

# SERVIR

Connecting Space to Village

Rebekke Muench, Foster Mensah, Robinson Mugo, & Kenneth Mubea  
SERVIR Global



SERVIR connects space to village by helping developing countries use satellite data to address critical challenges in food security, water resources, weather and climate, land use, and natural disasters. A partnership of NASA, USAID, and leading technical organizations, SERVIR develops innovative solutions to improve livelihoods and foster self-reliance in Asia, Africa, and the Americas.

Prevent seafood poisoning by mapping harmful microalgae

Help herders & farmers by detecting ephemeral water bodies

TBD

Support food security by monitoring agricultural drought

Protect lives by monitoring & forecasting intense thunderstorms

Conserve forests by mapping land cover & land use change

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USAID FROM THE AMERICAN PEOPLE NASA

adpc ICIMOD

RCMRD

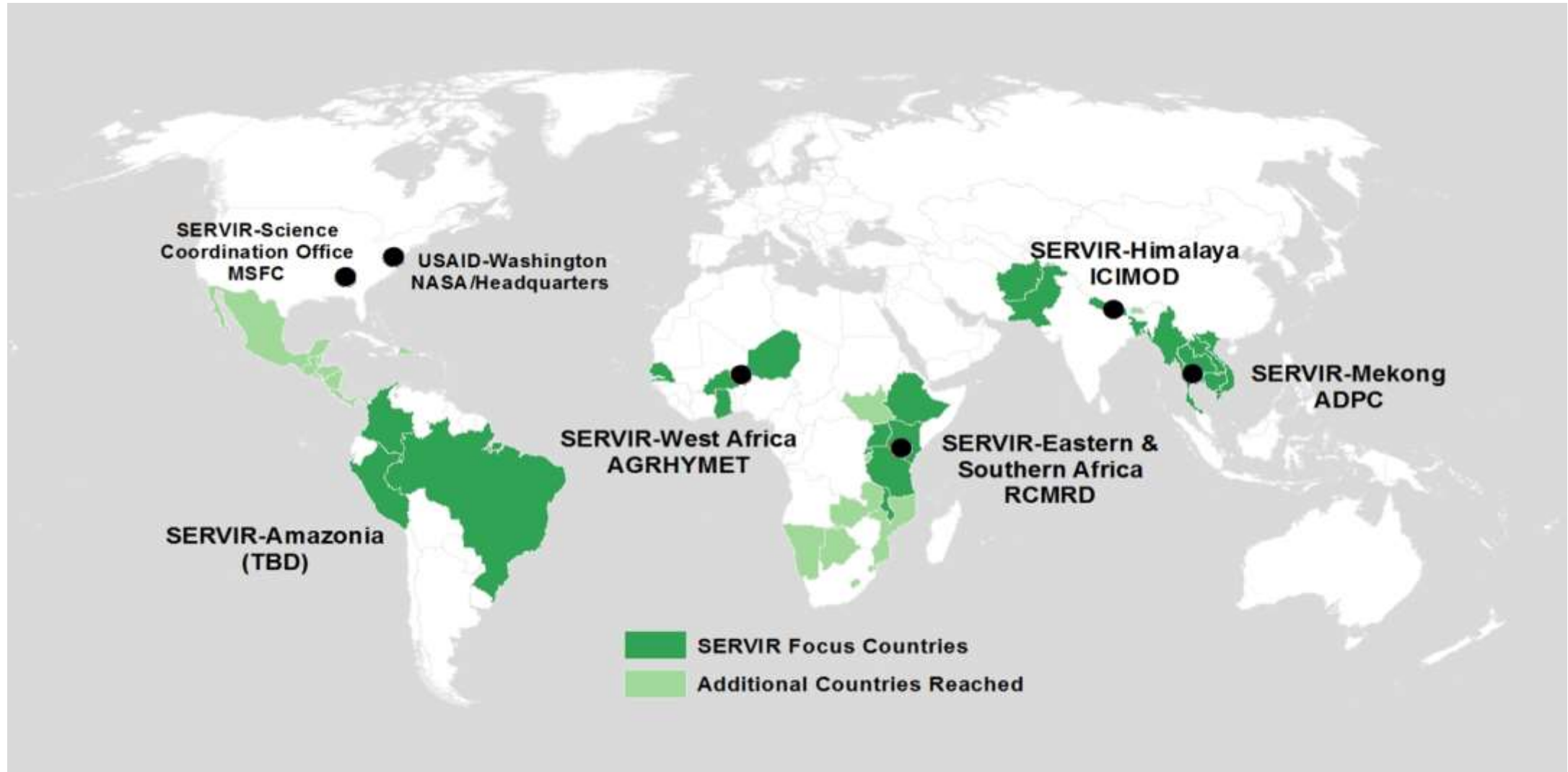


# NASA Constellation of Satellites



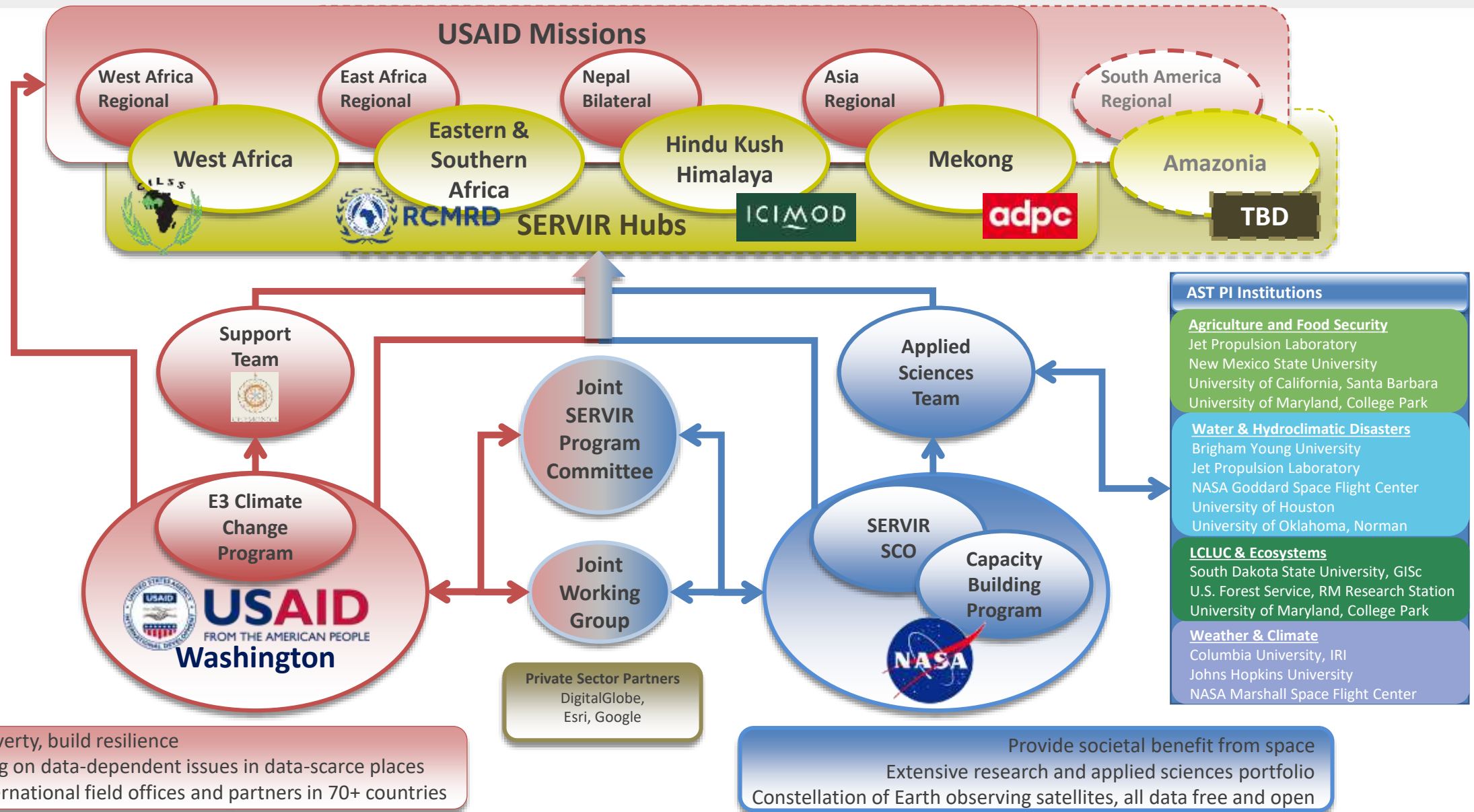
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# The SERVIR Hub Network

