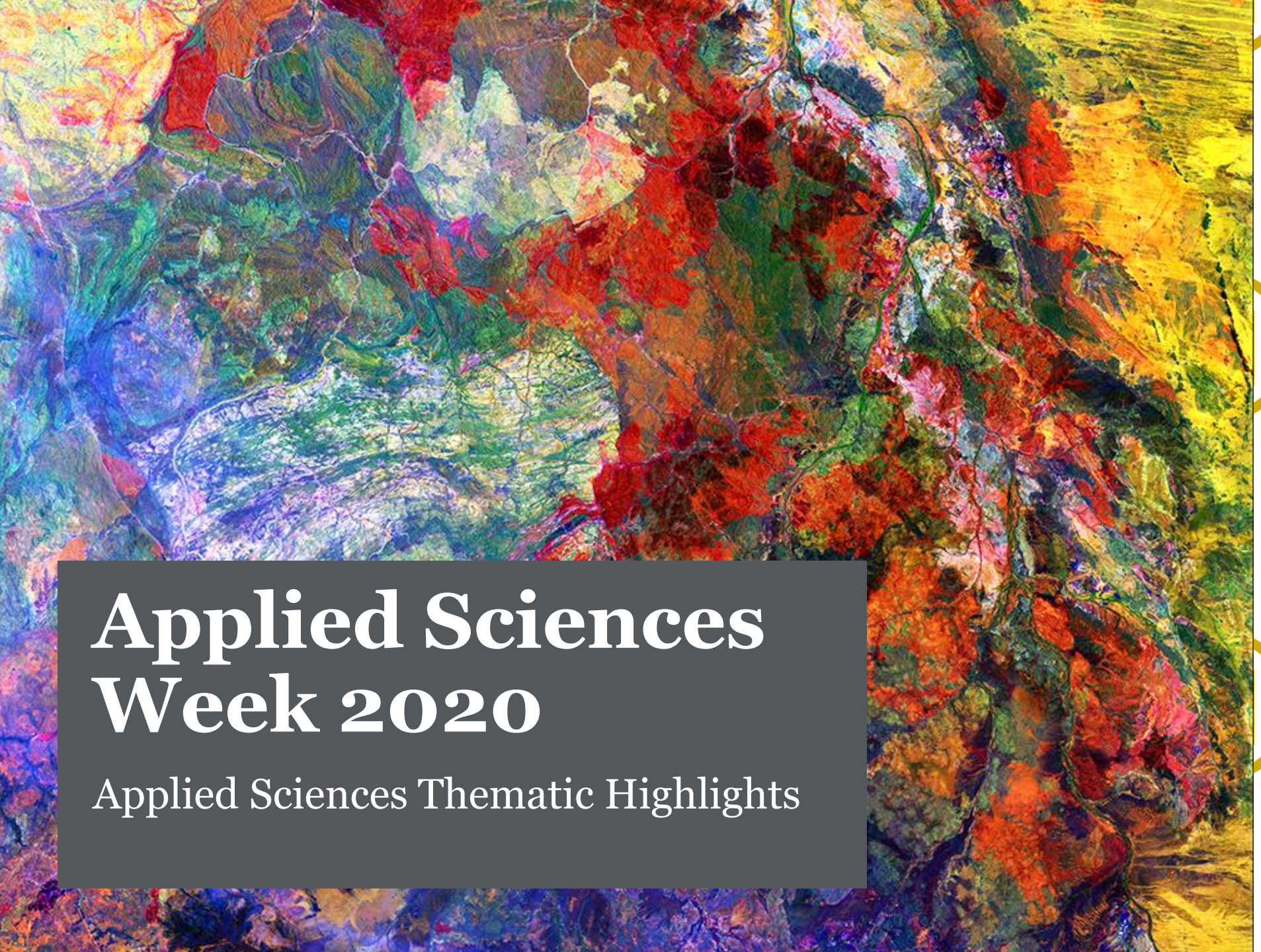


Applied Sciences Week 2020

Applied Sciences Thematic Highlights

EARTH SCIENCE
APPLIED SCIENCES

Huntsville Urban Development: Utilizing NASA Earth Observations to Evaluate Urban Tree Canopy and Land Surface Temperature for Green Infrastructure and Urban Heat Mitigation in Huntsville, AL

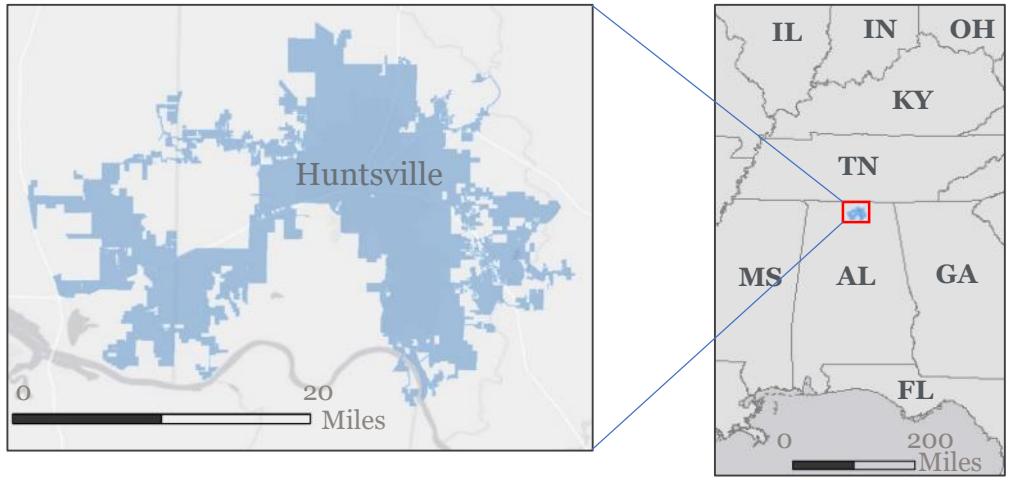
Greta Paris, Sabine Nix, Thomas Quintero, Amanda Tomlinson

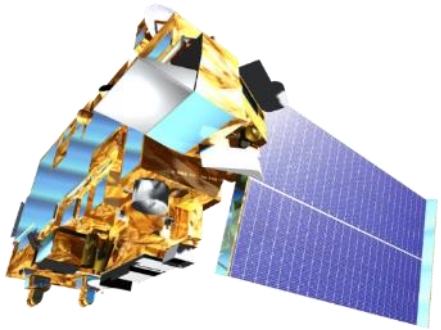
CAPACITY BUILDING

COMMUNITY CONCERNS & PROJECT PARTNERS

"20 million hectares of forest are projected to be lost in the United States to **population growth** and associated **urban expansion** by the year 2040."

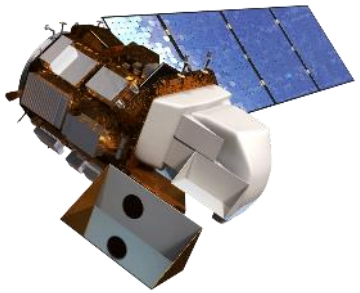
- Huntsville, Alabama has experienced rapid **urban expansion** between the years of 2010-2020, and this has citizens concerned about **tree canopy loss**
- Tree canopy loss could be resulting in an enhanced **urban heat island (UHI) effect**
- The UHI effect can lead to **health issues** for those with existing medical conditions such as COPD, diabetes, or asthma.
- The Huntsville Urban Development team partnered with the City of Huntsville to examine the effects of urban expansion on tree canopy loss and the resulting UHI effect



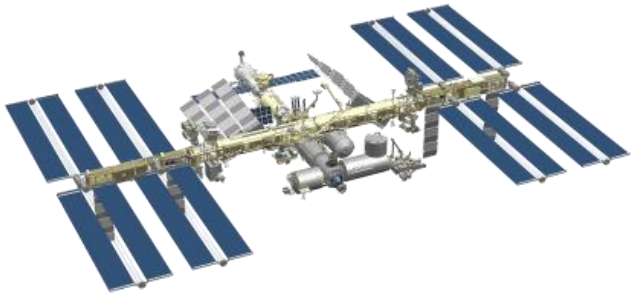


Terra MODIS

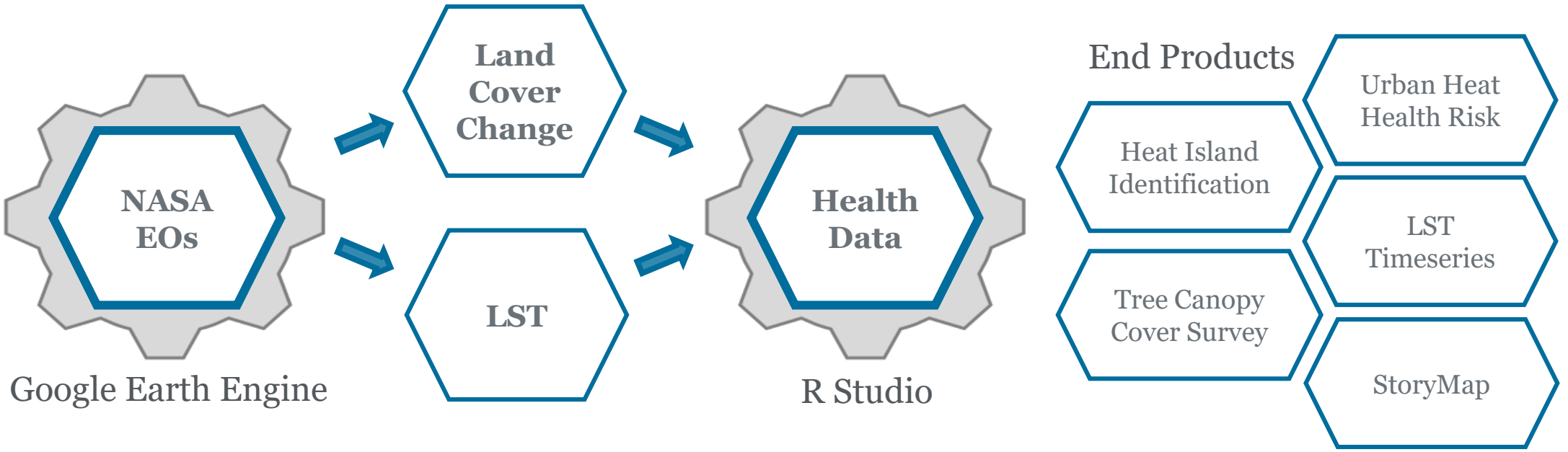
Landsat 5 TM



Landsat 8 OLI and TIRS



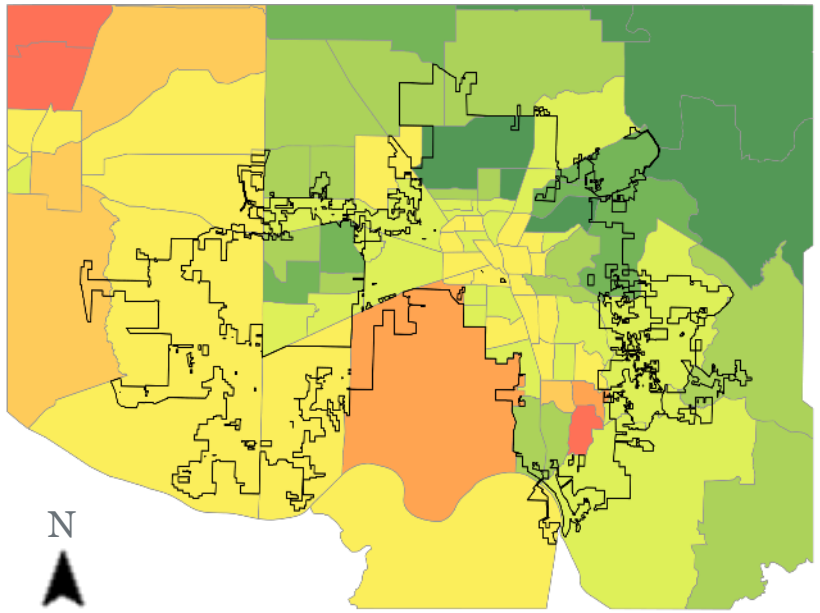
International Space Station
ECOSTRESS and GEDI



Google Earth Engine

R Studio

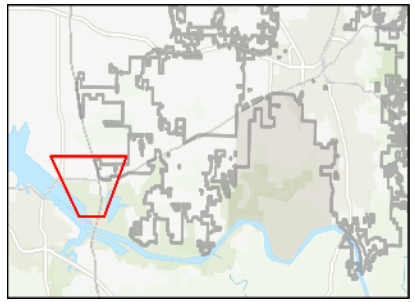
RESULTS & CONCLUSIONS



Tree Cover Change
(2010 to 2019)

≤ -4%	≤ 6%
≤ -2%	≤ 8%
≤ 0%	≤ 14%
≤ 2%	City of Huntsville
≤ 4%	Census Tracts

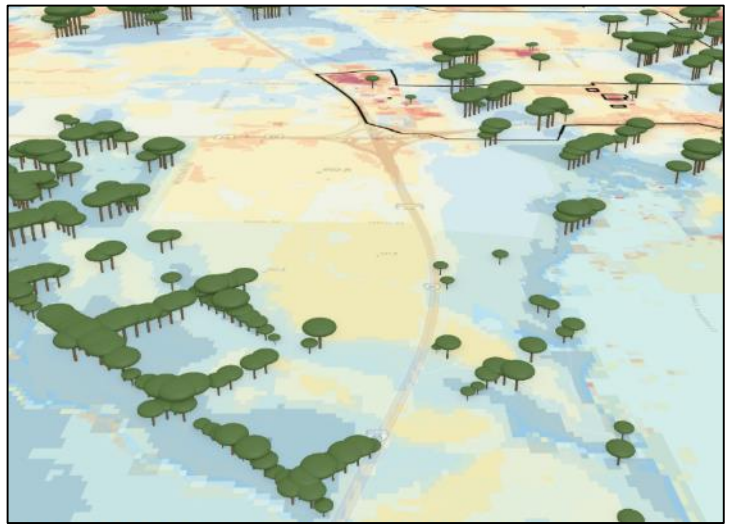
0 10 miles



LST (°F)
106
70

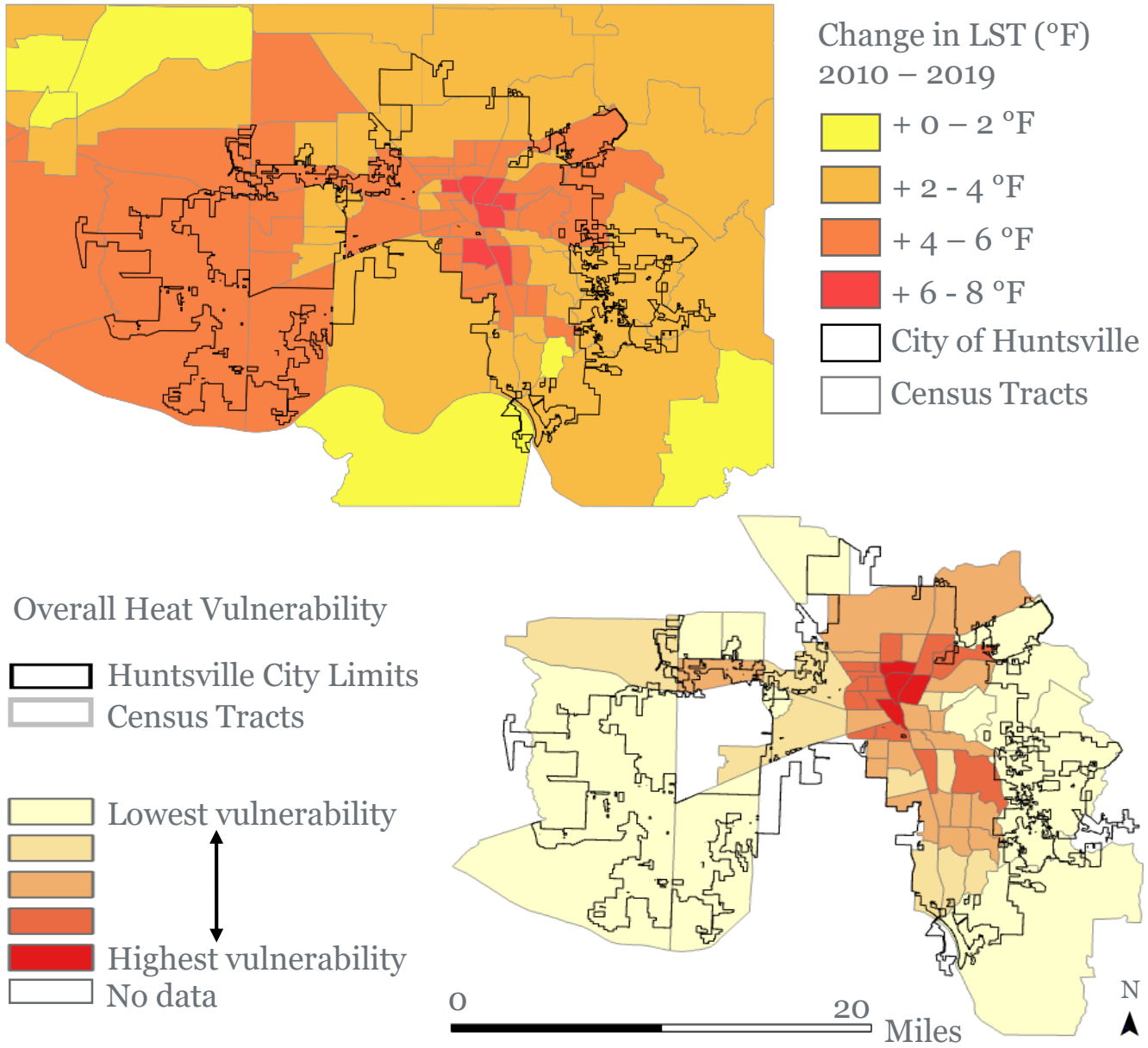
City of Huntsville

0 0.2 miles



- From 2010 to 2019, overall tree cover increased 3% while some census tracts experienced **tree cover loss** as much as 8%.
- The 2019 mean **tree height** in the city area was 82 feet and mean Plant Area Index was 3.
- Land surface temperature **decreases** logarithmically with tree cover and increases linearly with impervious surface cover.

