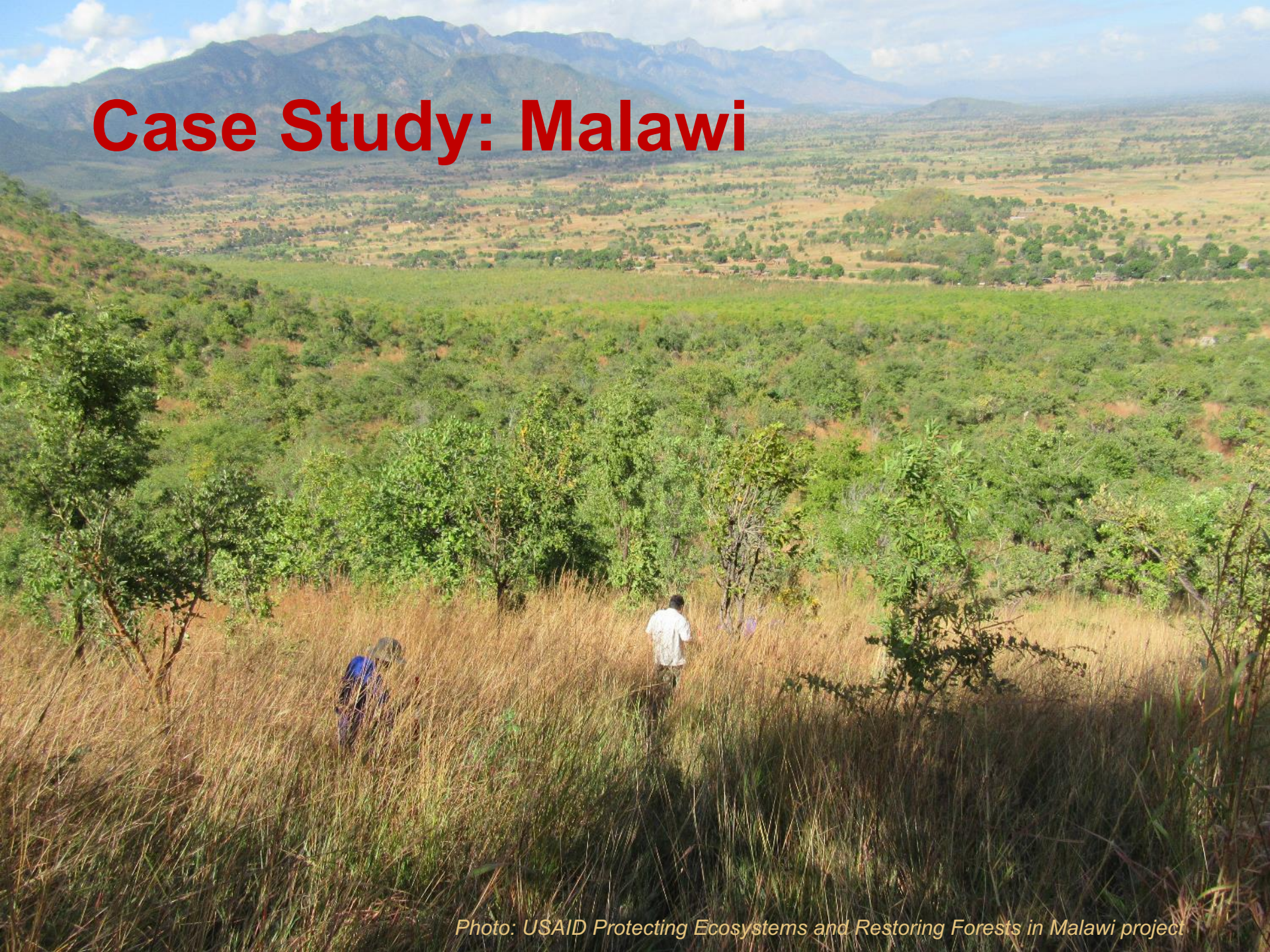


Photo: USAID Protecting Ecosystems and Restoring Forests in Malawi project

Case Study: Malawi

- Winrock supporting REDD+ RL development
- RL should be compatible with future NFMS that serves multiple needs