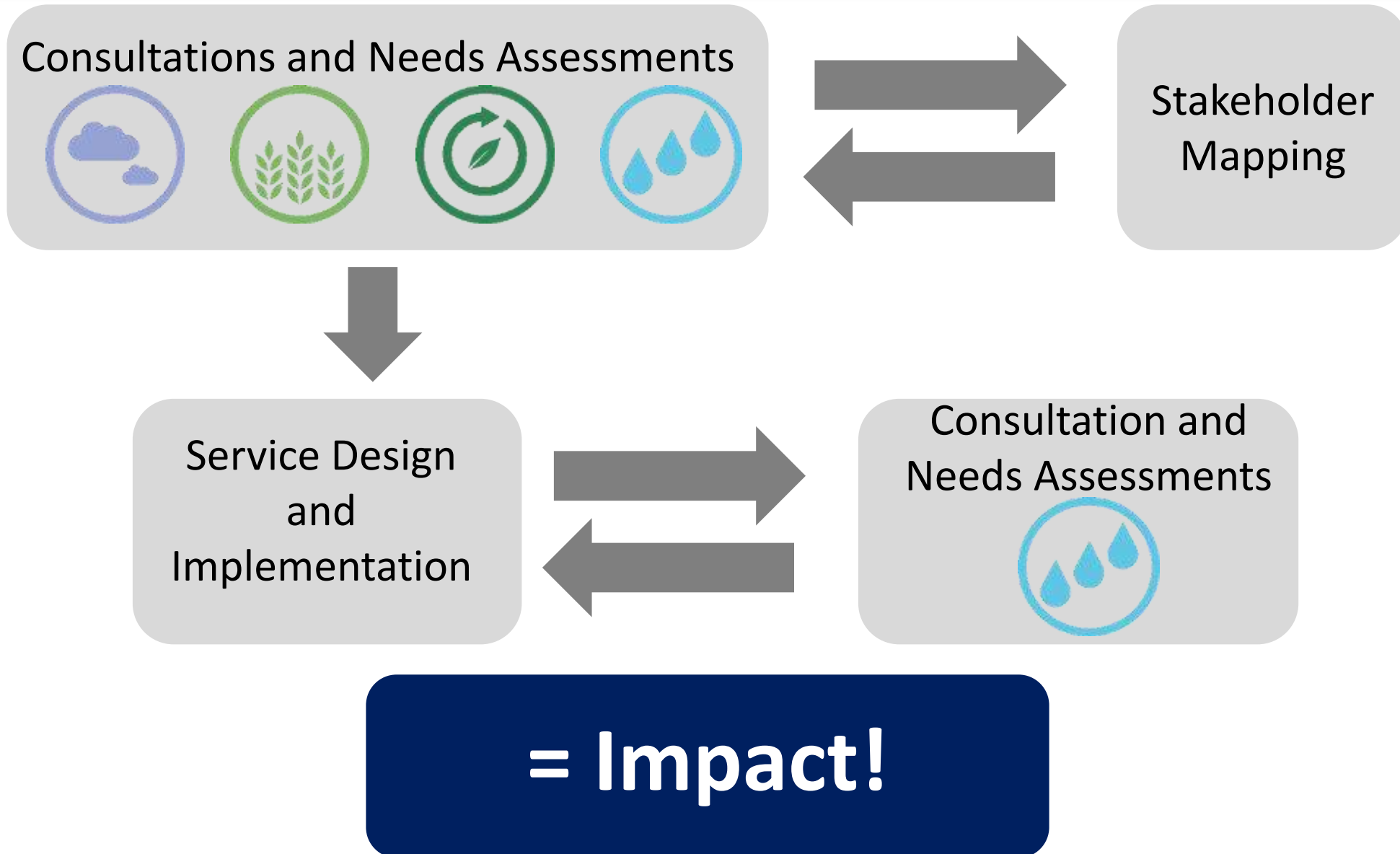


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# SERVIR's integrated global structure



# The Service Planning Approach





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# SERVIR WEST AFRICA

Foster Mensah

Centre for Remote Sensing and Geographic Information Services (CERSGIS)  
University of Ghana



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# The SERVIR West Africa Consortium

Regional and national organizations led by the AGRHYMET Regional Centre

- Centre for Remote Sensing and Geographic Information Services (CERSGIS)
- Centre de Suivi Ecologique (CSE)
- African Regional Institute for Geospatial Information and Technology (AFRIGIST)
- African Centre of Meteorological Applications for Development (ACMAD)
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

## WITH SUPPORT FROM

- National Aeronautics and Space Administration (NASA)
- Applied Sciences Team (AST)
- SERVIR Support Team – supporting exchanges and learning between hubs

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# The SERVIR Program

- A science and data driven technology program designed to improve decision making through the application of geospatial science and remote sensing
- Central aspect of this effort will focus on demand-driven product and service development
- Interactive process with a clear understanding of the problem and decision context
- Building upon existing capacity and products that are potentially available

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# Stakeholder-focused services

- Enhancing ephemeral water body management in the Ferlo ecological region of Senegal
- Use of satellite imagery and remote sensing data for improved forecasting and response to potential locust outbreaks in the Sahel
- Charcoal Production Site Monitoring in the West Gonja Districts of Ghana
- Monitoring illegal mining activities in Ghana using remote sensing technology
- Forest Degradation Monitoring in the high forest zone of Ghana

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# Ferlo Ephemeral Water Body Monitoring

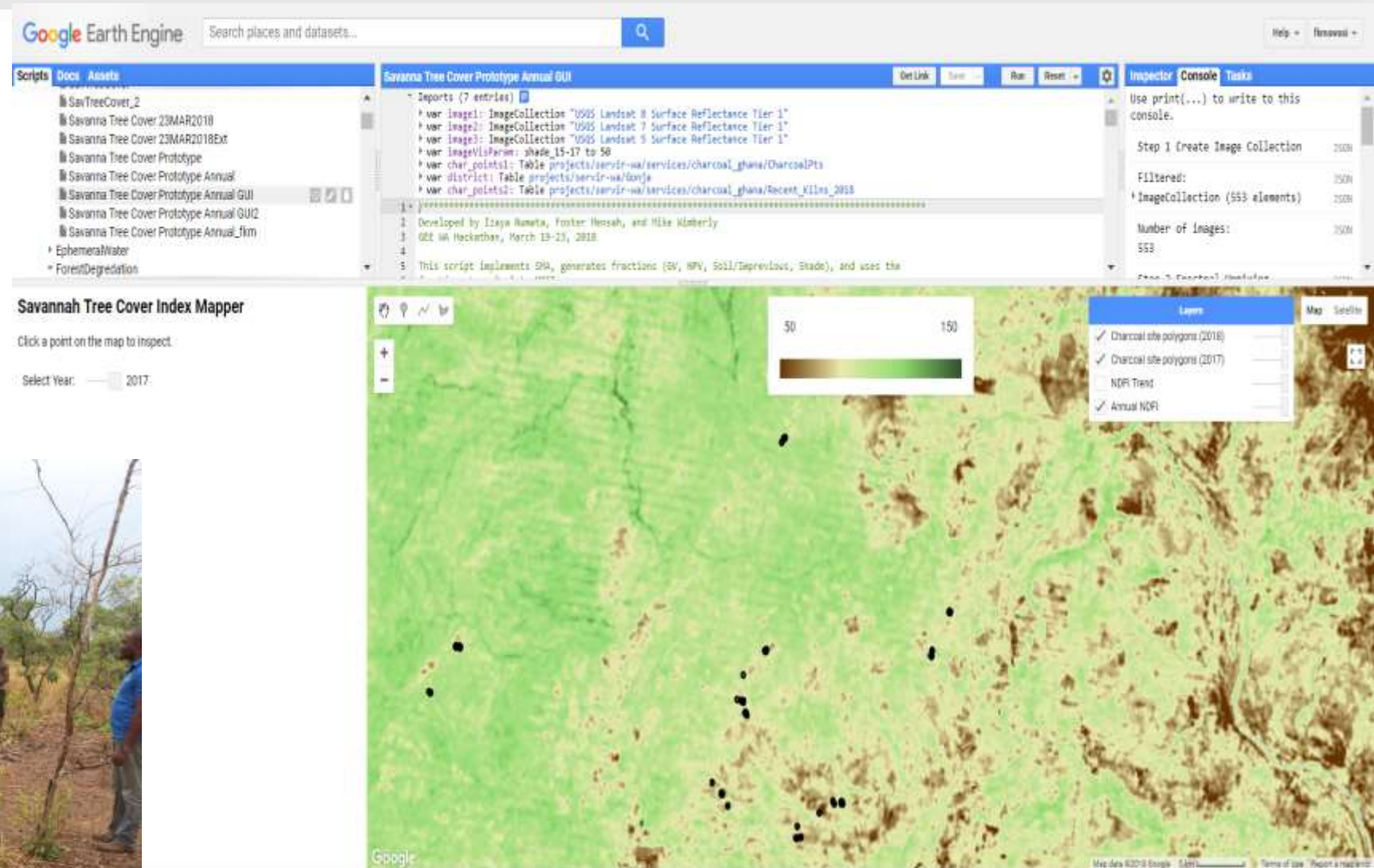


<https://tethys.servirglobal.net/apps/waterwatch/>

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# Charcoal Production Site Monitoring