RESULTS & CONCLUSIONS



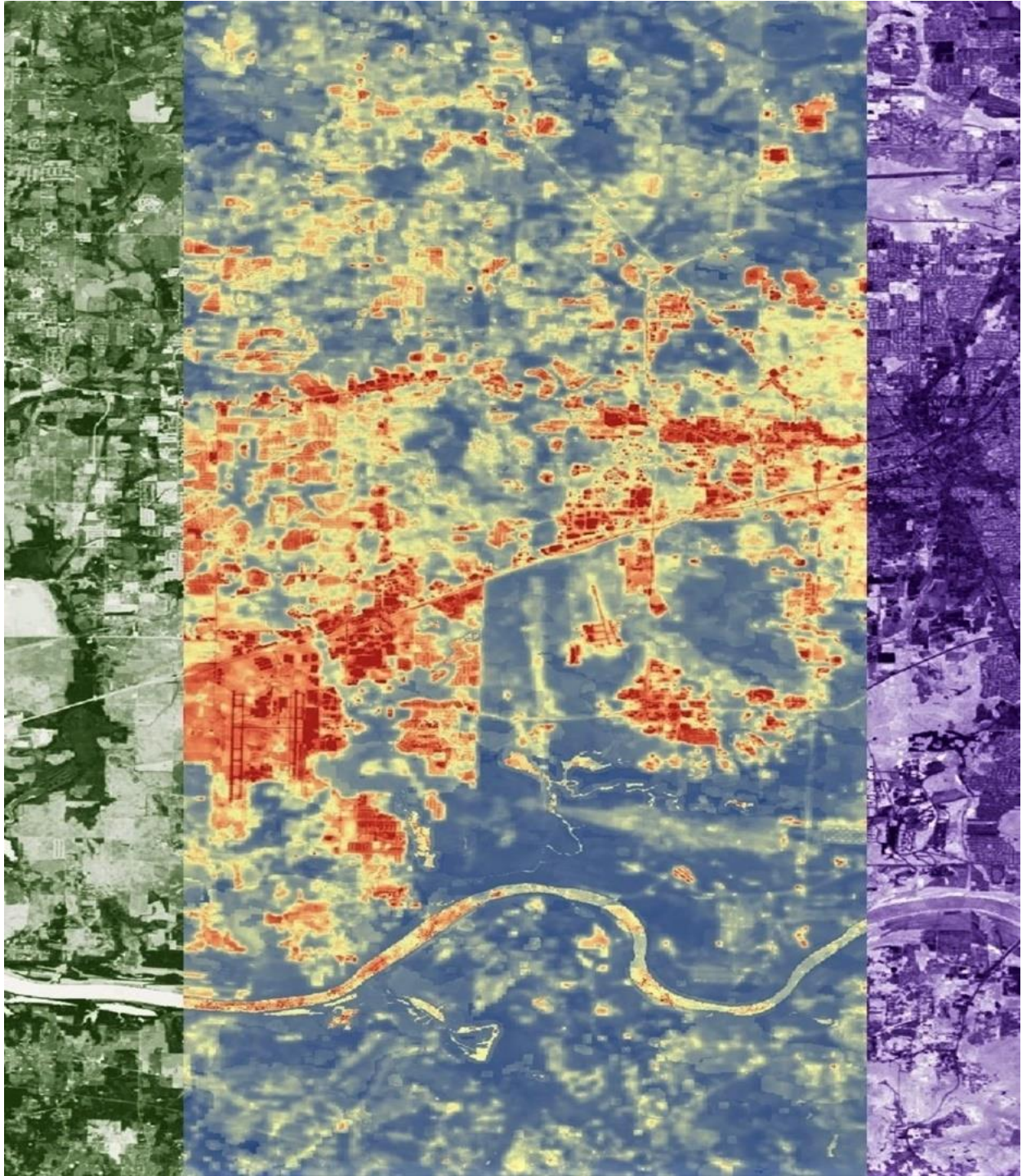
- Every census tract in Huntsville has experienced an **increase in LST** between 2010 and 2019.
- On average, LST increased by **4 °F** across the study area, with some tracts increasing by up to 8 **°F.**
- Based on the Urban Heat Health Risk Map, many of the tracts experiencing the most LST increase are also the most vulnerable.
- Urban Heat Island **mitigation efforts** could be targeted to most vulnerable census tracts to **reduce risk** of heat-related illness.

Thank You.

For further questions, please contact us at NASA-DL-DEVELOP@mail.nasa.gov

https://develop.larc.nasa.gov

EARTH SCIENCE
APPLIED SCIENCES



Scaling Up a Multi-State System for West Nile Virus Forecasting in the United States

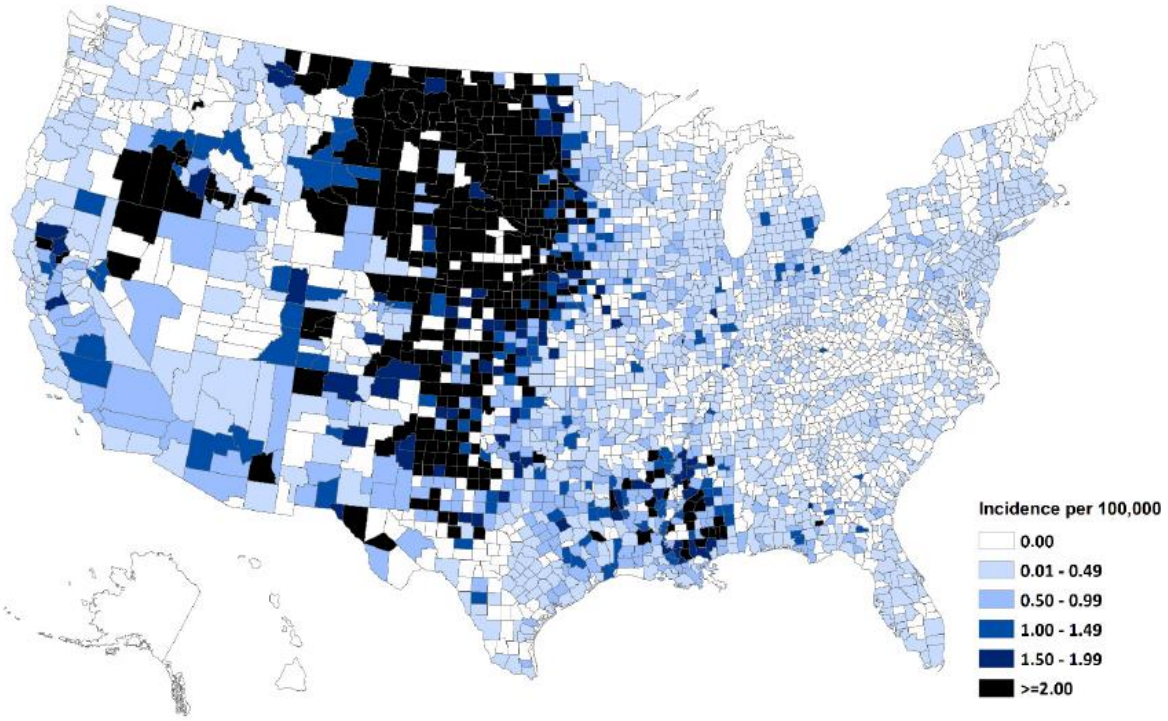
Michael C. Wimberly and Justin K. Davis
Department of Geography and Environmental Sustainability
University of Oklahoma

HEALTH &
AIR QUALITY

This story about forecasting the risk of a tropical, mosquito-borne disease begins in South Dakota of all places.

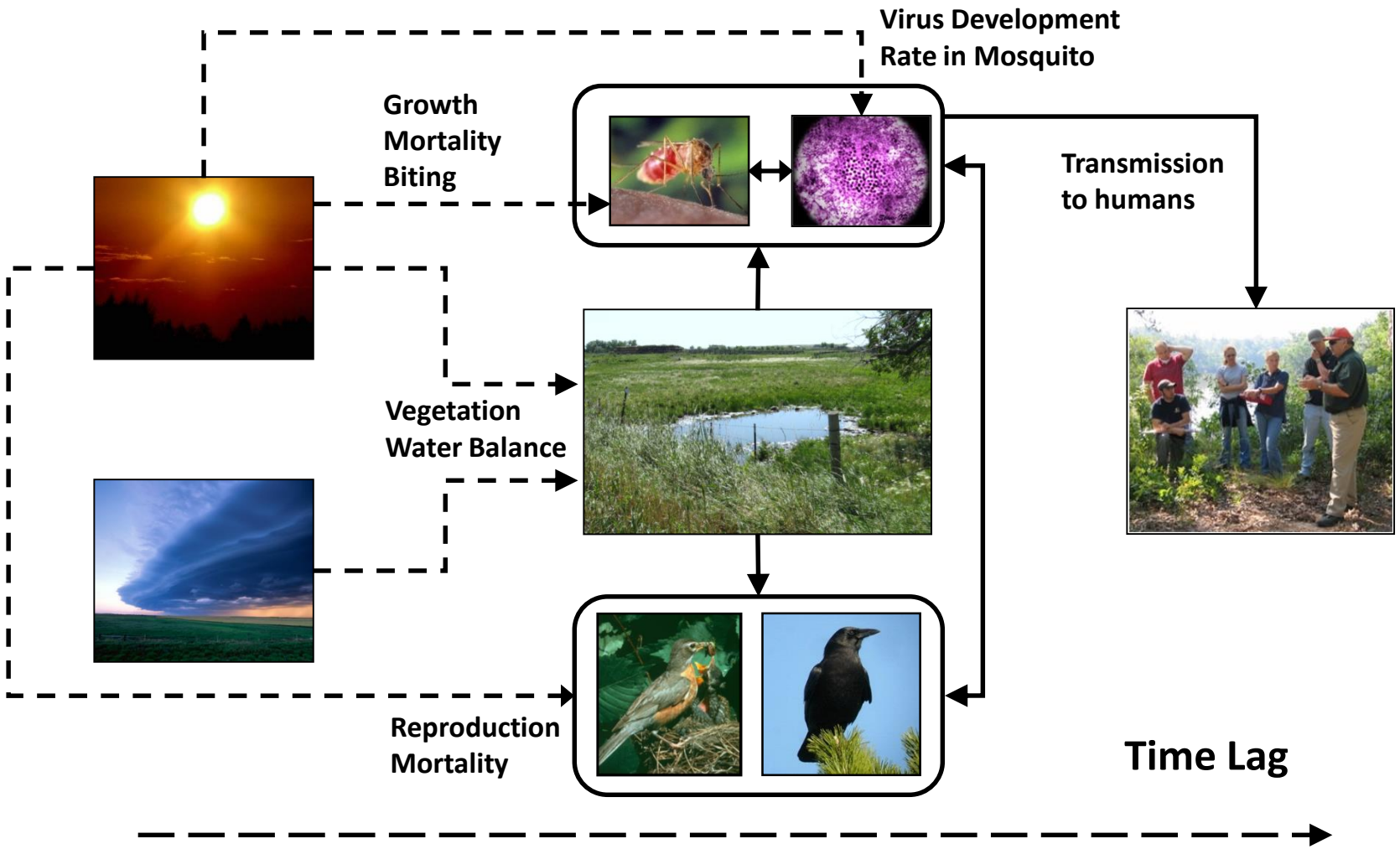
- 2,360 cases since 2002
  - 509 Neuroinvasive
  - 46 Deaths
  - 820,000 Population (2010)
- Highest annual incidence of WNV disease (19.4/100,000) in the U.S.
- Seasonal outbreak with high interannual variation
  - 2 cases In 2011
  - 203 cases in 2012

Average annual incidence of West Nile virus neuroinvasive disease reported to CDC by county, 1999-2018

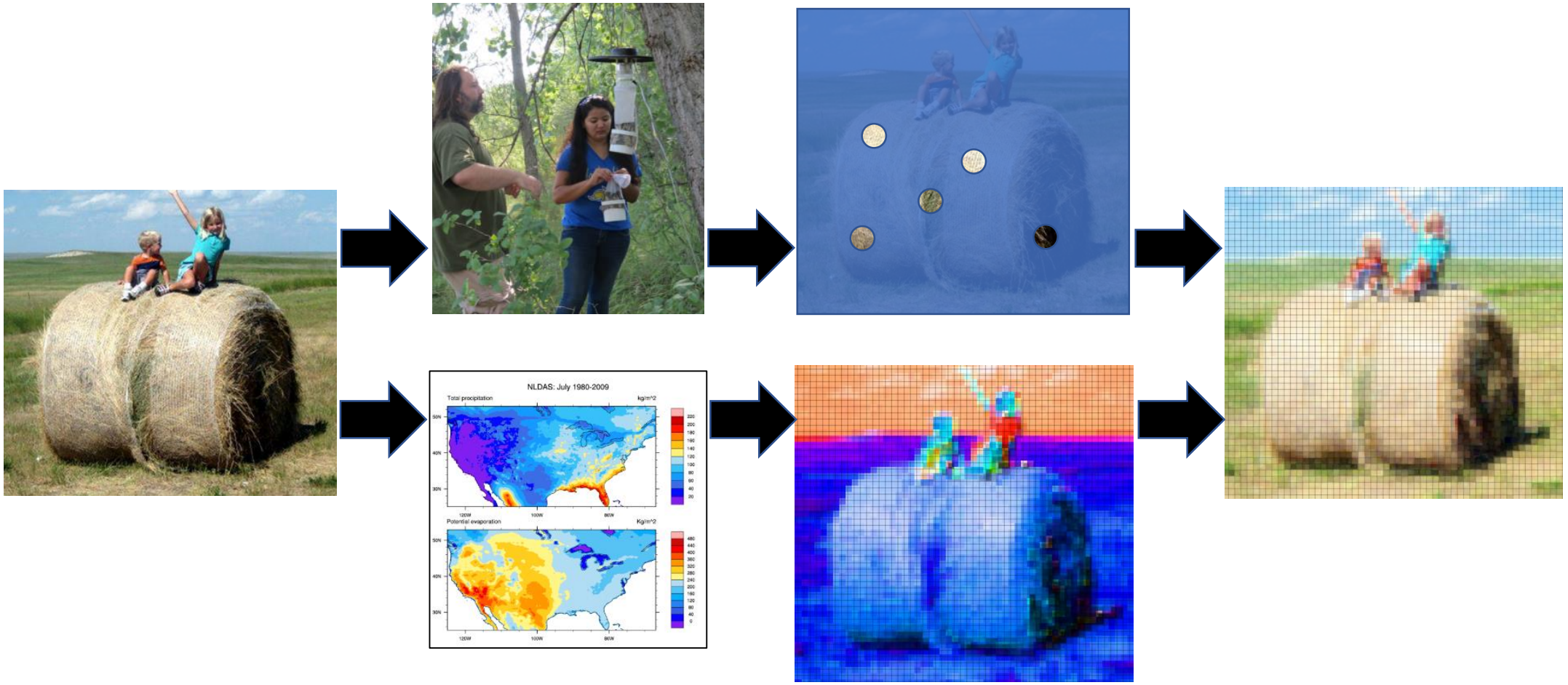


Source: ArboNET, Arboviral Diseases Branch, Centers for Disease Control and Prevention

Environmental factors, including temperature, precipitation, and atmospheric moisture, influence WNV transmission through multiple pathways.