Self-Expressed national needs:

- Bonn challenge – 4.5m ha reforest by 2030
- NDC – increase forest cover by 2%
- NAMA
  - reduce from baseline 2.4% deforestation rate
  - A/R (~700,000 Gg tCO2e)

Case Study: Malawi – Institutional Challenges

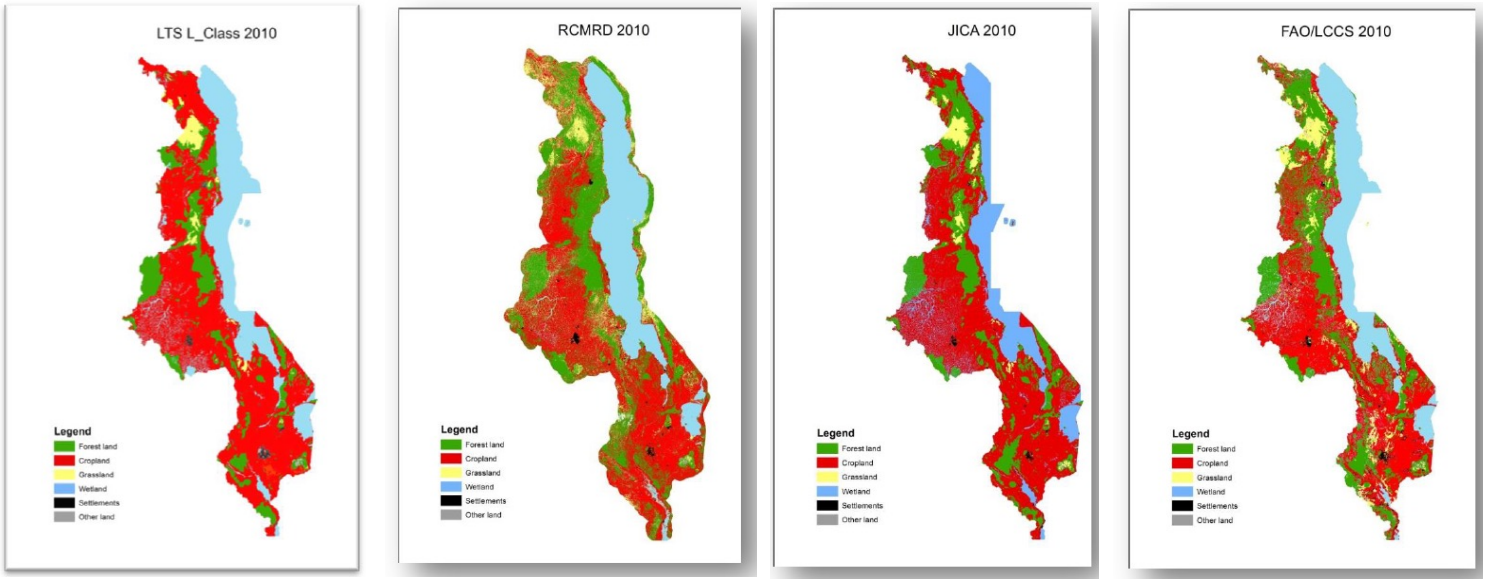
- Limited, overstretched local technical capacity
- Multiple intersecting national priorities
- Loss of continuity across donor funded initiatives

Case Study: Malawi

- Inconsistent approaches
- No planned continuity
- Available data are ‘pilots’

Table 1. Comparison of MMUs and forest cover for each mapping effort.