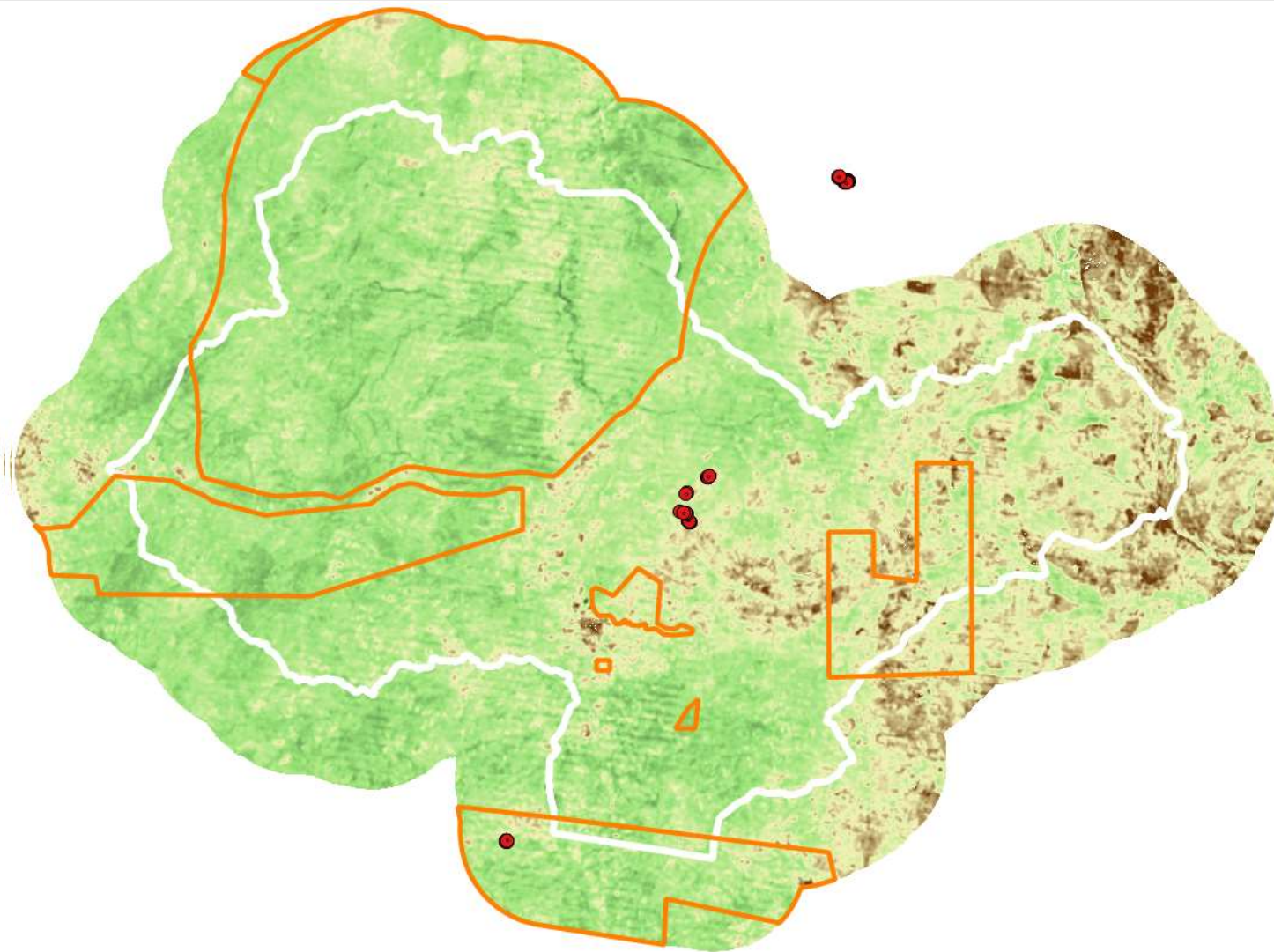
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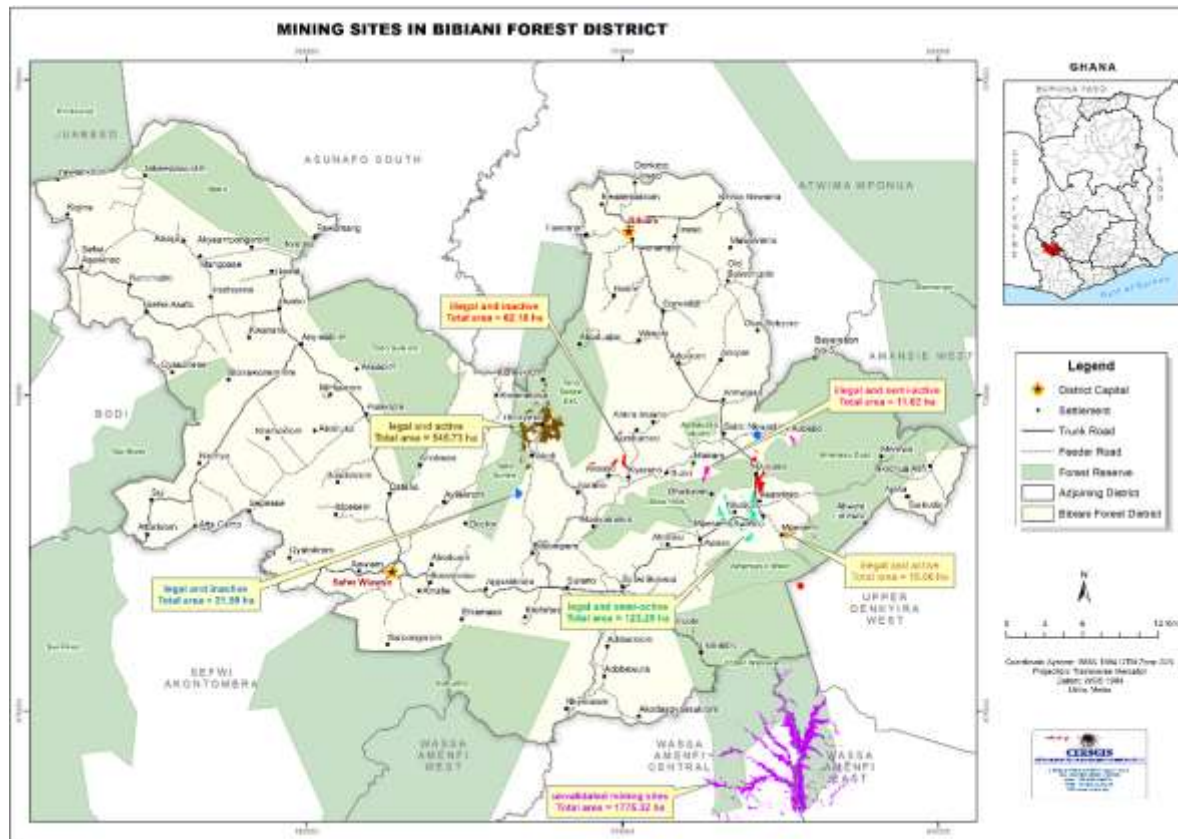
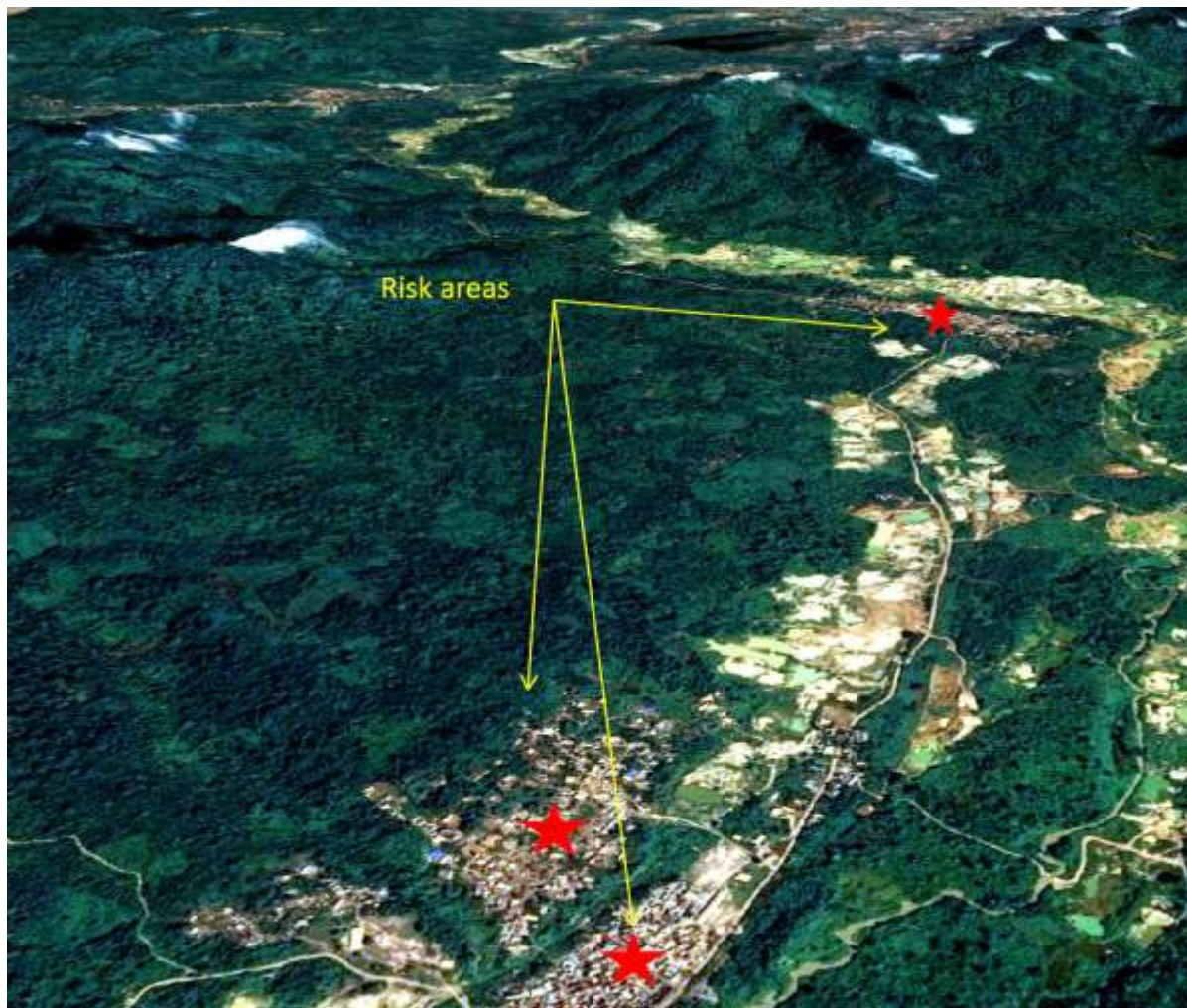