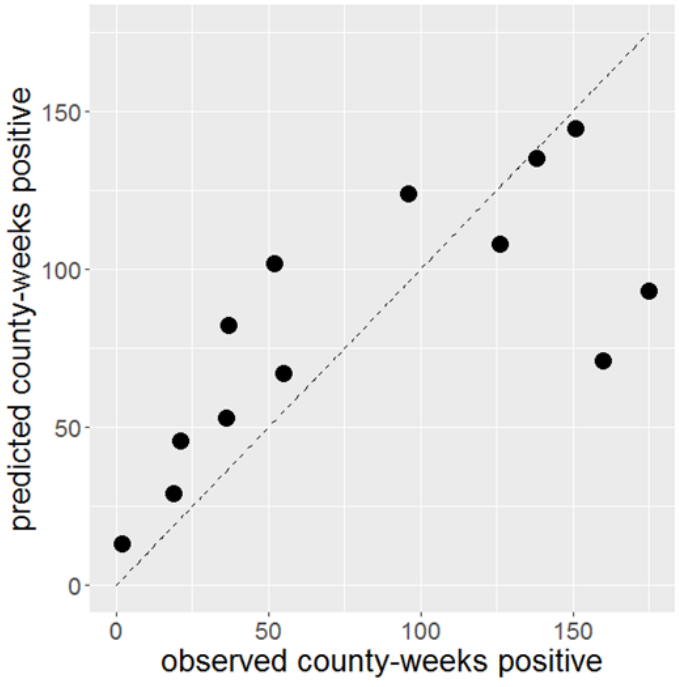


ArboMAP integrates environmental monitoring with mosquito surveillance data to improve the accuracy of forecasts.

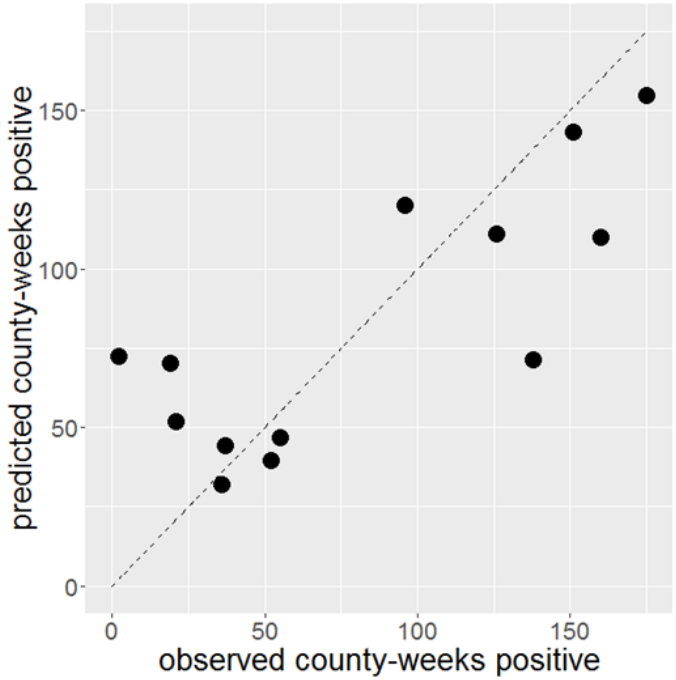


Combining mosquito infection data with meteorological data results in the most accurate predictions of human WNV cases.

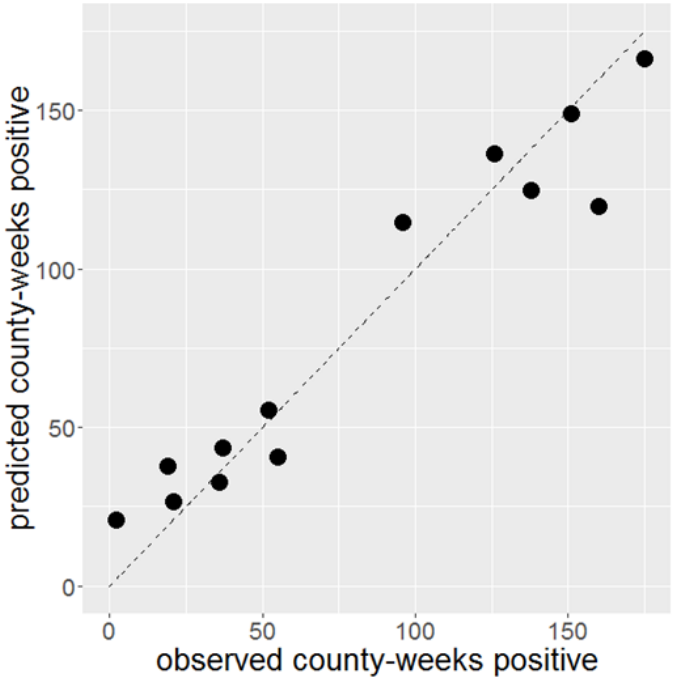
Mosquito infection data



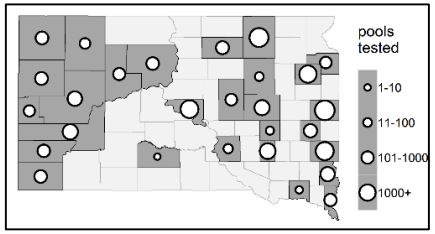
Meteorological data

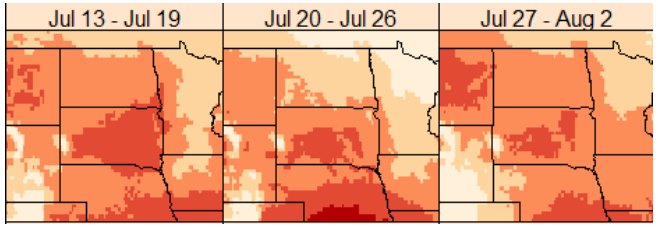


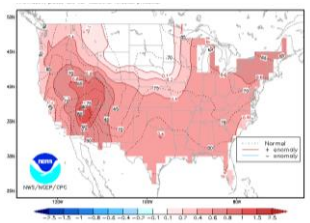
Combined mosquito infection and meteorological data

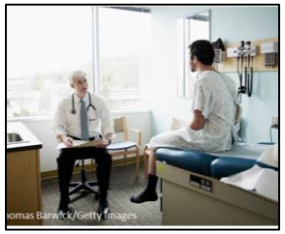


Model fit from 2004-2016 (each dot represents one year)

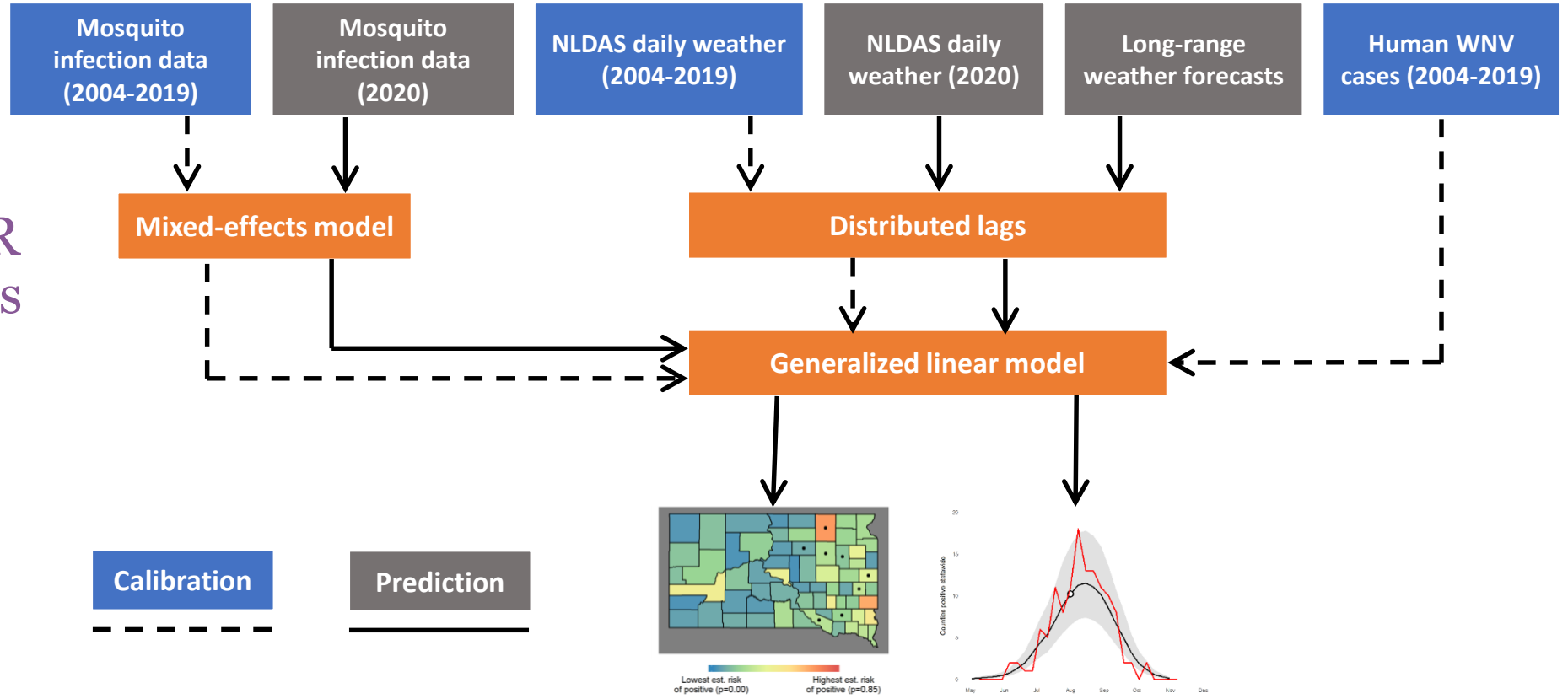








ArboMAP is implemented as an R script that automates model fitting, forecasting, and report generation

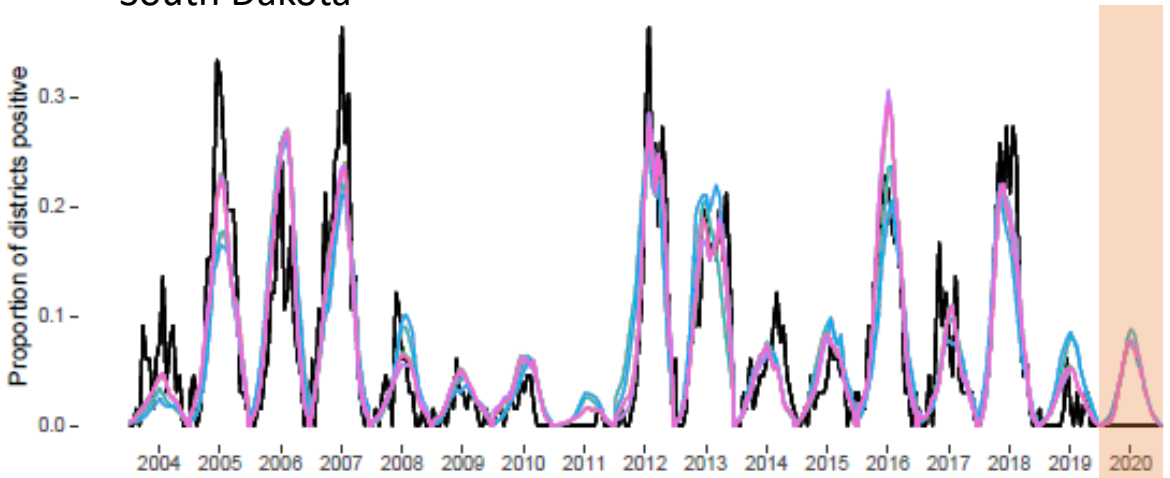


We have extended ArboMAP forests to several new states in 2020.

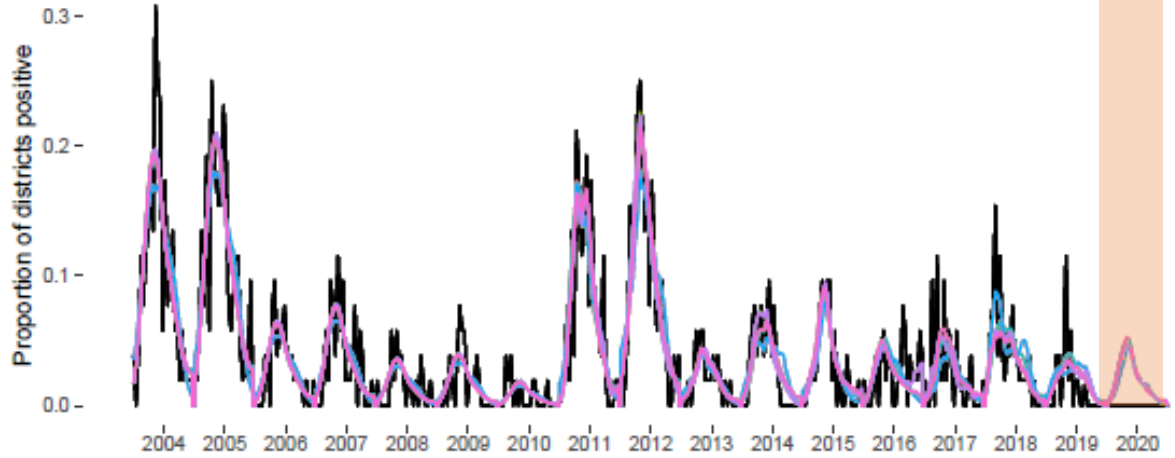
- South Dakota
  - Continuing to support the SD Department of Health
- Louisiana
  - Focus of current NASA project
  - Virtual collaboration with the LA Department of Health
- Michigan
  - Implemented independently by the MI Department of Health
- Oklahoma
  - Collaboration with Southern Nazarene University and the OKC-County Health Department

2020 West Nile virus forecasts made in mid-July

South Dakota



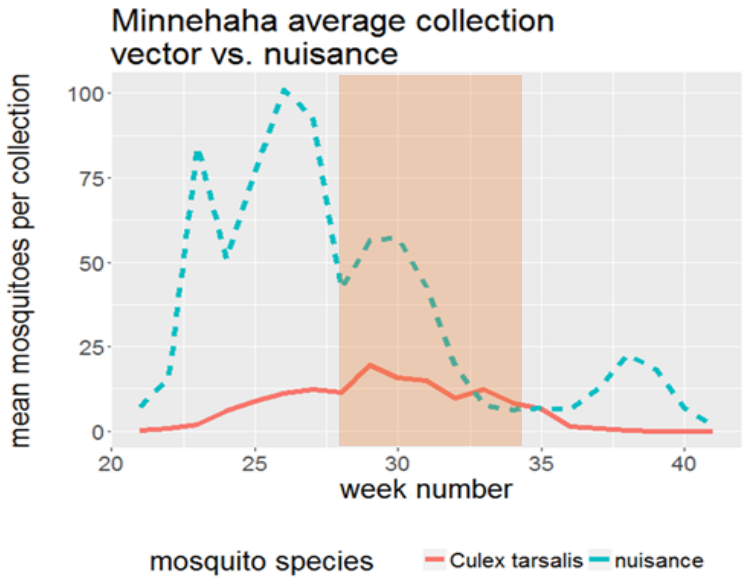
Louisiana



Black line: historical case data
Colored lines: fitted (2004-2019) and predicted (2020) values from an ensemble of forecasting models

ArboMAP is needed to support public health decisions because other sources of information have substantial limitations.

- Reports of human cases are delayed by weeks or months.
- Mosquito abundance is not a reliable predictor of WNV transmission risk.



Most WNV cases in SD occur between weeks 27-34, *after the seasonal peak in mosquito abundance*.

In 2018, only 8 cases were reported in SD by July 26th, giving the false impression of low WNV risk. In reality, 50 cases had already occurred, and there were 169 cases during the 2018 season – the highest total since 2012.

ArboMAP predicted a higher-than-usual level of WNV risk in early July, indicating a need for aggressive prevention messaging and vector-control.

Thank You.