Mapping Effort	Forest Cover (% area)
FAO	28.7%
JICA	20.4%
LTSI/WB	18.2%
RCMRD	28.7%



Figures: USFS (2015) Malawi REDD+ Readiness Program: Final Report on Developing a Recommended Suite of Land Use/Land Cover Standards for the Government of Malawi

Malawi - Technical RS Challenges

- Smallholder driven land cover change
- Dry forest / savannah less studied from RS
- Shifting Cultivation confused with land cover change
- Widespread small-scale AR cannot be attributed to drivers

Challenging enough for world-class scientists. Result in extreme uncertainty in LCC

Malawi - Winrock lessons learned

- Must move past pilot RS analyses
- Lack of consistency and institutional sustainability much greater threat to NFMS/MRV than finding the ‘perfect’ algorithm
- Simplified, automated, web-based and externally audited workflows needed
- Avoid local data storage – never ‘touch the ground’

Malawi – Working towards a sustainable RS-based forest monitoring system

- Rely exclusively on existing global, stable, multi-decadal data products
- May require international community to ‘stitch together’ missions, past current and future.
- Need focus on tropical dry forests – an underserved biome

Case Study: Ghana

Ecosystem services awareness

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USAID-Ghana AgNRM

- Northern Ghana—savannah region, rural
- Landscape focus—link ecosystem services (ES) with value chains (shea, dawadawa etc.)

- Steady land degradation—shifting cultivation
- Need to protect ecosystem services

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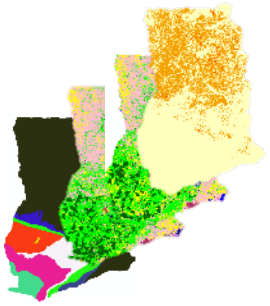
USAID-Ghana AgNRM

- Remote sensing/mapping needed to understand changes in ES- LUC, water balance, biodiversity

- Translate science → COMMUNITY decision support:
  - Land use planning needed
  - No internet/computers
  - High local knowledge of weather, ecosystem

USAID-Ghana AgNRM

Satellite images



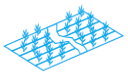
GIS layers

SWAT Soil & Water Assessment Tool

- Hydrological modeling
- Carbon analysis

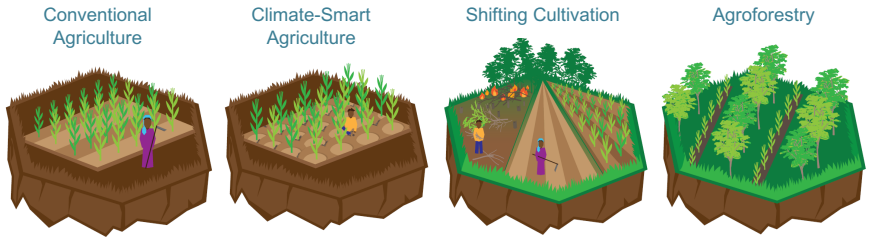
SURFACE WATER RUNOFF MITIGATION

NUTRIENT RUNOFF MITIGATION

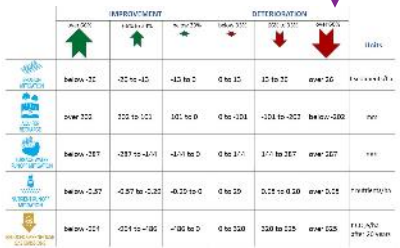


EROSION MITIGATION

AQUIFER RECHARGE



Analysis by ES, land use



Decision support tool

ECO games

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Ghana-lessons learned

- Mapping products important even at community level
- Translation of remote sensing conclusions has additional challenges at local level
- Need for integrated/interdisciplinary approaches

Winrock's Global-scale tools

- REDD+ Decision Support Tool
  - Allows countries to prioritize the scope and elements of REDD+ program
  - User-driven priorities drive rapid assessment of priorities for emissions reduction
- AFOLU Carbon Calculator
  - Determine baseline and hypothetical project emissions scenarios for AFOLU interventions in USAID projects

HOW TO ESTIMATE HOW USAID AGRICULTURE AND FORESTRY PROJECTS IMPACT THE CLIMATE?