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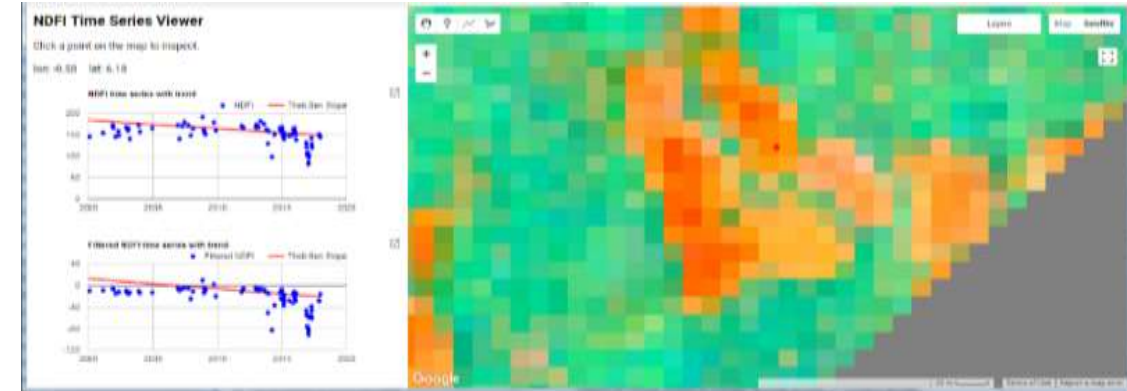
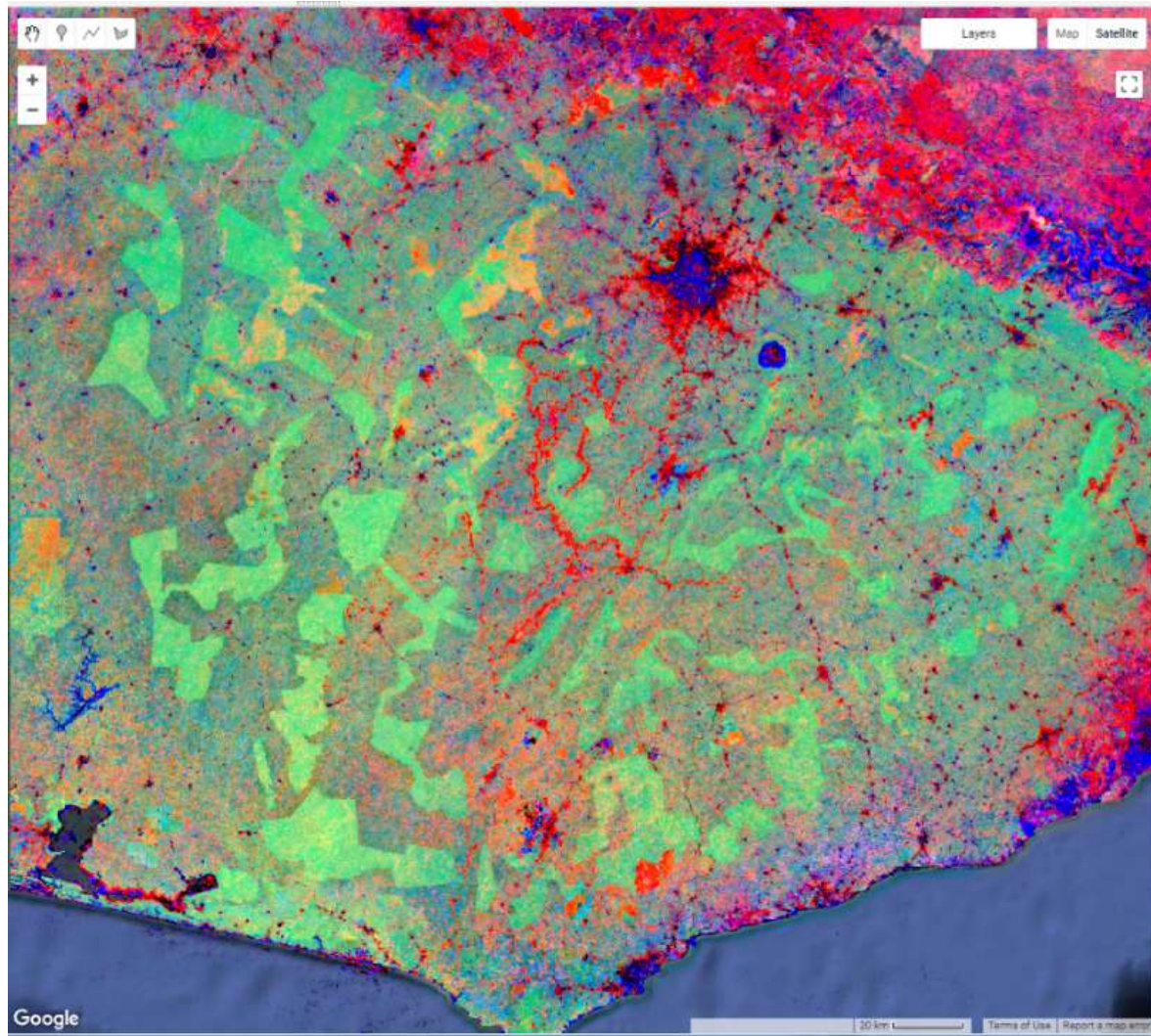
# Illegal mining monitoring application



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# Forest degradation mapping application



Declining Forest Index values exhibit large disturbance anomalies near a forest reserve boundary



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# Opportunities

- Improved access to data
- Advanced training in remote sensing and capacity building
- Institutional coordination and networking
- Improved evidence-based decision making
- Training in geospatial product and service development
- Technical backstopping

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# Key Stakeholders

- Public Institutions
- Private Sector Organization
- Non-Governmental Organizations
- Development Partners
- Research Institutions
- Professional Bodies

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**REGIONAL CENTRE FOR MAPPING  
OF RESOURCES FOR DEVELOPMENT**

*Our Vision*  
*To be a premier Centre of Excellence in provision of  
Geo-Information services*

*Our Mission*  
*To promote sustainable development through generation,  
application & dissemination of Geo-Information and allied  
ICT services and products in the  
Member States & beyond*

Contracting  
Member States

Non-Contracting  
Member States

 Botswana  Burundi  Comoros  Ethiopia  Kenya  Lesotho  Malawi  Mauritius  Namibia  Rwanda  Seychelles  Somalia  South Africa  South Sudan  Sudan  Swaziland  Tanzania  Uganda  Zambia  Zimbabwe



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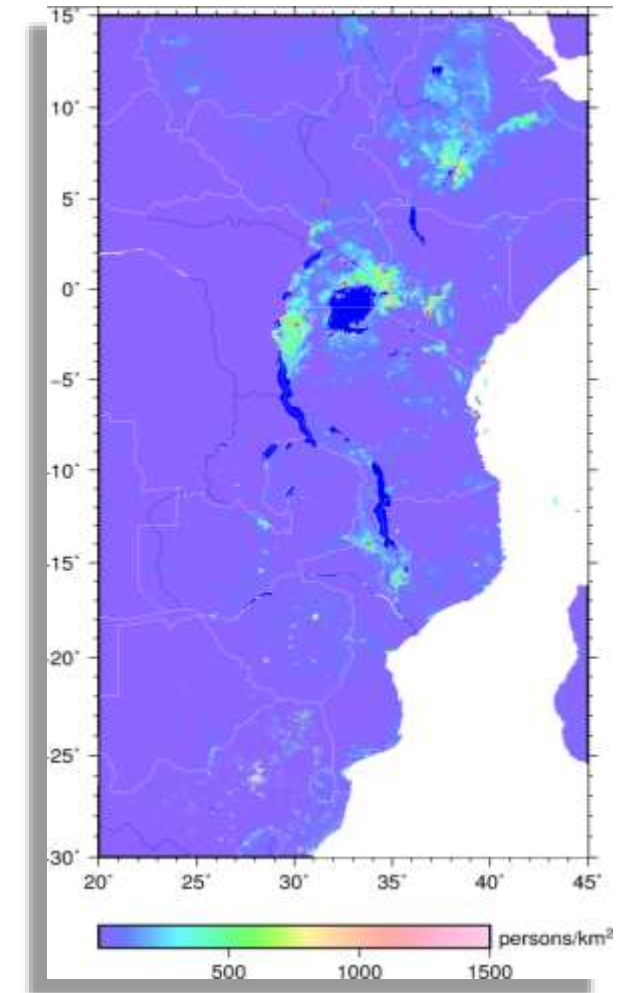