For further questions, please contact:
mcwimberly@ou.edu
@mcwimberly
http://ecograph.net

Watch our NASA Applied Sciences video!:
https://tinyurl.com/nasawnv

HEALTH &
AIR QUALITY

Satellite Beach Energy:
Restructuring the Energy Balance in Satellite Beach, Florida, by Quantifying Solar Energy Production Potential using NASA POWER Data Products and LiDAR

Spencer Nelson*, Katherine Beall, Jake Dialesandro, Julia Marturano

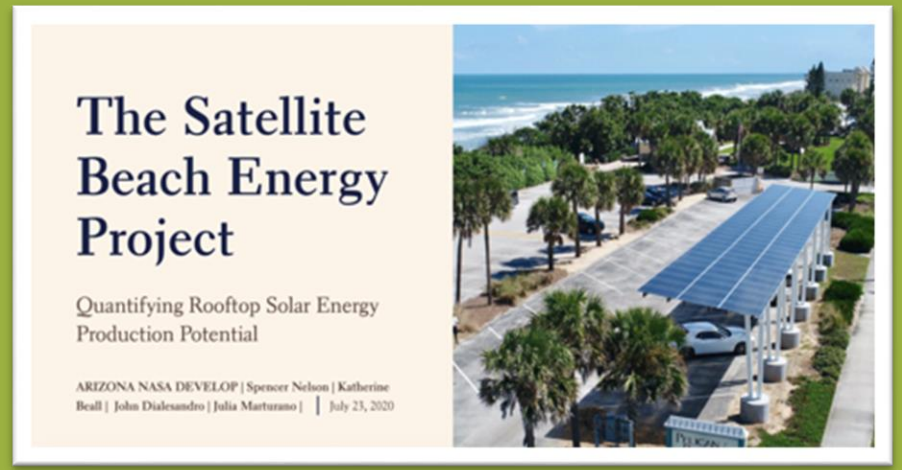
CAPACITY BUILDING

COMMUNITY CONCERS & PROJECT OBJECTIVES

- **Solar Potential** of rooftops
  - Find most efficient way to implement rooftop PV panels
- Reusable **code-based tool**
  - Repeat analysis in other communities
- Accessible **StoryMap**
  - Share with residents of Satellite Beach, Florida

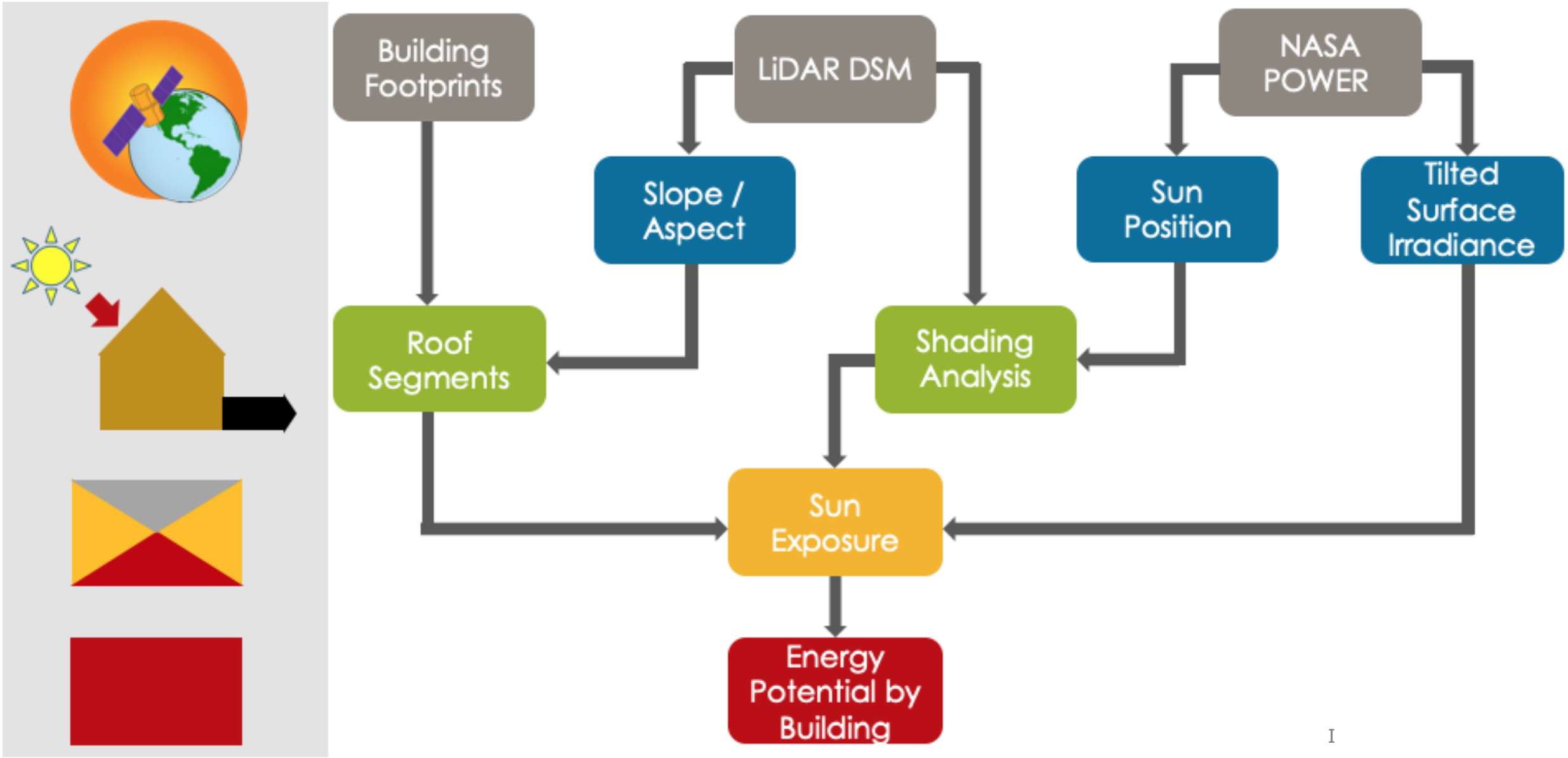
NASA POWER
Prediction of Worldwide Energy Resources

100% Renewable Energy by 2050



Credit: Alexis Miller

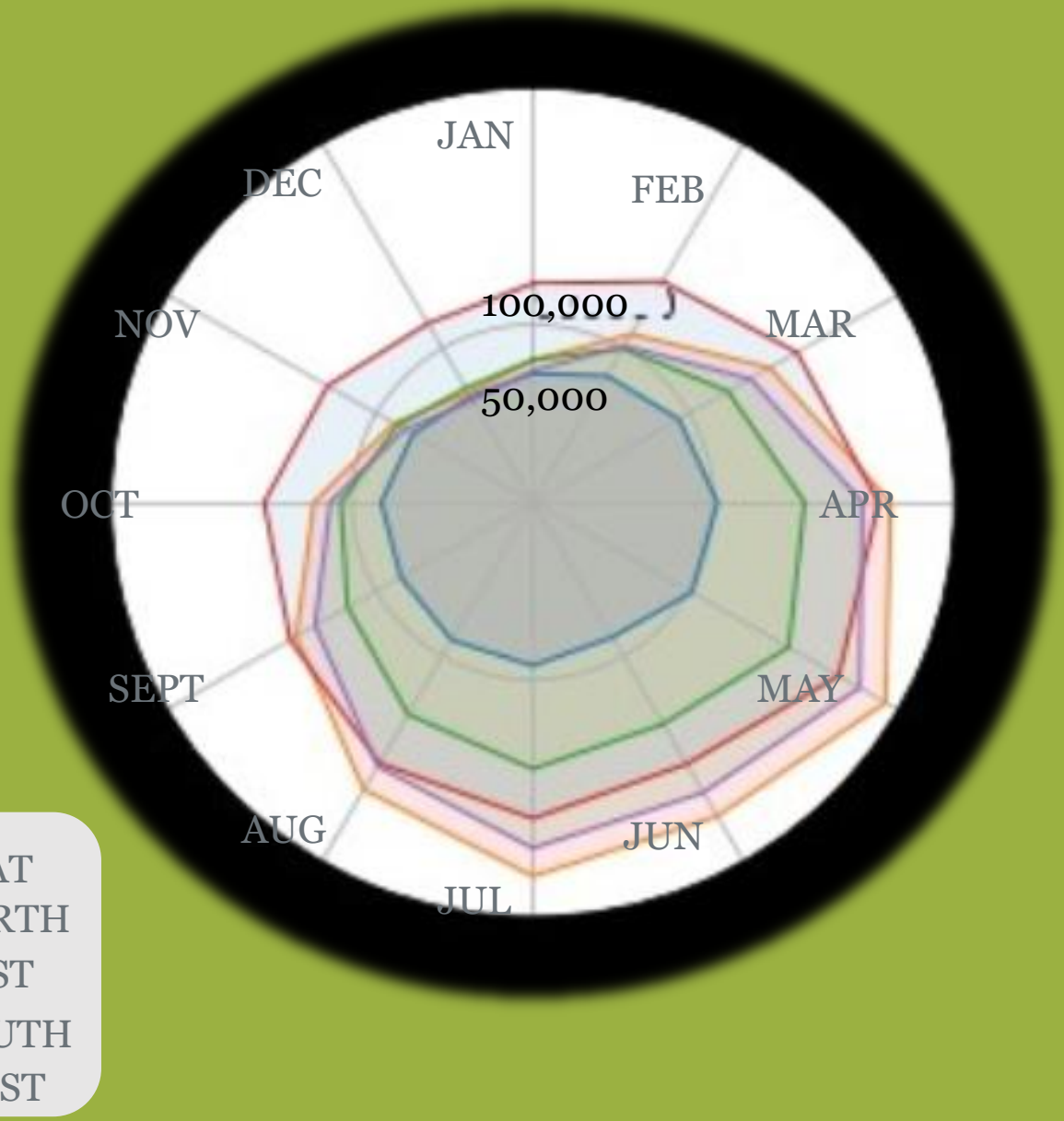
METHODOLOGY & DATA PROCESSING



RESULTS AND CONCLUSIONS

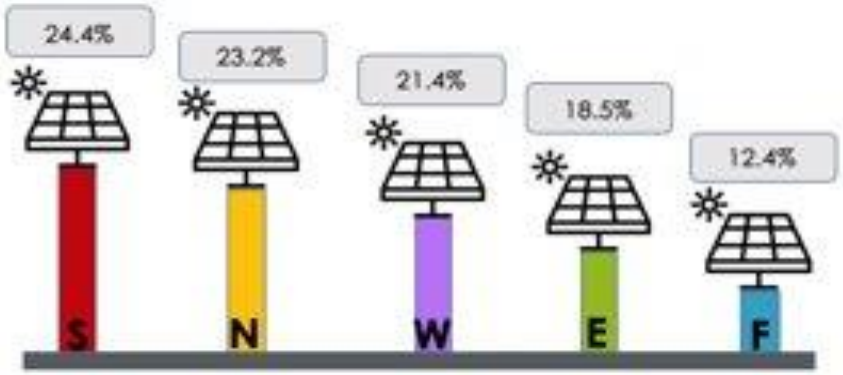
- North-facing roofs produce the most solar potential of all roofs, April-Aug
- May produces the most, December produces the least (44% of May)
- South-facing roofs produce notably more energy during the winter months and greatest annually
- 212,172,448 KWh of PV potential, annually
  - Enough to power nearly 20,000 average homes

DAILY ENERGY POTENTIAL OF ROOF SEGMENTS (KWh)



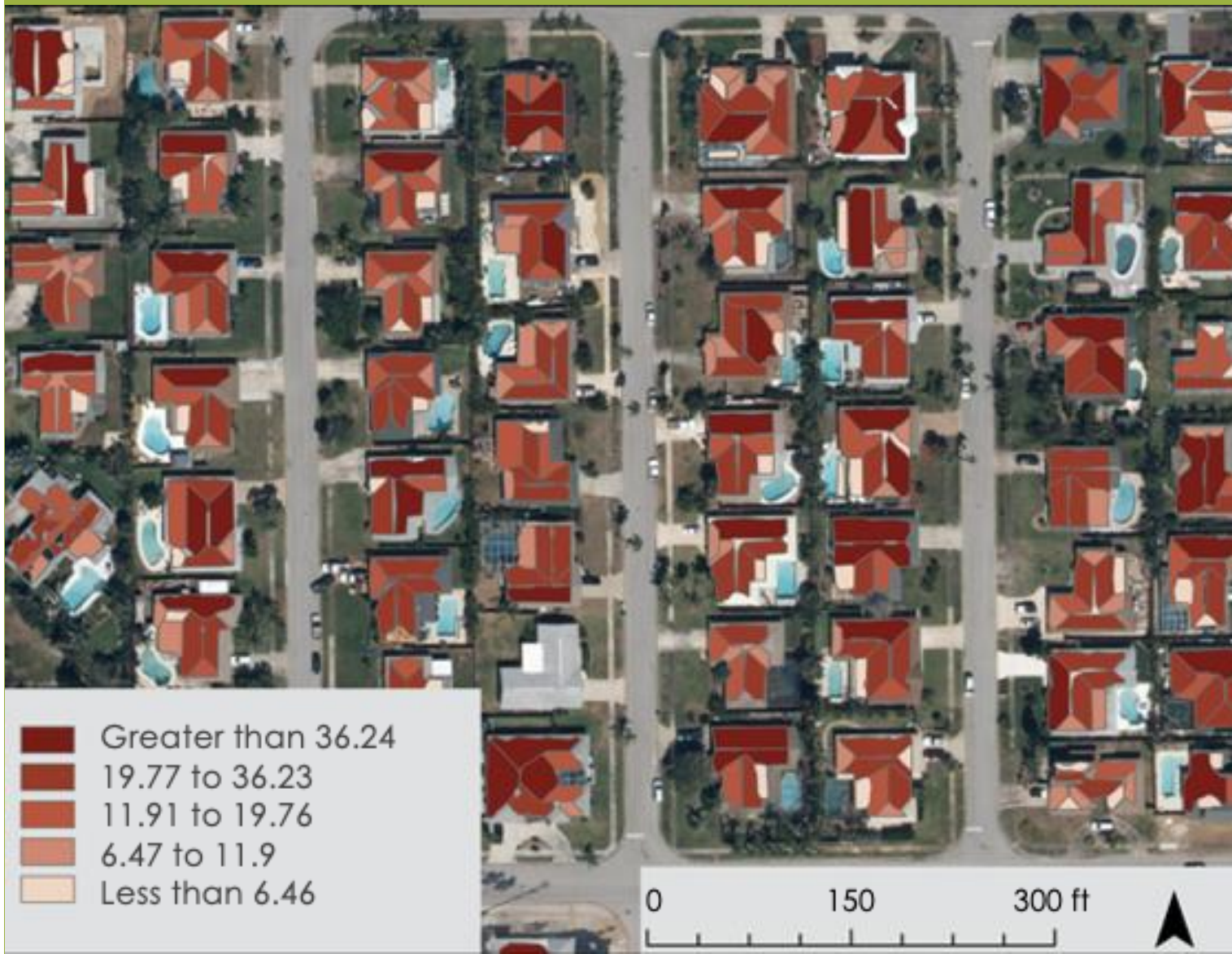
RESULTS AND CONCLUSIONS

- Annual PV potential south facing segments: 51,755,072 KWh
  - Average: 11,000 KWh (about average household energy consumption)
- Annual PV potential flat-roof segments: 26,363,411 KWh
  - Average: 5,396 KWh
- Average building PV potential: 55,010 KWh (500% of average household energy consumption)



Inform solar panel planning for 100% solar goal

Annual PV Potential in KWh by Roof Segment

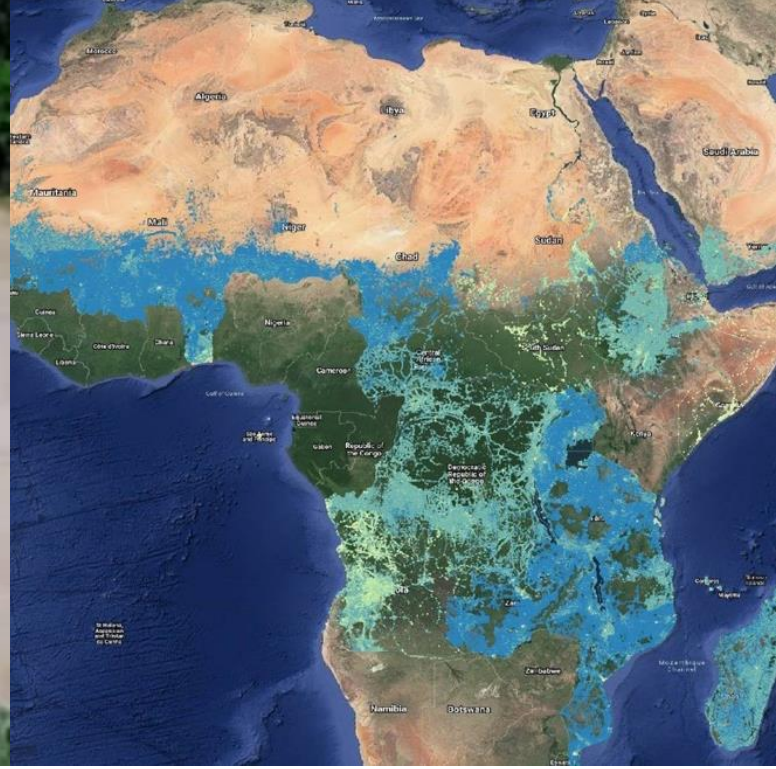


Thank You.