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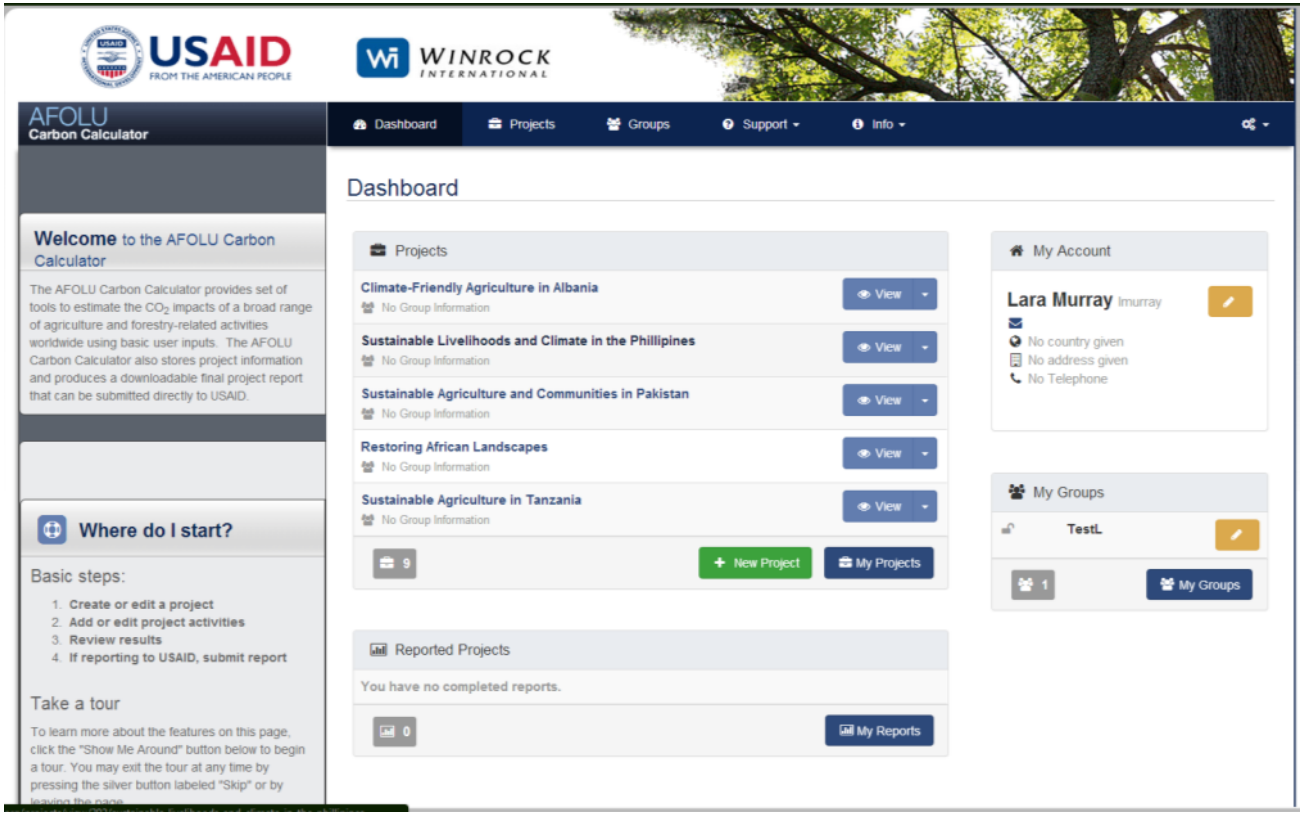
THE AFOLU C CALCULATOR ALLOWS ESTIMATION OF THE CLIMATE IMPACTS