# The Complexity of Modern Day Decision Making

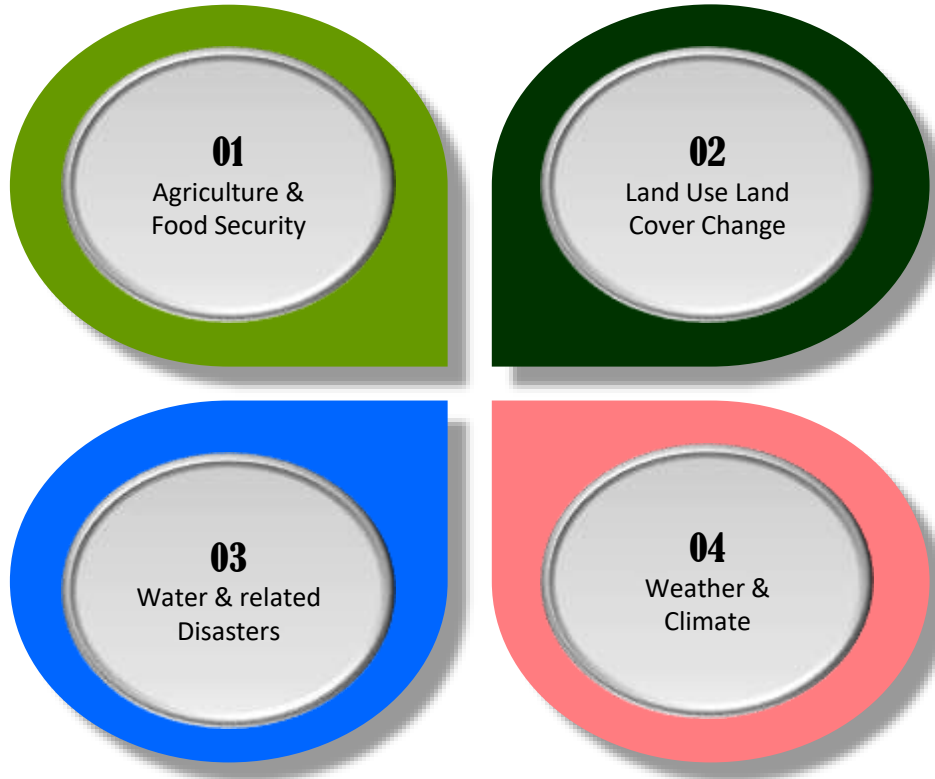
*"I am a firm believer in the people. If given the truth, they can be depended upon to meet any national crisis. The great point is to bring them the real facts."* Abraham Lincoln

## Population & Demand for Services

- Population ~ 400 M
- About 5% of globe
- Distribution: 25% is urban
- Median age: 18.1 years
- Projection 2050: 870M (9.2% of global)



# Services



## Food security

- Agricultural monitoring
- Drought management
- Crop productivity
- Rangeland decision support
- Aquaculture decision support

## Water resources and disasters

- Water resources monitoring and forecasting
- Flood management
- Hazard monitoring and forecasting
- Fire monitoring
- Water quality monitoring

## Weather and climate



- Weather monitoring and forecasting
- Climate modeling and scenario planning
- Air quality monitoring
- Adaptation planning

## Land cover/land use and ecosystems

- Land cover/land use change mapping
- Ecosystem management
- REDD+ decision support
- Land use decision support
- Low emission development planning



## Agriculture & Food Security

-  Agricultural Cropmask – Kenya
-  Monitoring Crop Conditions & Early Warning

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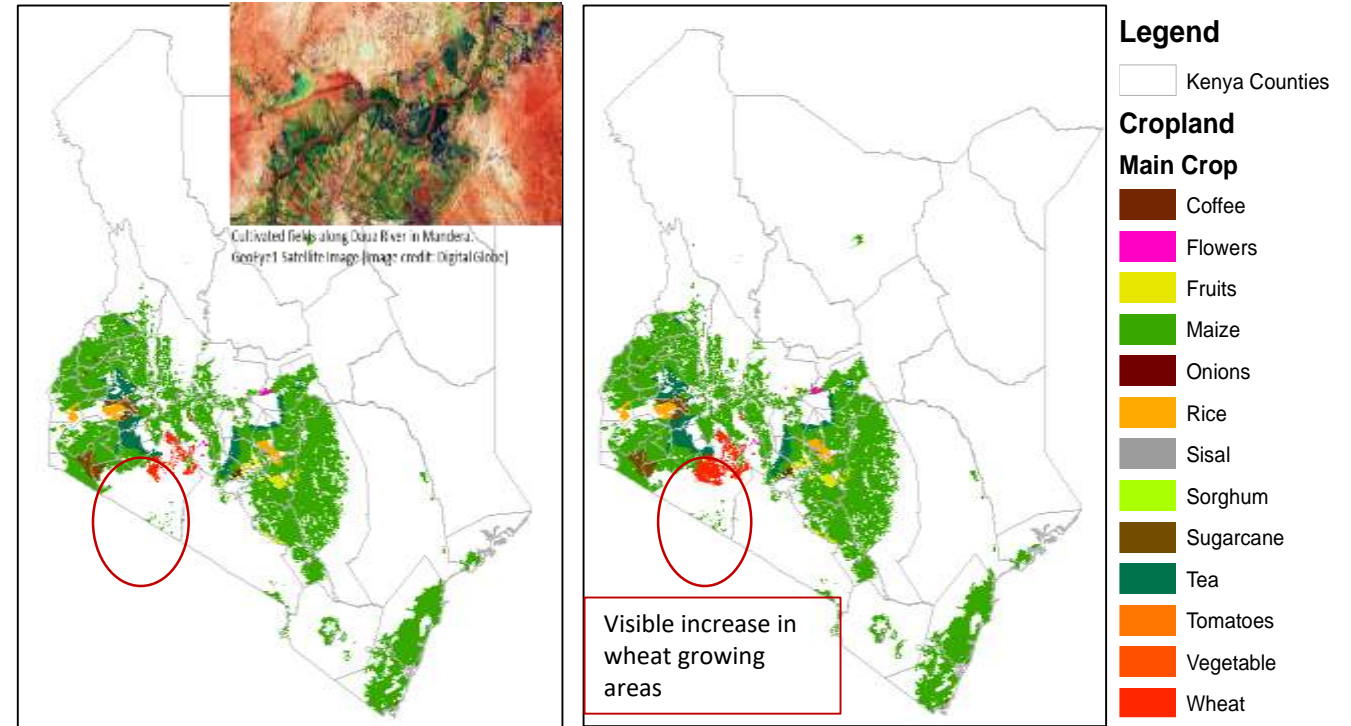
# Agricultural Crop Mask Mapping for Kenya

## Goal:

- Develop cropland maps depicting cropland extent, major and other crops and system used(rain-fed/irrigated) and change maps.

## Impact:

- Used to compute National level Agric. statistics for SDA (Area under Agric, Area under specific crops).
- Input to FEWSNET crop modelling(GEOWRSI) , feeds into crop monitors and as an Input to the sampling frame.
- Further engagements for support of national assessments by SDA, KNBS.



**Wall to wall cropland maps for 2000-2015**

## **Change Between 2000 and 2015**

- Total change:** 5394km<sup>2</sup> of land converted to cropland

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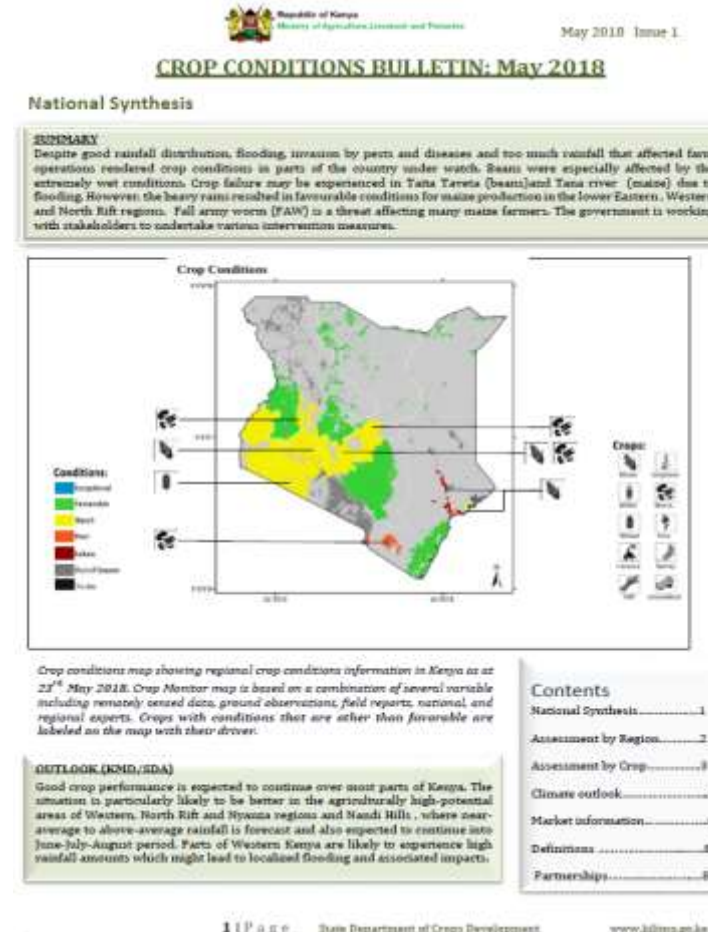
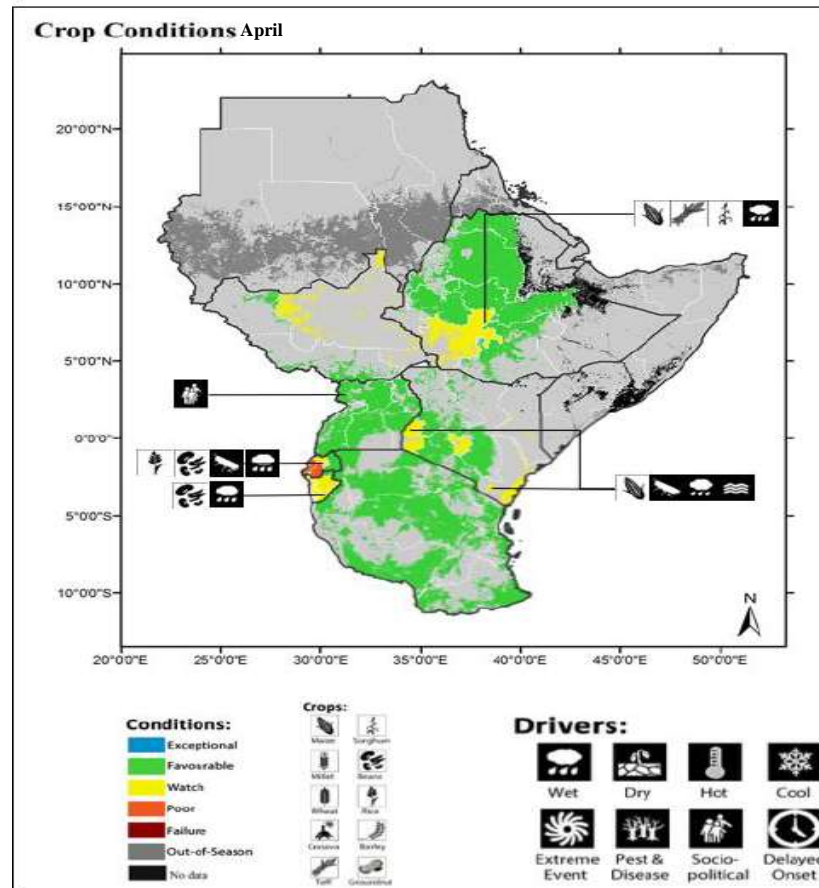