For further questions, please contact:
us at NASA-DL-DEVELOP@mail.nasa.gov

https://develop.larc.nasa.gov

EARTH SCIENCE
APPLIED SCIENCES



Africa Floods and Cascading Hazards

Maggi Glasscoe

Jet Propulsion Laboratory, California Institute of Technology

DISASTERS

Central and east Africa, particularly the countries of Kenya, Somalia, Sudan, South Sudan, and the Democratic Republic of the Congo, experienced severe flooding this past spring as greater and more widespread than normal rainfall occurred during their “long rains” season.

The NASA Disasters Program activated for this event to investigate the effects of the flood and see how our products might aid in supporting future flooding events.

- During this event Africa experienced transboundary flooding and food insecurity
- Rising waters impacted vulnerable settlements along riverbanks
- News reports indicated hundreds of people losing lives to overflowing rivers and mudslides and thousands of others displaced
- NASA Disasters A.37 “Advancing Access to Global Flood Modeling and Alerting” research project investigated this event

Advancing Access to Global Flood Modeling and Alerting – Disasters A.37 ROSES Project

Using DisasterAWARE - an open access, global flood alerting system – for effective dissemination of flood risks and potential impacts to aid with emergency response.

The main components of the project are:

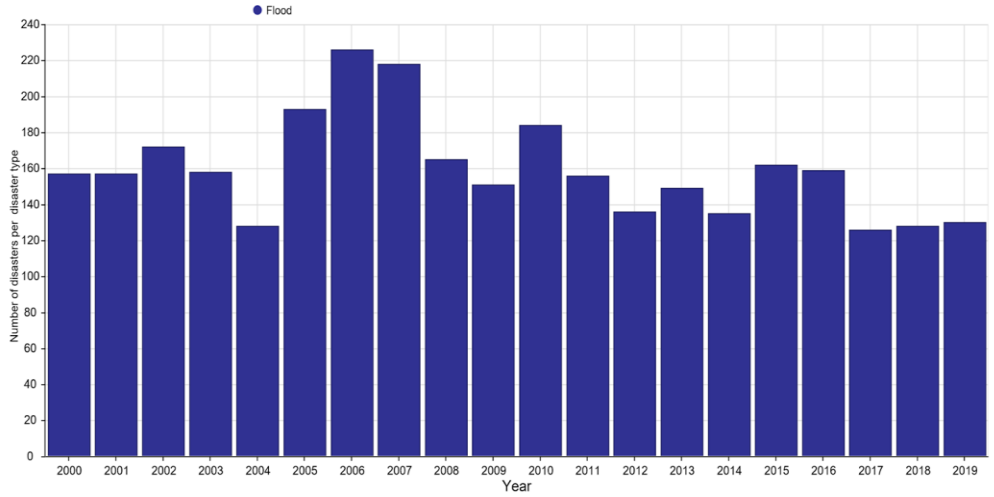
i. A Model of Models (MoM) to forecast flood severity at global scale by integrating flood outputs from two simulation models – GloFAS and GFMS in near real-time;

ii. Derive inundation outputs from Earth observation data sets in the MoM for validation and calibration;

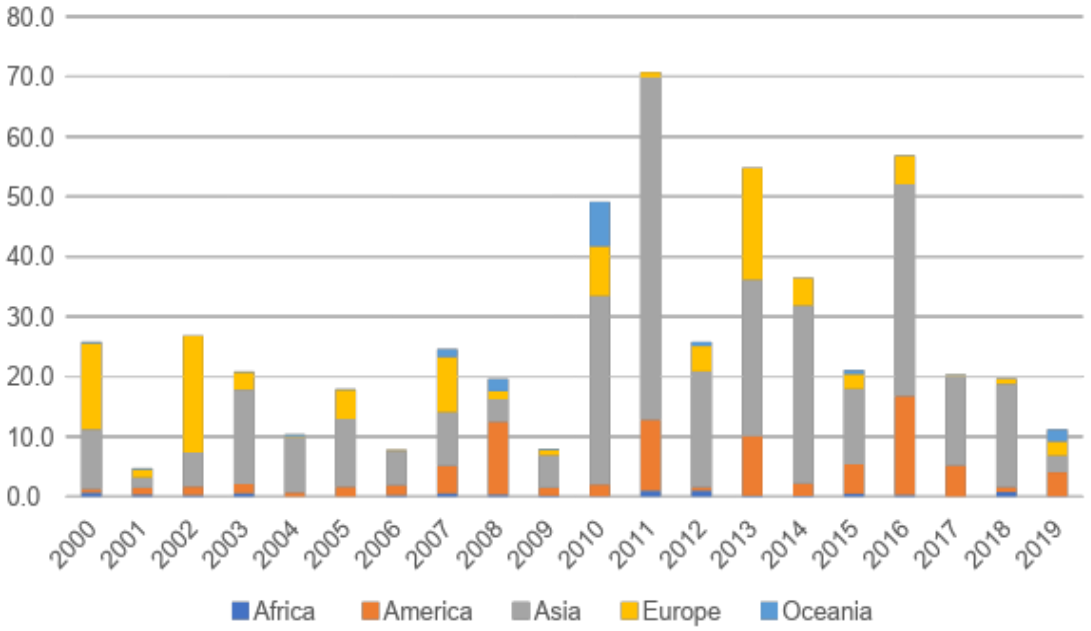
iii. Implement machine learning based flood damage assessment pipeline to generate impact outputs for vulnerable locations;

iv. Implement an end-to-end pipeline integrating the above-mentioned components.

Central to the project is the incorporation of flood model outputs and remote sensing derived products from multiple platforms to help with flood risk mitigation and increase resilience of impacted communities.



Number of Floods during 2000 – 2019
Source: https://www.emdat.be/

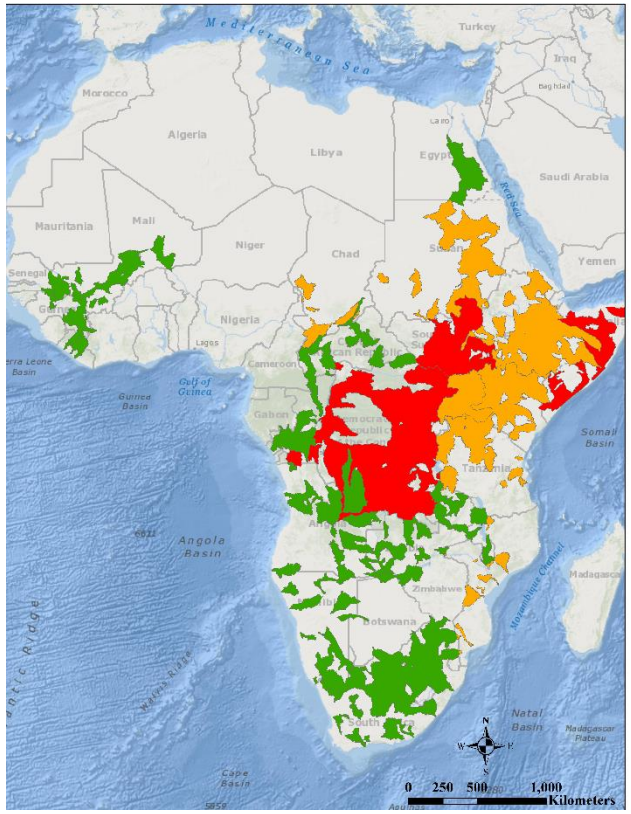


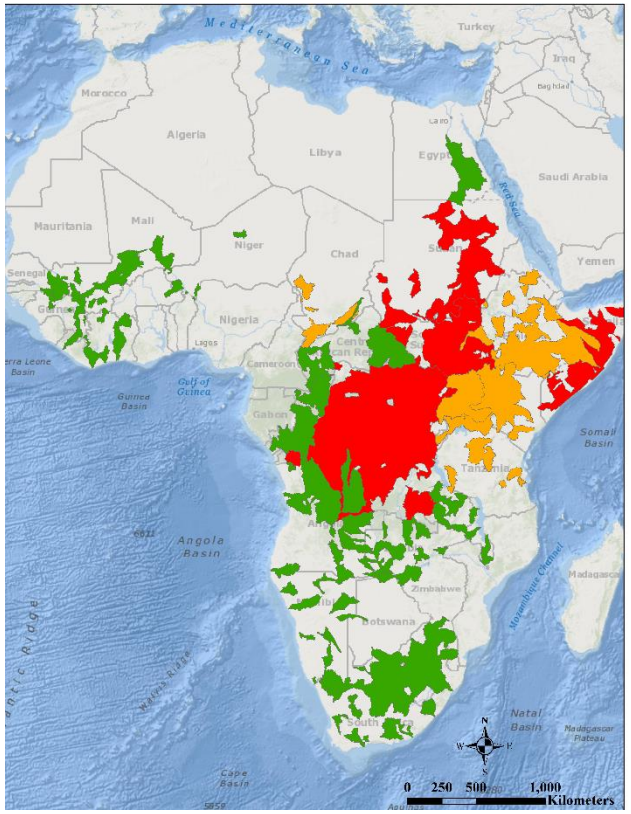
Continent Level Flood Damage (in USD Billion) During 2000 – 2019
Source: https://www.emdat.be/

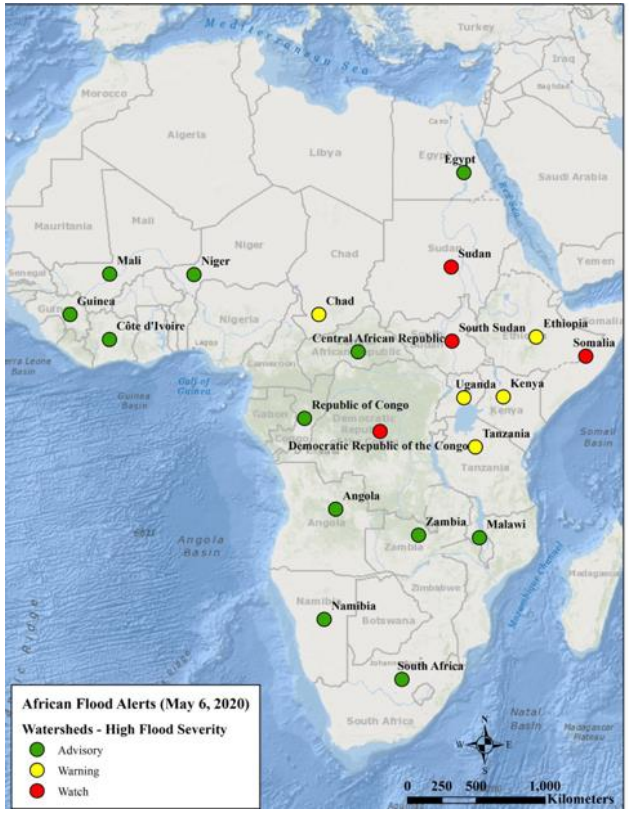
FLOODING IN EAST AND CENTRAL AFRICA SPRING 2020

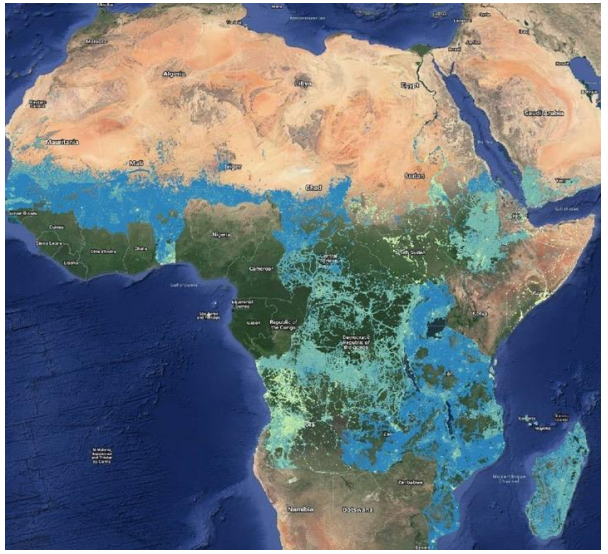
The NASA Disasters ROSES A.37 Applied Science research project "Advancing Access to Global Flood Modeling and Alerting" examined the regional flood event in Africa as a case study for testing the capabilities of their flood modeling and alerting system. The system combines model outputs from the Global Flood Monitoring System (GFMS) and the Global Flood Awareness System (GloFAS) with data on watershed risk, which is then validated using Synthetic Aperture Radar (SAR) data for flood inundation and depth, if available.

These data are being integrated into the Pacific Disaster Center (PDC) DisasterAWARE® multi-hazard monitoring, early warning, and decision support platform providing an automated source of global information on floods that is supported by a common, normalized data model.





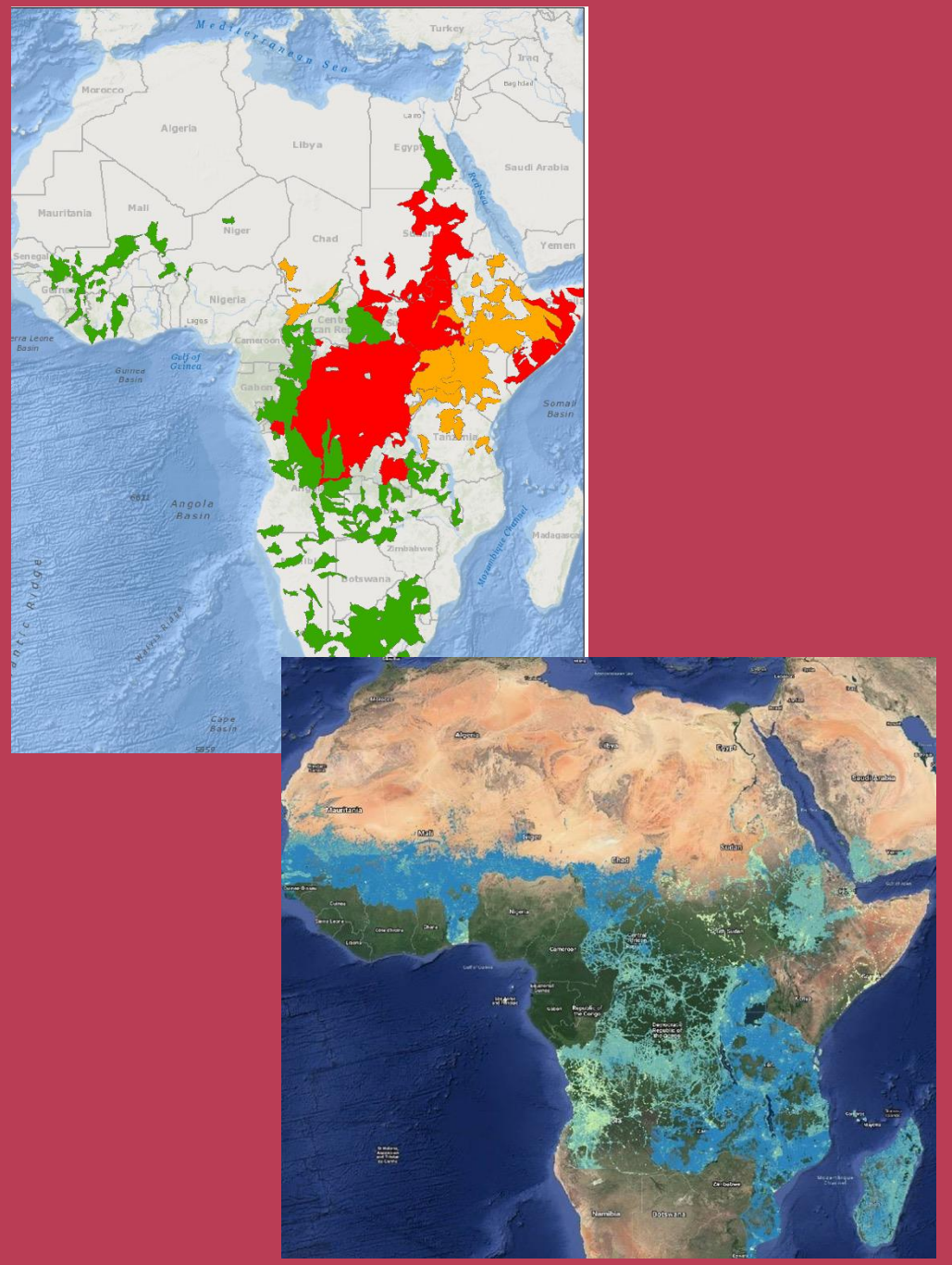




Watersheds (a, b) that are experiencing watches (red), warnings (orange), or advisories (green) are converted into alerts (c) that will be delivered to DisasterAWARE®. Exposure (d) can then be overlaid to show areas of vulnerability.