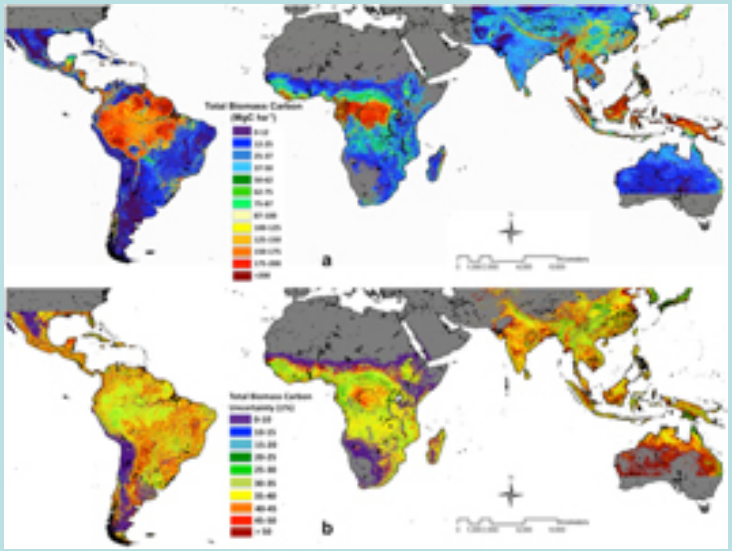
www.afolucarbon.org

- Free!
- Publicly available
- Online, easy-to-use platform
- Inputs can be saved and stored
- Transparent, scientifically sound methods and data sources



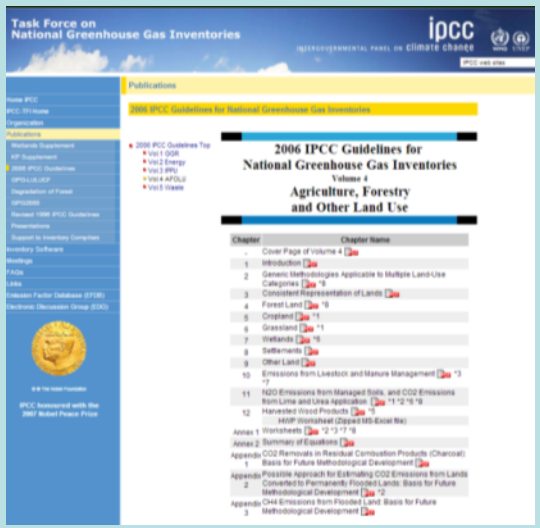
DEFAULT DATABASE

Global datasets



- Deforestation rates: Hansen et al. 2013. High-Resolution Global Maps of 21st Century Forest Cover Change. *Science*.
- Biomass: Saatchi, S.S. In preparation. Unpublished dataset.

IPCC Defaults & FAO data



- Intergovernmental Panel on Climate Change Tier 1 default data

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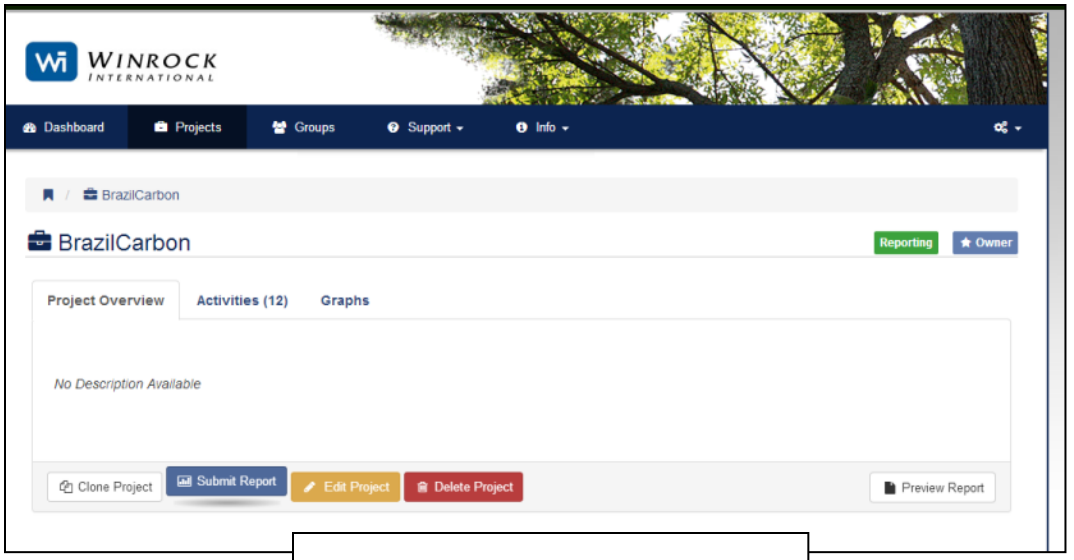
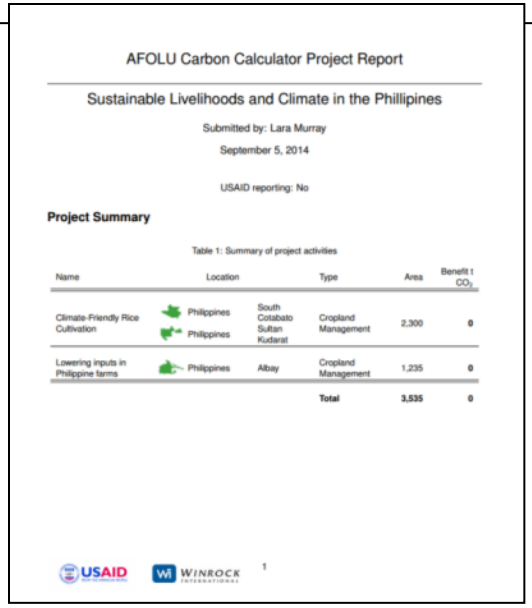
AFOLU C CALCULATOR RESULTS - REPORTING