# Monitoring Crop Conditions & Early warning

<http://www.kilimo.go.ke/index.php/2018/06/26/kenya-national-crop-monitor-for-may-2018/>

<http://pekko.geog.umd.edu/usda/apps/>

## Regional Crop Conditions



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## Land Use Land Cover Change & Ecosystems

- 🎯 Monitoring Vegetation Change Conditions
- 🎯 Invasive Species Mapping

# Invasive Species Mapping

## Problem

- ⦿ Lack of spatially explicit information for decision making & management of invasive species.

## Milestones

- ⦿ Invasive Spp.. App designed & developed
- ⦿ Data of invasive Spp.. Collected using the App and shared with partners.

## Planned

- ⦿ Disseminate and train the stakeholders on the use of Invasive Spp. App
- ⦿ Continue Supporting Invasive Spp.. Data collection Efforts



1. Forage land infested with *Acacia reficiens*, degrading & narrowing space for conservation.



2. Data collection using Invasive Spp.. App.

Species	Location	Date	Status
Acacia reficiens	...	...	...
Prosopis juliflora	...	...	...
Lantana camara	...	...	...

3. Database hosting collected data



4. Invasive Species extents modelled from the occurrence data

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# Modelling Extents of Acacia & Opuntia – using MAXENT

## Problem

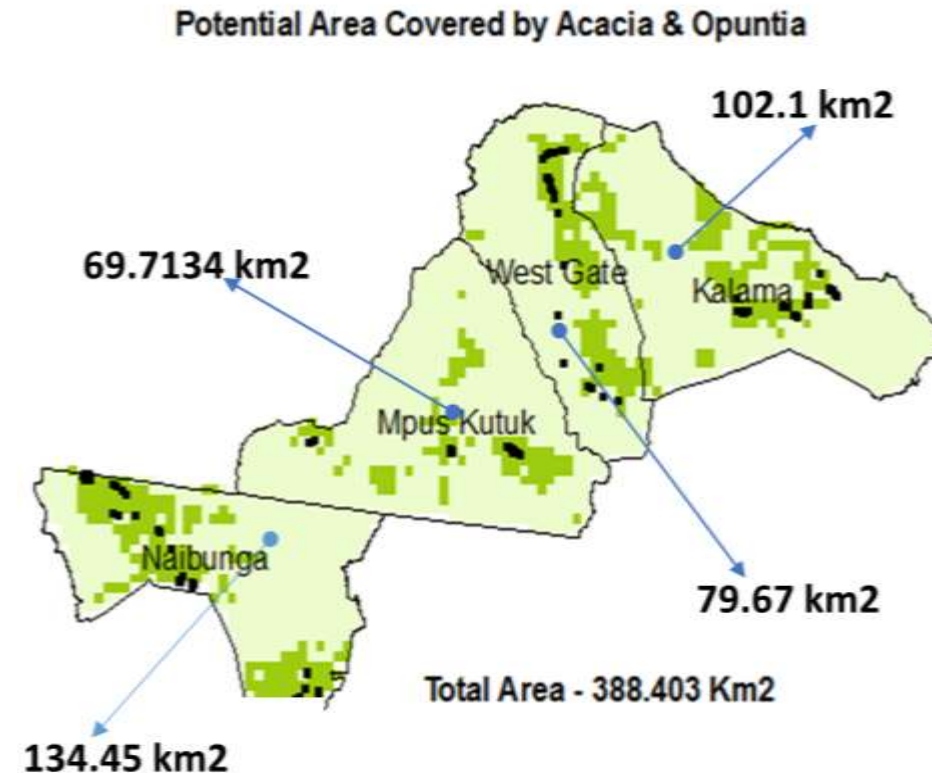
- Estimation of area covered by invasive species in the Northern Kenya Rangelands in recent decades. Information can improve plans for forage space available for both livestock and wildlife, & minimize conflicts.

## Milestones

- Extents of Invasive Spp. mapped within the 4 conservancies.
- Validation data collected for model fitting.

## Planned

- Disseminate the methodology and the preliminary results of modelling/Mapping of Invasive Spp.



# Providing Technical Support to KWTRP & KWTa

## Problem

- ⦿ Monitoring changes in key forest ecosystems in Kenya.

## Milestones



- ⦿ Provided 16 epochs change maps for climate vulnerability assessment.
- ⦿ Provided technical advice to the advisory team (4 technical meetings attended).
- ⦿ Trained USFS and KFS on automation and production of change maps.

## 16 epochs change maps for major water towers





## Water & Water Related Disasters

-  Monitoring Small Water Pans
-  Flood Monitoring (extent & depth)



# Mapping Surface Water Bodies

## Problem

- ❶ Lack of information on size & distribution of small water bodies.
- ❷ The activity will borrow from the methodology developed by NASA-JPL team for mapping surface water bodies using Landsat images
- ❸ The product will feed into the rangeland monitoring tool being developed under SERVIR E&SA and inform other activities like water balance modelling under FEWSNET.

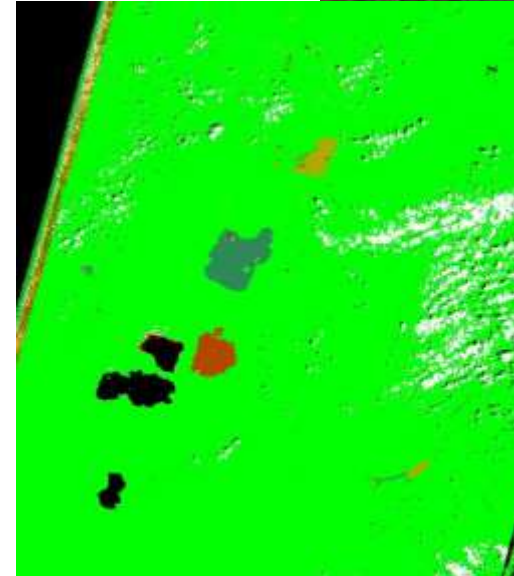
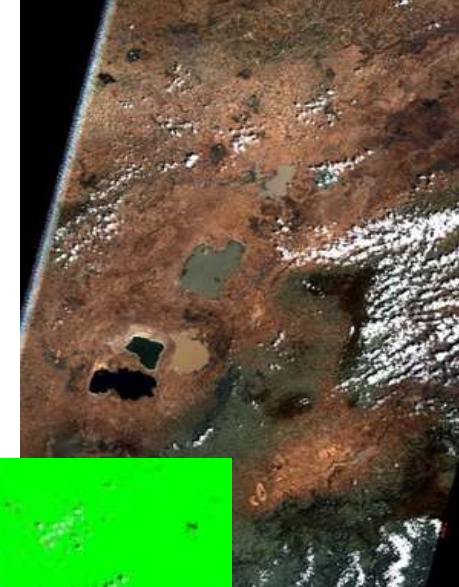
## Milestones

- ❶ Training by NASA-JPL to RCMRD and stakeholders team was done- 16 participants were trained.

## Planned

- ❶ SERVIR ESA team working on exploring suitable methodologies to allow mass/operational production of the maps.