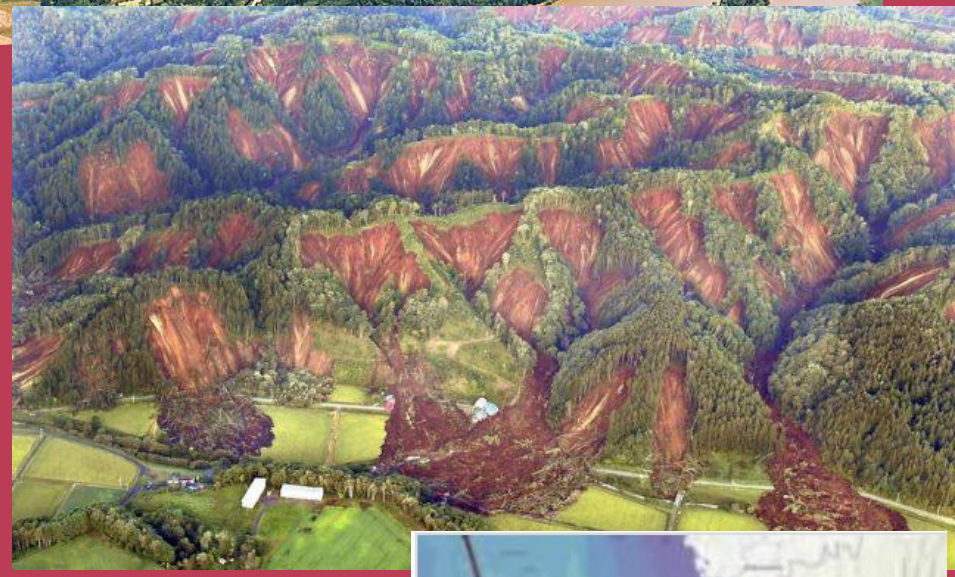
FLOODING IN EAST AND CENTRAL AFRICA SPRING 2020

- Flooding in Africa led to exposure/risk to vulnerable populations and infrastructure
- Oftentimes these risks are compounded by multiple associated events – heavy rainfall causing both flooding and landslides
- These events both lead to exposure/risk to vulnerable populations and infrastructure
- https://disasters.nasa.gov/africa-flooding-2020



FLOODING IN EAST AND CENTRAL AFRICA SPRING 2020

- Disasters A.37 ROSES projects:
  - Solicited proposals for user-centric applications research enabling risk-informed decisions and actions
  - Multidisciplinary projects which harness the convergence of expertise and collaborative partnerships.
- Bringing together three A.37 teams, we would like to investigate how cascading hazards evolve in an event
- Leveraging each of the project's expertise, we will conduct a study on an event that demonstrates these cascading hazards and allows us to investigate associated exposure
- Three projects are actively collaborating on a potential case study:
  - Advancing Access to Global Flood Modeling and Alerting
  - Development of Predictive Models to Improve Landslide Disaster Risk Reduction and Response
  - Identifying Critical Infrastructure Exposure for Disaster Forecasting, Mitigation and Response
- https://disasters.nasa.gov/portfolio

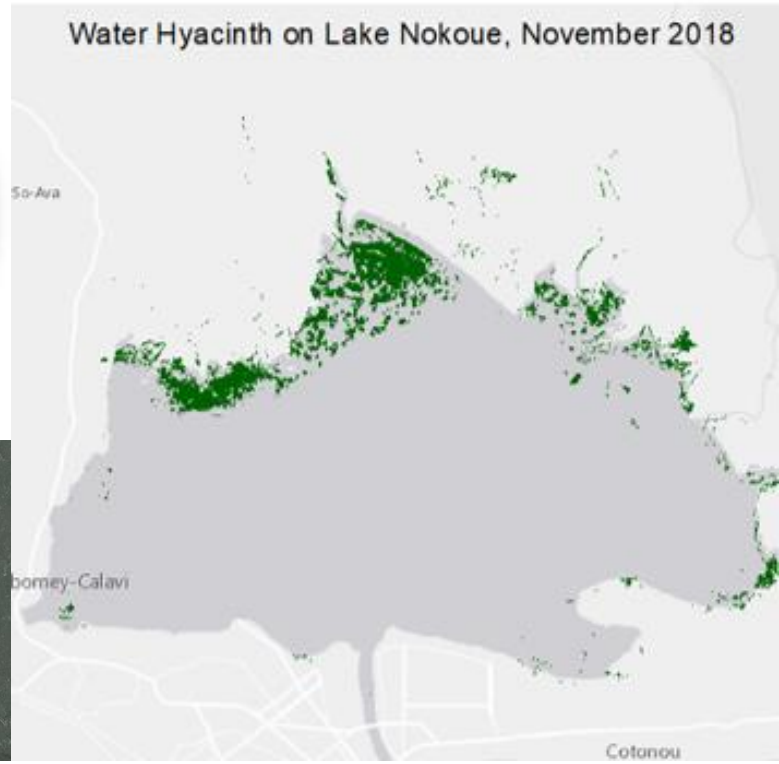


Floods and landslides can be cascading events that lead to exposure to vulnerable populations and infrastructure.

Thank You.

For further questions, please contact:
Margaret.T.Glasscoe@jpl.nasa.gov

DISASTERS



Designing Applications to Foster the Health of Terrestrial and Wetland Ecosystems in the Coastal Zone of West Africa

Professor Danielle Wood

Director, Space Enabled Research Group

ECOLOGICAL FORECASTING

SCIENTIFIC COLLABORATION BETWEEN TEAMS IN BENIN, GHANA AND THE UNITED STATES

- US Team Members: Dr. Danielle Wood, Dr. Lola Fatoyinbo-Agueh, Dr. David Lagomasino, Ufuoma Ovienmhada, Eric Ashcroft
- West African Co-Investigators: Ghana Statistical Service, Ghana Space Science and Technology Institute, CENATEL (Benin), Green Keeper Africa

CENATEL

Green Keeper Africa

GHANA SPACE SCIENCE AND TECHNOLOGY CENTRE

STATISTICAL SERVICE GHANA

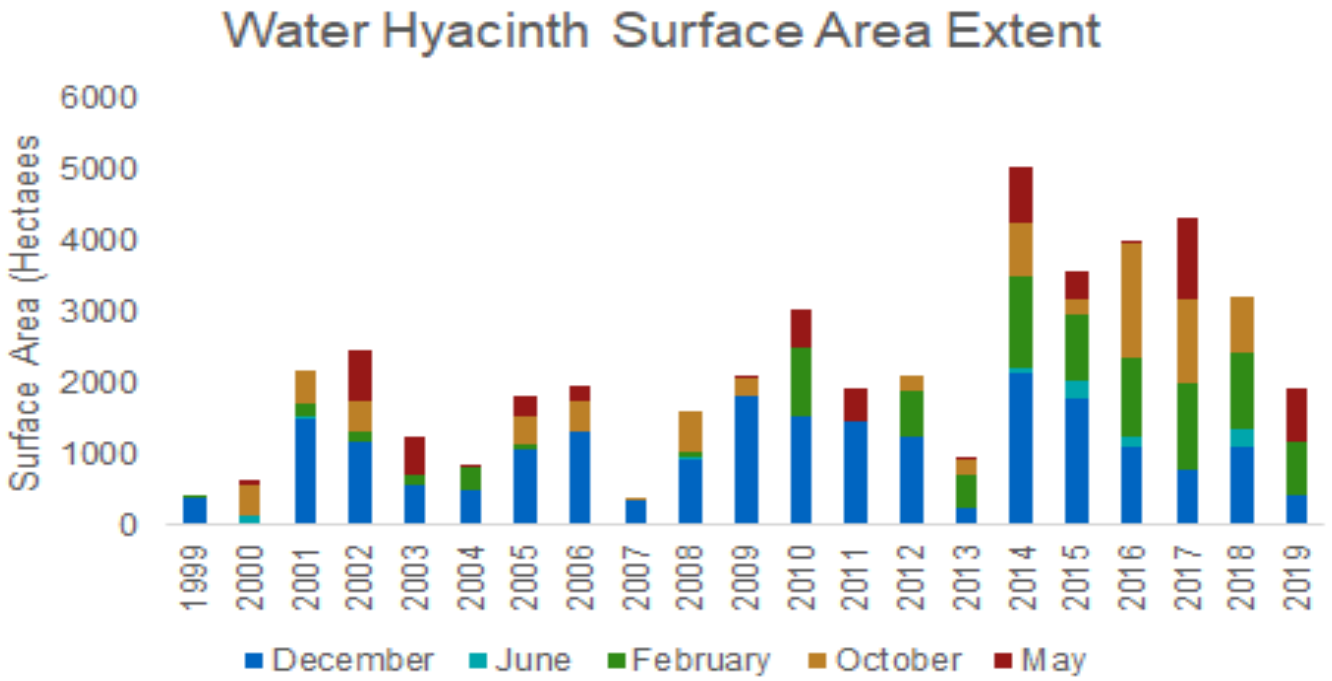
GHANA STATISTICAL SERVICE

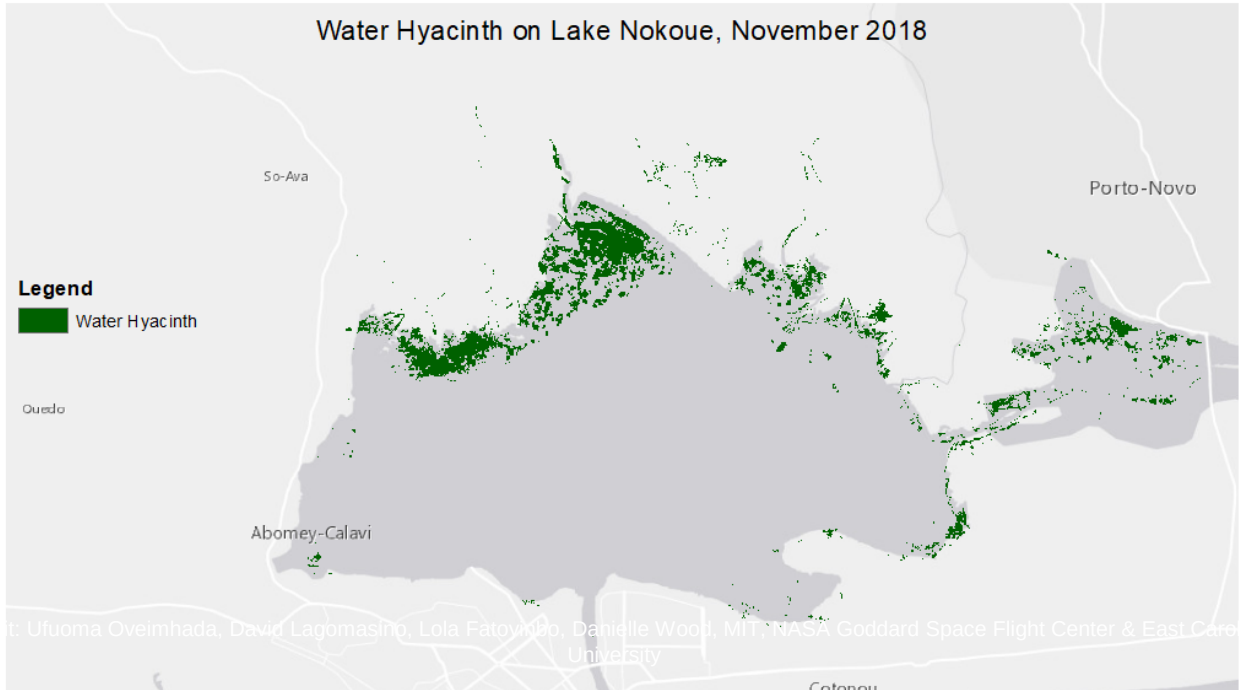
BLUE RASTER

NASA

space enabled


Green Keeper
Africa





A Flower Against Pollution

How we are collaborating with Green Keeper Africa to monitor an invasive plant that is used to clean oil-based waste

Green Keeper Africa

Green Keeper Africa is an entrepreneurial company based in Cotonou, Benin. They pay local community members to harvest the invasive water hyacinth plant and convert it into kits that absorb oil pollution caused by industry. Their work improves the environment and creates a new eco-friendly source of income.
Green Keeper Africa has invited Space Enabled to work together to create an Observation System for Invasive Plants to monitor the water hyacinth and its impact on the community.

Satellite Earth Observation

Space Enabled is working with Green Keeper Africa to use imagery and measurements from earth observation satellites to monitor the water hyacinth. We are combining information from government and commercial satellites that show how the water hyacinth grows and drifts through rivers and lakes.