- Downloadable, printable project reports can be generated as a PDF
- Can submit project results directly to USAID
- Data saved in calculator, making for reporting over many years easier and more consistent




AFOLU Carbon Calculator Project Report

Sustainable Livelihoods and Climate in the Phillipines

Submitted by: Lara Murray

September 5, 2014

USAID reporting: No

Project Summary

Table 1: Summary of project activities

Name	Location		Type	Area	Benefit t CO_2
Climate-Friendly Rice Cultivation	Philippines Philippines	South Cotabato Sultan Kudarat	Cropland Management	2,300	0
Lowering inputs in Philippine farms	Philippines	Albay	Cropland Management	1,235	0
			Total	3,535	0

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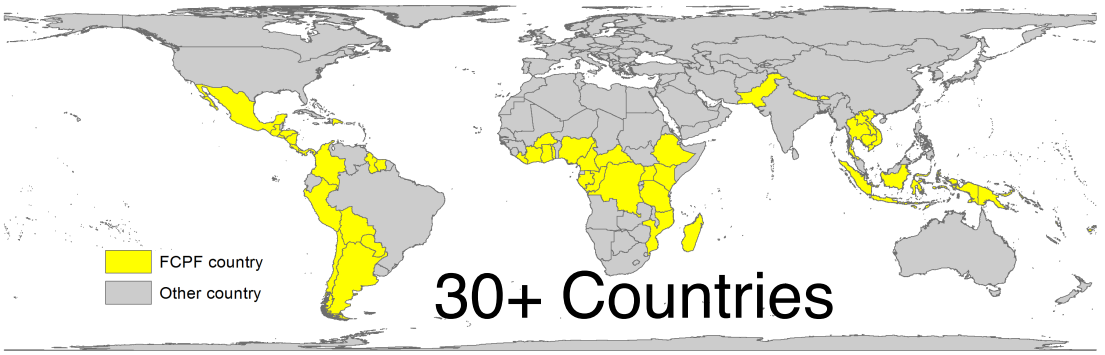
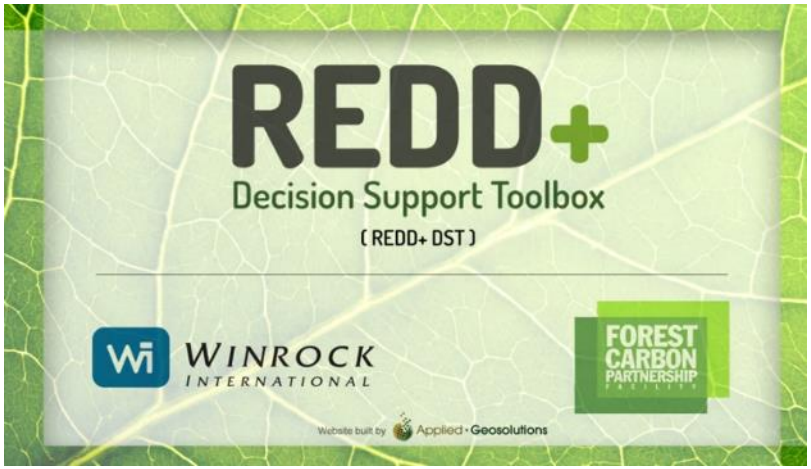
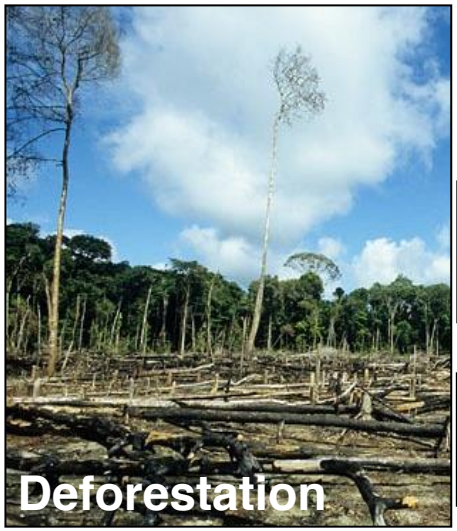
REDD+ Decision Support Toolbox