*Before processing*



*Output after processing*

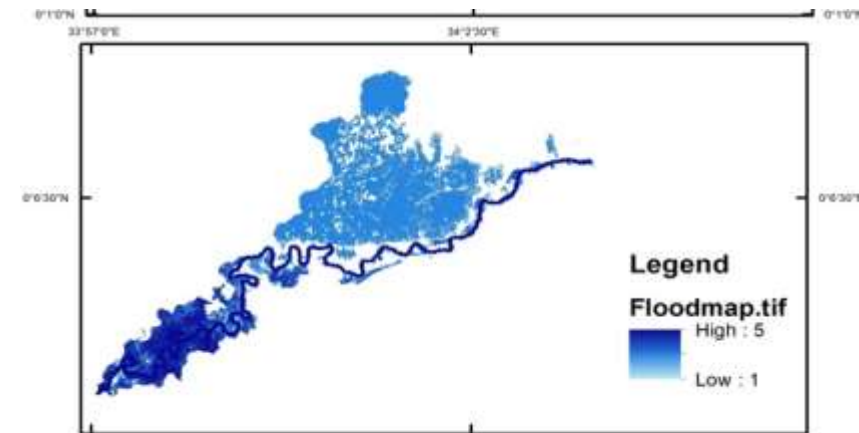
# Flood Monitoring

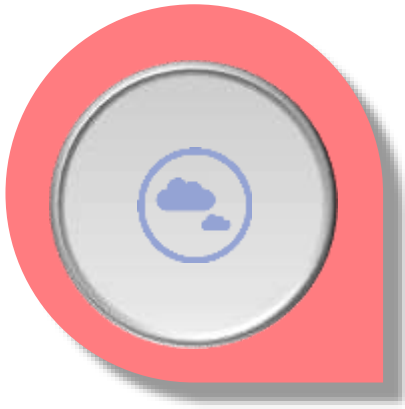
## Problem

- ❊ Lack of timely information on the likelihood of flooding and flood extent maps for decision making – useful for water managers.
- ❊ SERVIR ESA is implementing a flood monitoring system using EO data and hydrologic model(CREST).
- ❊ The model output has been linked with an online tool which can translate water levels into a flood inundation extent.

## Milestones

- ❊ The tools have been used for flood risk assessment under the Kenya Water Security and Climate Resilience project.
- ❊ SERVIR E&SA trained 20 stakeholders drawn from Lower Mekong and HKH region on the use of the flood tool for disaster management.
- ❊ Through the AST project, the tool is being enhanced to include other capabilities including disaster communication mobile app development.





## Weather & Climate

- ☁ Climate Change Vulnerability Impact Assessments
- ☁ Hazard Atlas Mapping

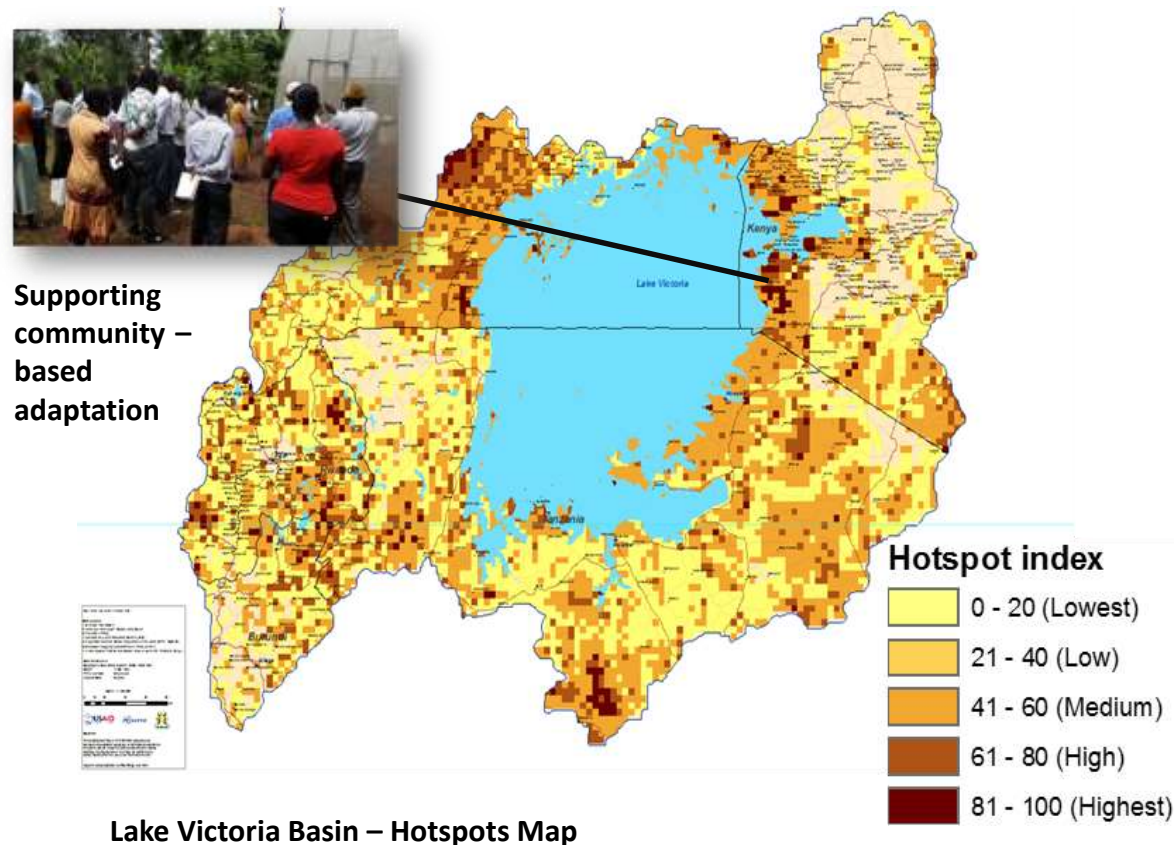


# Community Climate Change Adaptation Assessment (C3A2)

Using C3A2 results to plan and implement community adaptation projects

## Objectives:

1. Identify climate change “hot-spots” at community-level, their risks and adaptation strategies (C3A2).
2. With communities, develop adaptation options and projects
3. Support small scale pilot climate change adaptation projects at community level (17 communities)

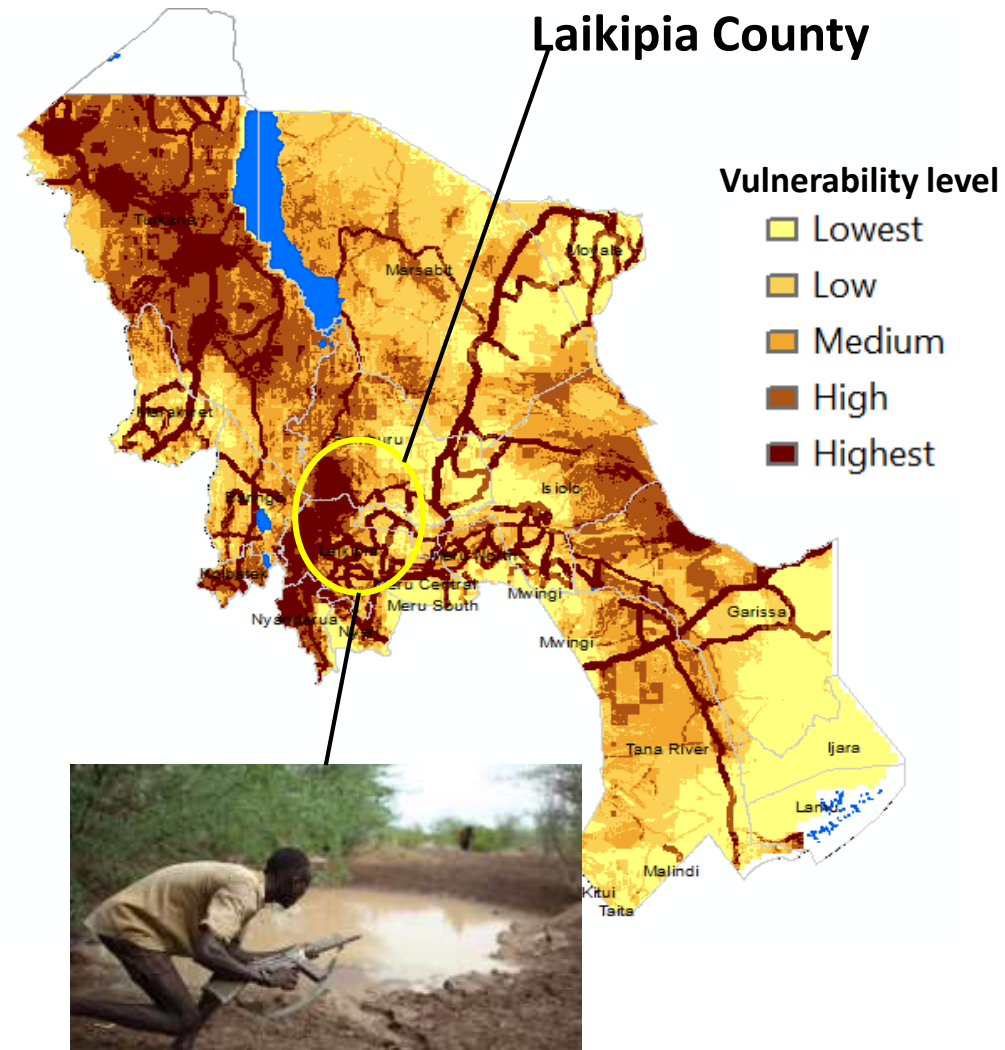


Source: VI mapping supported by PREPARED Project through CIESIN, SERVIR, FEWSNET and EAC Partner States