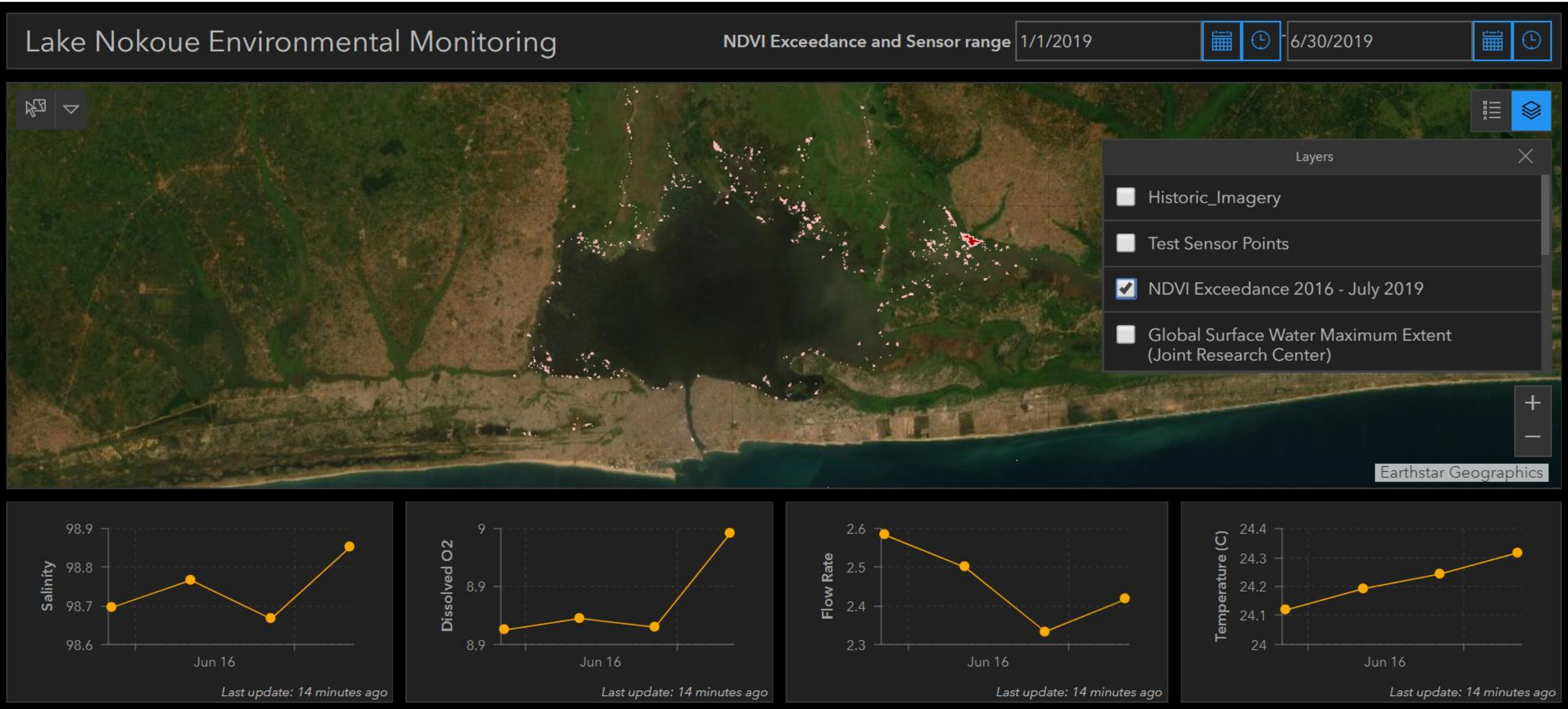
Aerial Earth Observation

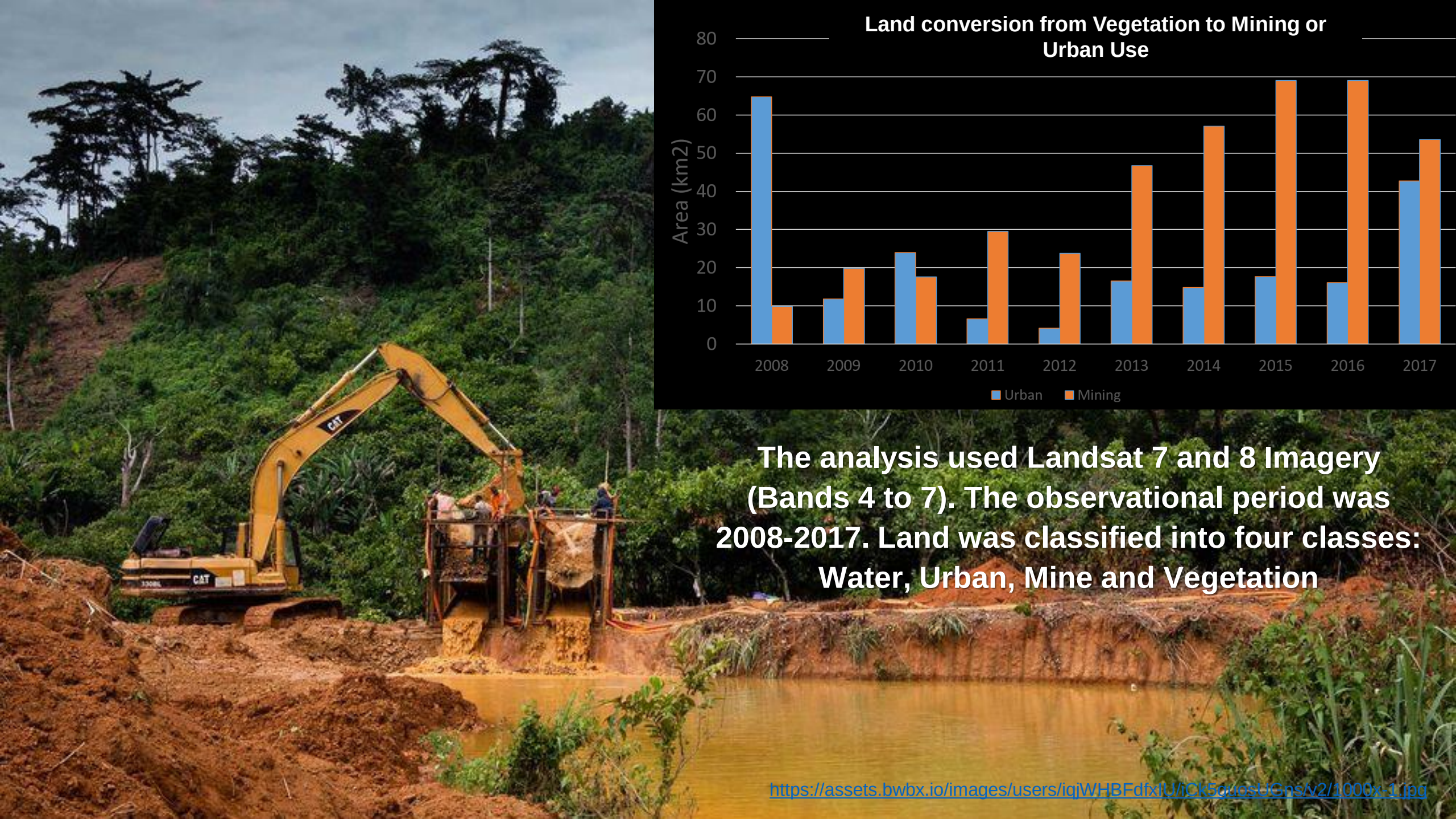
Space Enabled is exploring with Green Keeper Africa how they might use cameras mounted on radio controlled planes, drones, solar air balloons or kites to track the growth of the invasive water hyacinth plant.

Measuring

The growth of the invasive water hyacinth plant is impacted by environmental factors such as the temperature, salinity and nutrient content of the water as well as local weather patterns. Space Enabled is working with Green Keeper Africa to explore how they can use sensors placed in local water ways to measure environmental changes. In the long term, these measurements may help Green Keeper Africa predict where the invasive water hyacinth plant will bloom.

DESIGNING AN OPEN ENVIRONMENTAL OBSERVATORY FOR LAKE NOKOUE IN COTONOU, BENIN

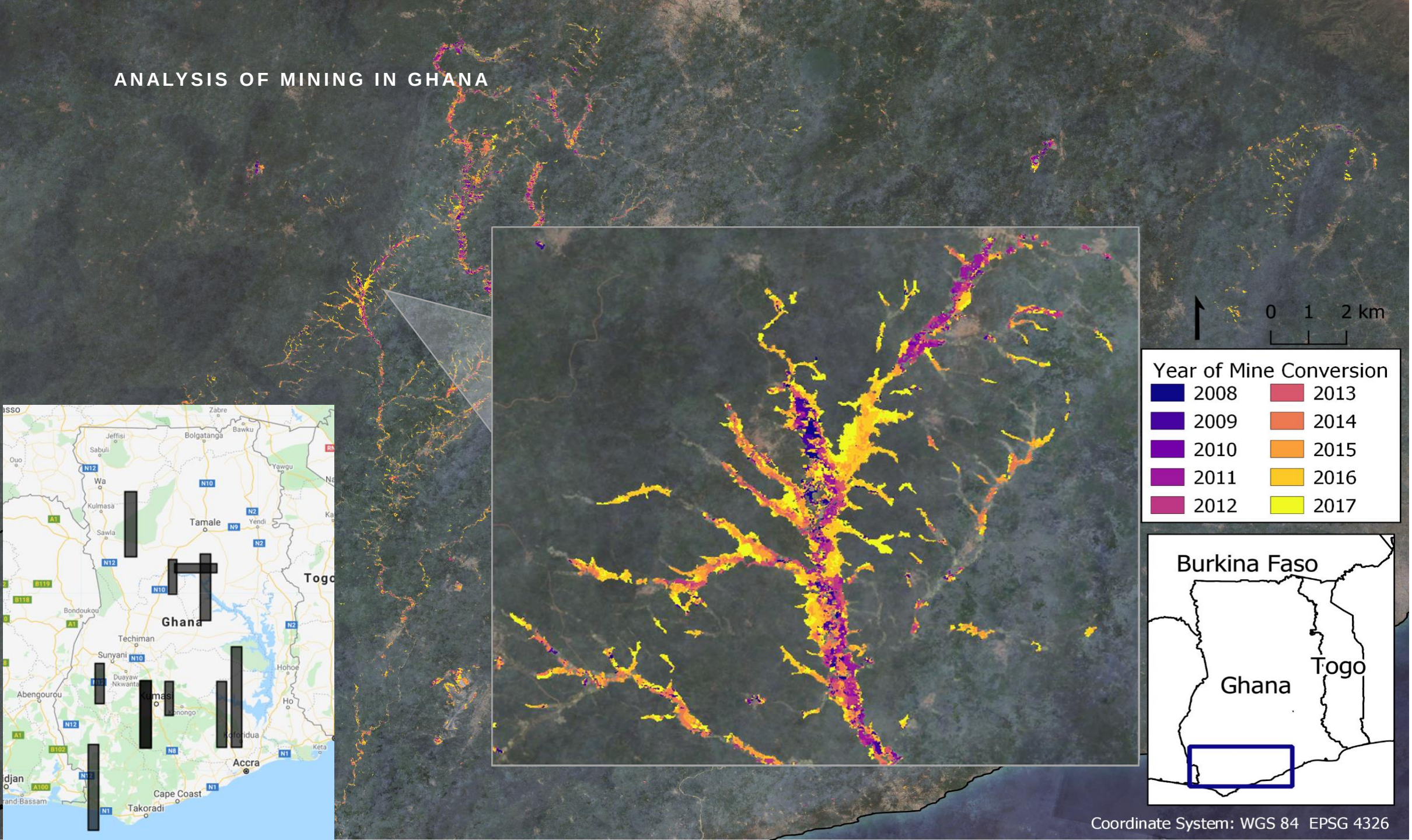




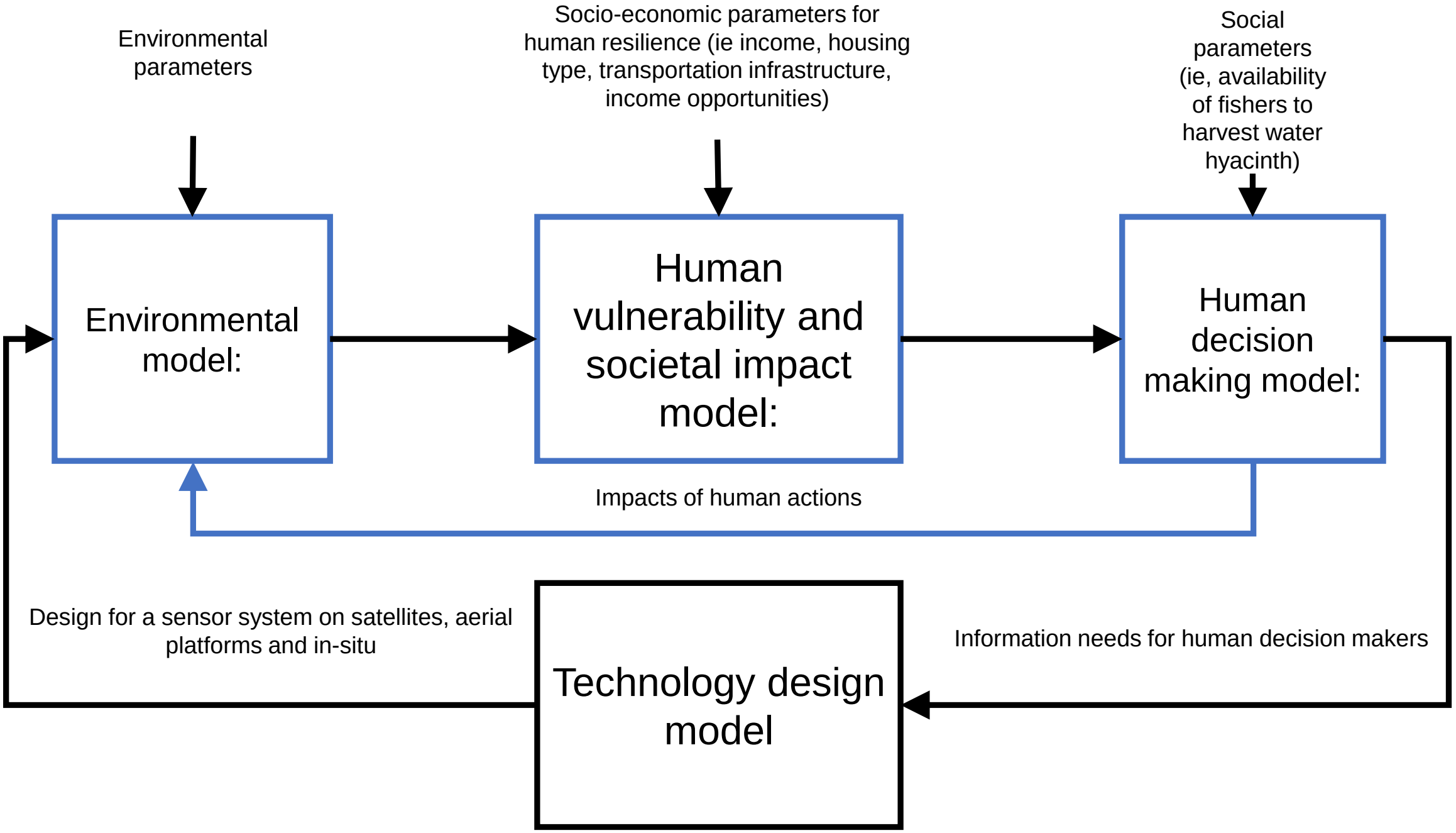
The analysis used Landsat 7 and 8 Imagery (Bands 4 to 7). The observational period was 2008-2017. Land was classified into four classes: Water, Urban, Mine and Vegetation

https://assets.bwbx.io/images/users/iqjWHBFdfxIU/iCk5quosUGns/v2/1000x-1.jpg

ANALYSIS OF MINING IN GHANA



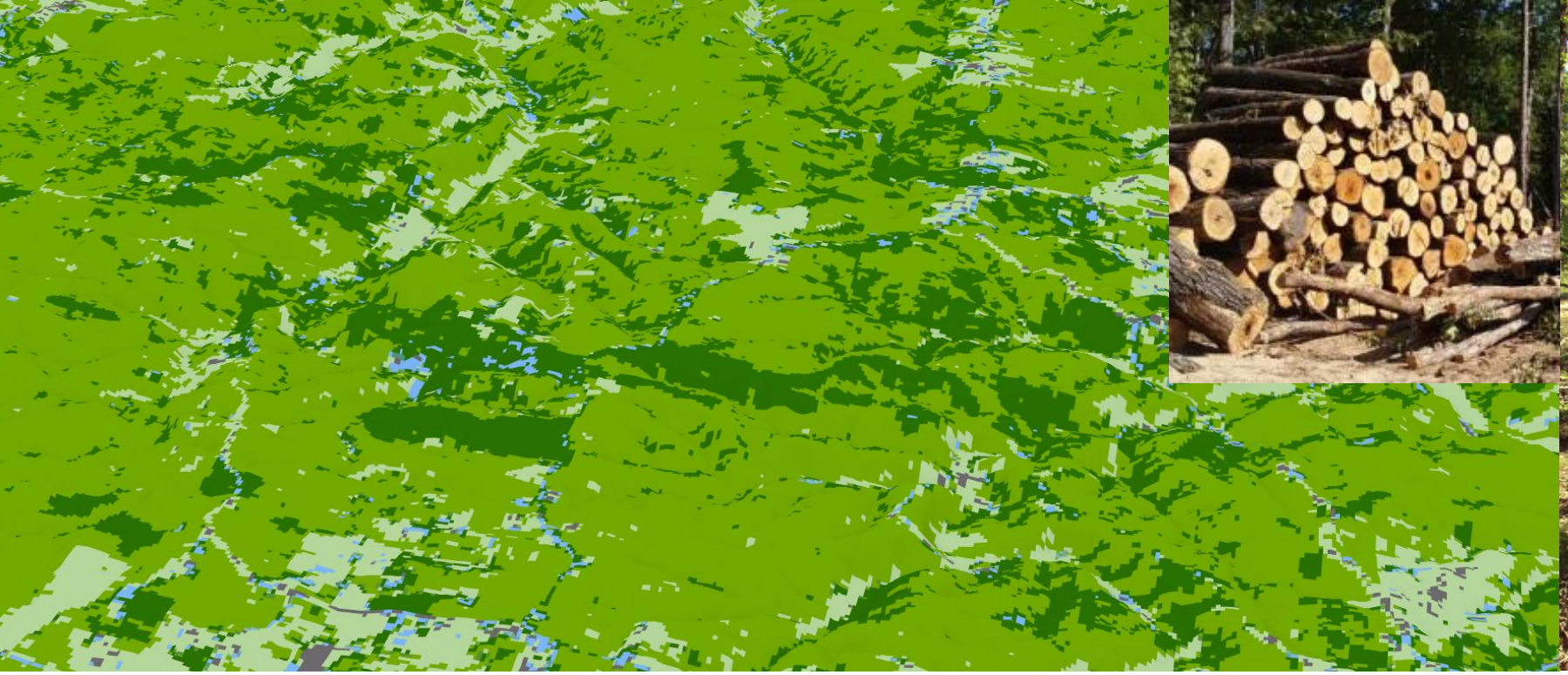
Credit: Amanda Payton, Abigail Barenblitt, David Lagomasino, Lola Fatoyinbo, NASA Goddard Space Flight Center & East Carolina University


Environmental parameters
Socio-economic parameters for human resilience (ie income, housing type, transportation infrastructure, income opportunities)
Social parameters (ie, availability of fishers to harvest water hyacinth)
Environmental model:
Human vulnerability and societal impact model:
Human decision making model:
Impacts of human actions
Design for a sensor system on satellites, aerial platforms and in-situ
Technology design model
Information needs for human decision makers

Thank You.