Developed to help countries explore REDD+ program development.



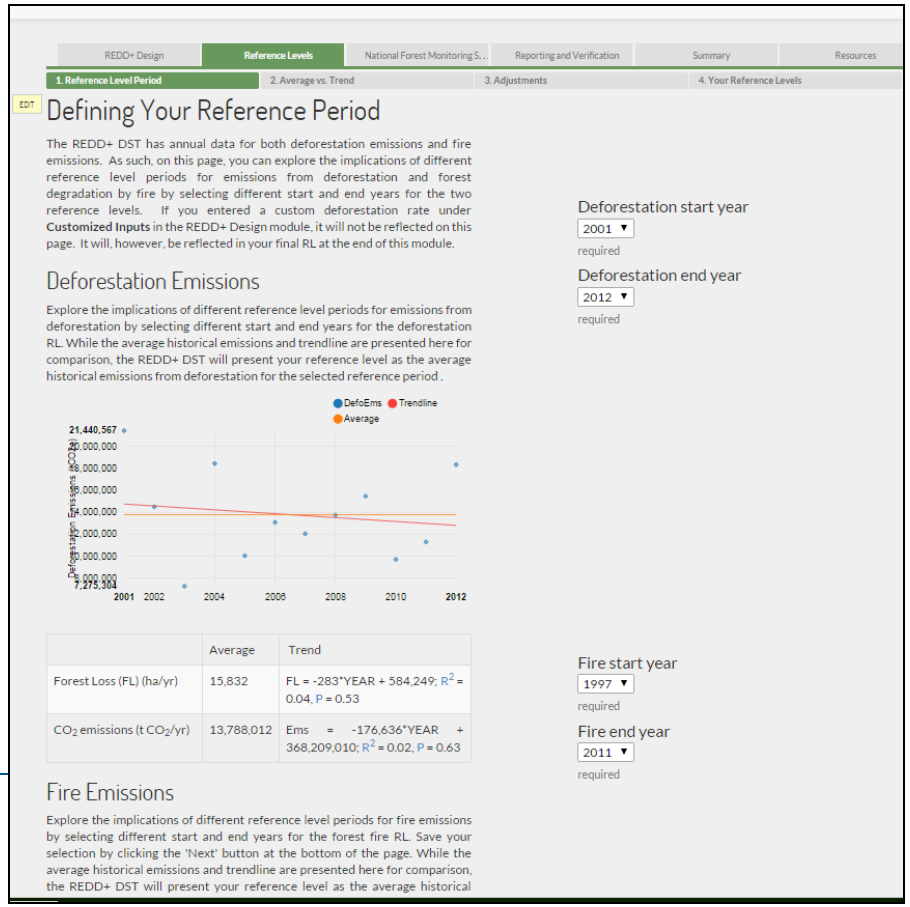




www.forestcarbonpartnership.org/dst

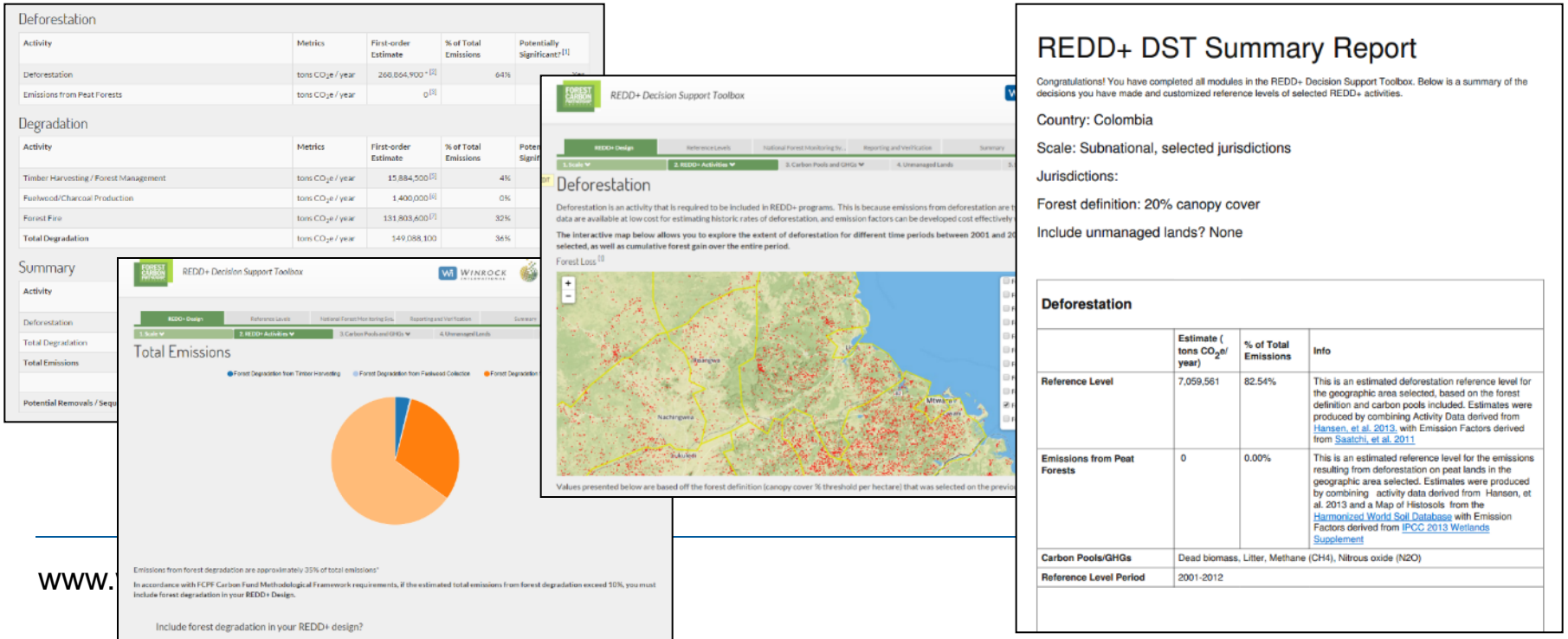
REDD+ Decision Support Toolbox

Interactive features to explore the impacts of decisions



REDD+ Decision Support Toolbox

Helps informed decision-making by indicating where the greatest opportunities for emission reductions are



www.

Review - challenges

- Data diversity and volume is accelerating
- Attention spans are decreasing – more 'non-GIS' users expect to visualize, interact with, ask questions of data.
- Users in many countries lack capacity to appropriately act on RS data in a timely manner
- Developed-world based Researchers often do not have a window into how products are used 'on the ground' of development

Development Community's Role

- Long term, **stable relationships** needed between data producers and users are key
- Int. Development community, including Winrock, understand the **context** that drives decision making in countries
- Challenge for countries isn't just technical capacity, it's **bandwidth and continuity**. Int. NGOs can bridge this gap.
- **Curated products & tools** that can be jointly managed by researchers and country reps. are the way forward.
- If you package RS data and analysis in attractive way, it can be adopted without need to mandate via law or policy

THANK YOU

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