# Vulnerability and conflicts in Northern Rangelands in Kenya

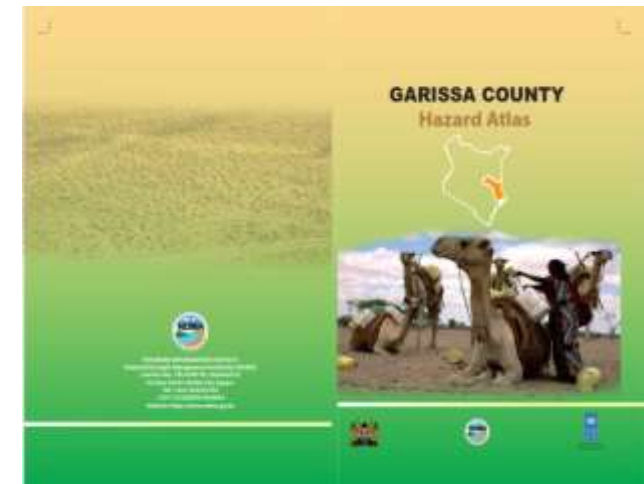
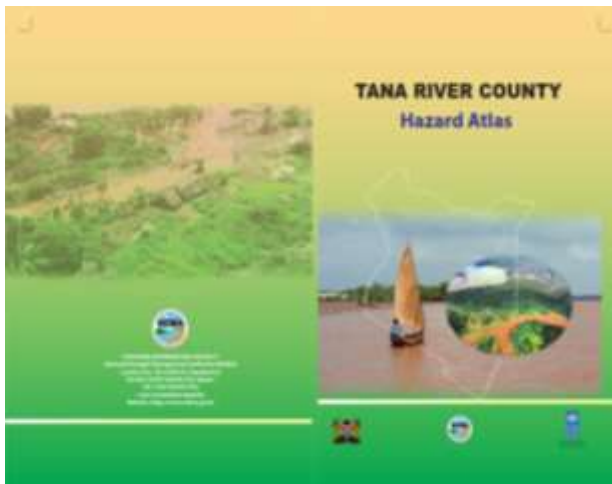
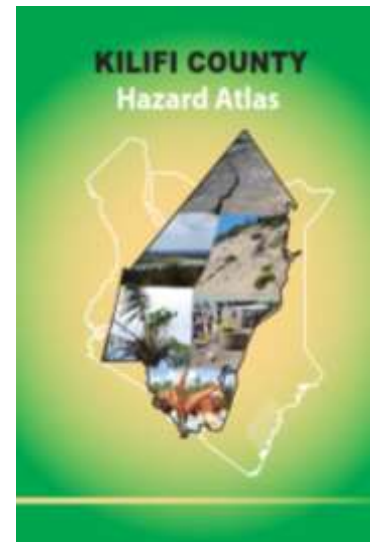
## Problem & Goal

- 10,000 pastoralists & 135,000 cattle moved into Laikipia
- Human – wildlife and pastoralist – farmer conflicts increasing
- USAID supporting holistic grazing management in vulnerable areas



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# Hazard Atlas Mapping for Counties (supporting devolution)



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## Partnerships

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# Partnerships

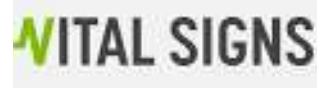
- ✦ Kenya Meteorological Department
- ✦ NDMA
- ✦ Kenya Water Towers
- ✦ Northern Rangelands Trust (NRT)



**Partnership for Resilience and Economic Growth (PREG)**



SEVERE WEATHER CONSULT  
Information. Predictions Alerts



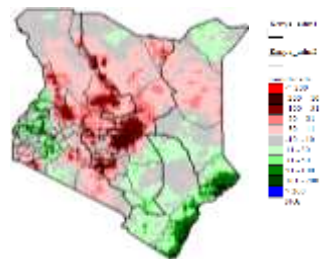
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# Partnership for Resilience & Economic Growth - PREG

SERVIR-E&SA support to PREG:

- ✿ Capacity building for decision makers - GIS for natural resources management
- ✿ Natural Resource Mapping – digitization of grazing plans & livestock movement; Wajir, Garissa, Turkana, Isiolo.
- ✿ Rangeland assessment and monitoring



**KENYA**  
Resilient Arid Lands Partnership  
for Integrated Development  
Building Resilience Together





# Private Sector Engagements - TAHMO

**Goal:** leveraging weather data through robust and cost-effective stations for enhanced water and agricultural productivity that leads to economic growth in Sub-Saharan Africa.

**school<sup>2</sup>school** <https://school2school.net/>



Beneficiaries:

- Universities
- schools



Trans-African Hydro-Meteorological Observatory



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# RCMRD Space Challenge

Goal: Equip students with skills in environmental science, climate change and its drivers. Contribute to STEM & SDG's.

Video: <https://www.youtube.com/watch?v=8v5WTv8J79M&t=1s>



Nasokol Girls School



St. Scholastica Primary School



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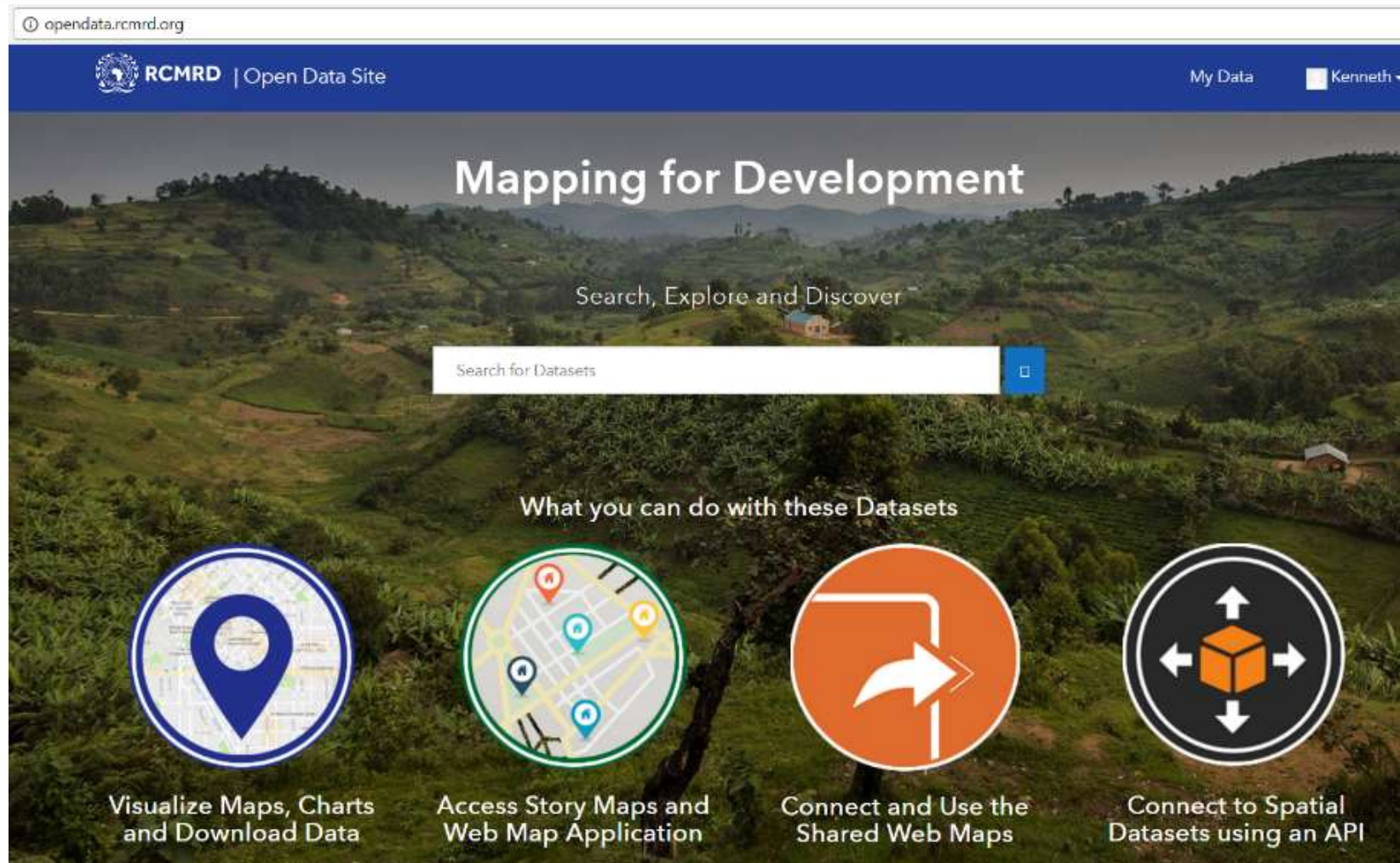


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# RCMRD Open Data



The screenshot shows the RCMRD Open Data Site homepage. The browser address bar displays "opendata.rcmr.org". The site header includes the RCMRD logo, "Open Data Site", "My Data", and a user profile for "Kenneth". The main heading is "Mapping for Development" with the subtext "Search, Explore and Discover". Below this is a search bar labeled "Search for Datasets". The section "What you can do with these Datasets" features four icons and their corresponding descriptions:

-  Visualize Maps, Charts and Download Data
-  Access Story Maps and Web Map Application
-  Connect and Use the Shared Web Maps
-  Connect to Spatial Datasets using an API

<http://apps.rcmr.org/>

<http://opendata.rcmr.org/>  
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# RCMRD International Conference

## RCMRD International Conference

15 to 17 Aug 2018, Nairobi, Kenya



## 2<sup>nd</sup> RCMRD INTERNATIONAL CONFERENCE (RIC2018)

RIC 2018: <http://ric2018.rcmrd.org/>

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# Thank you

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