For further information, please visit:
spaceenabled.media.mit.edu

ECOLOGICAL
FORECASTING



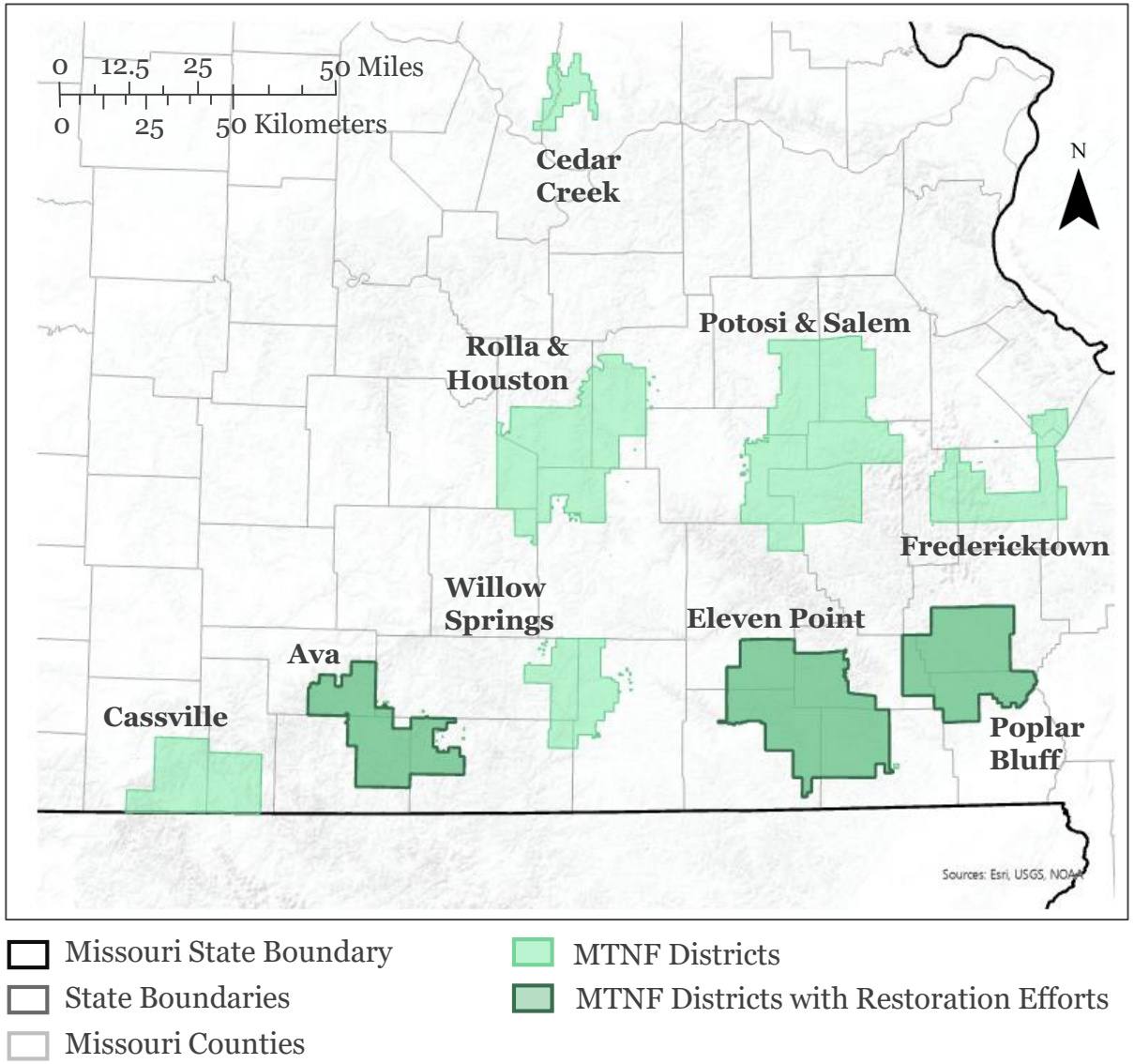
Mark Twain Ecological Forecasting:
Utilizing NASA Earth Observations to Classify Ground Cover Types in Mark Twain National Forest

Sarah Hafer*, Kaitlyn Bretz, Madison Bradley, Grant Verhulst

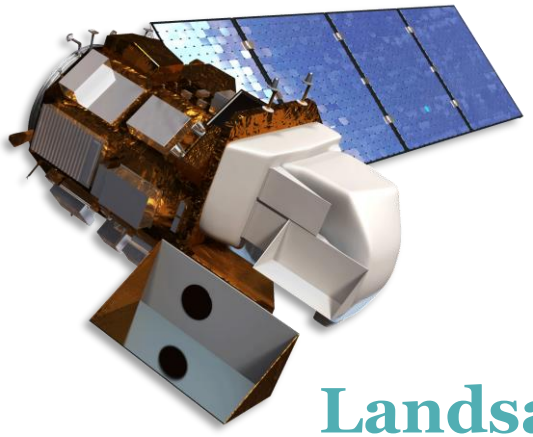
CAPACITY BUILDING

The identification of shortleaf pine loss and eastern red cedar encroachment can assist partners at the US Forest Service with efficient, targeted restoration.

- **Project Partner**: USDA, US Forest Service
- **Study period**: 1986-2020
- **Ongoing Restoration Efforts**:
  - Shortleaf Pine-Oak Woodland Restoration
  - Glade Restoration
- **Objectives**:
  - *Classify* land cover types from 1986-2020
  - *Forecast* changes in land cover out to the year 2040



Landsat 5 TM
Thematic Mapper



Landsat 8 OLI
Operational Land Imager

Data Acquisition

- Google Earth Engine
  - Landsat 5 TM
  - Landsat 8 OLI
- National Elevation Data

Image Processing

- Composite Images & Indices (NDVI, EVI, NDWI)
- Digital Elevation Model
- Aspect
- Slope

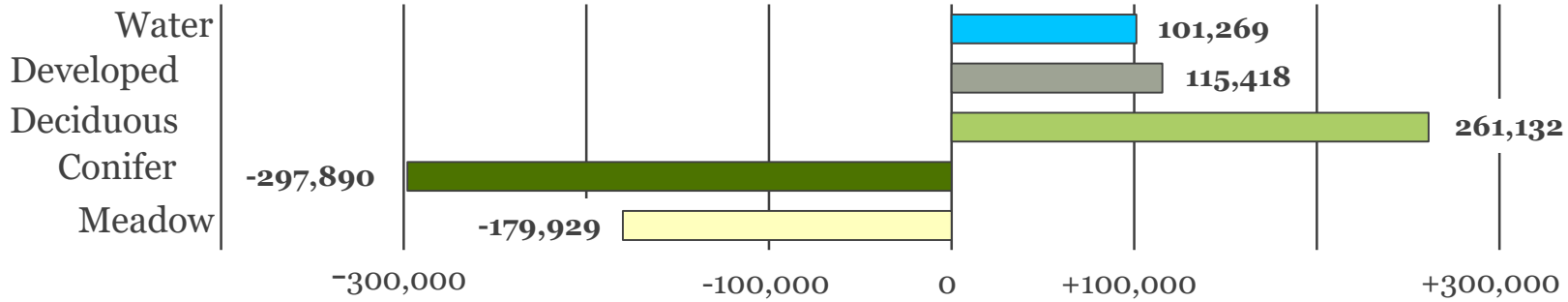
Supervised Classification

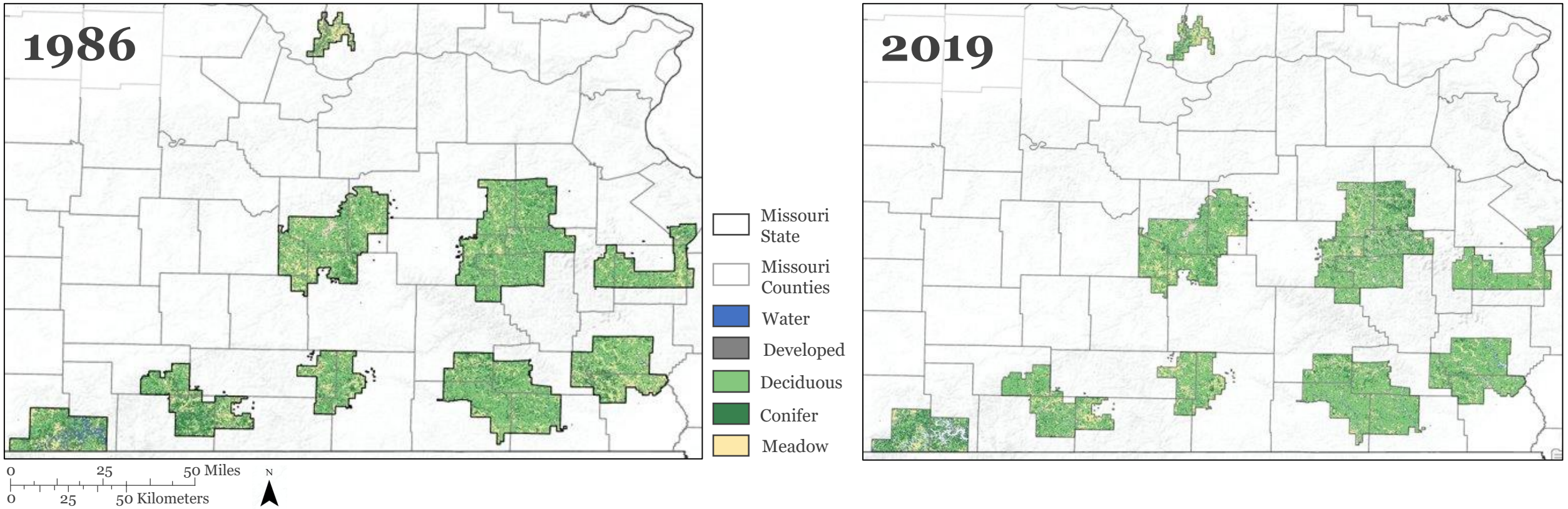
- 5 Land Cover Classes
  - Conifer forest, deciduous forest, meadow (grassland/cropland), developed, water

Ecological Forecasting

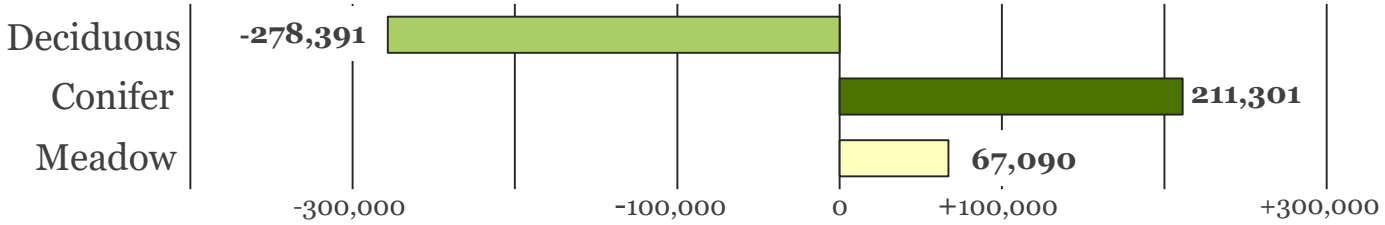
- Land Change Modeler & Predictions
  - 1986 – 2019 Land Change Analysis
  - 2019 – 2040 Prediction

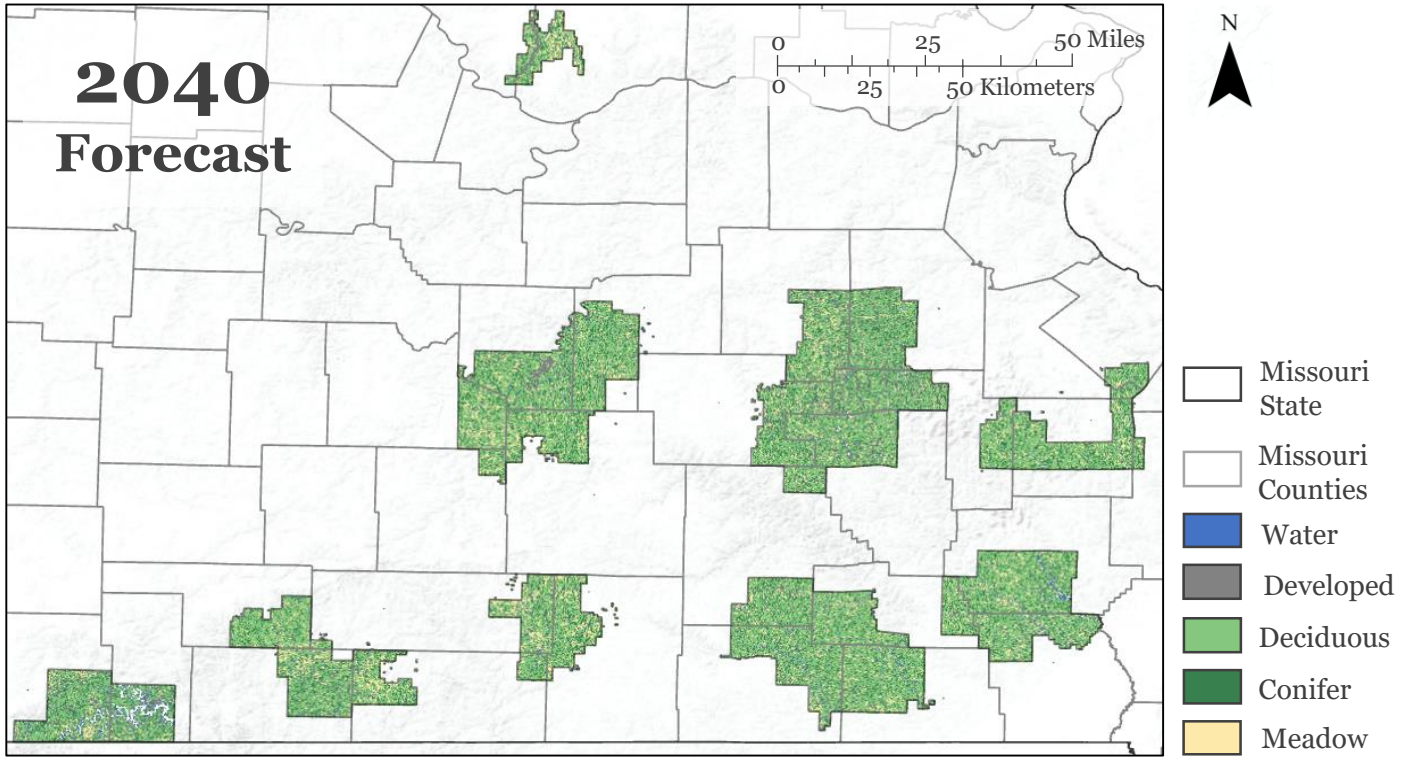
Net Land Cover Change (acres): 1986 - 2019



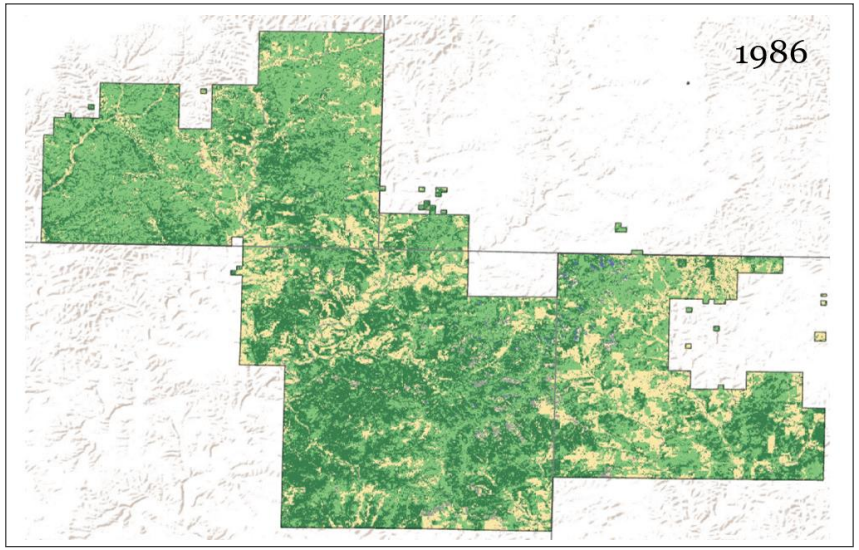


Net Land Cover Change (acres): 2019 - 2040

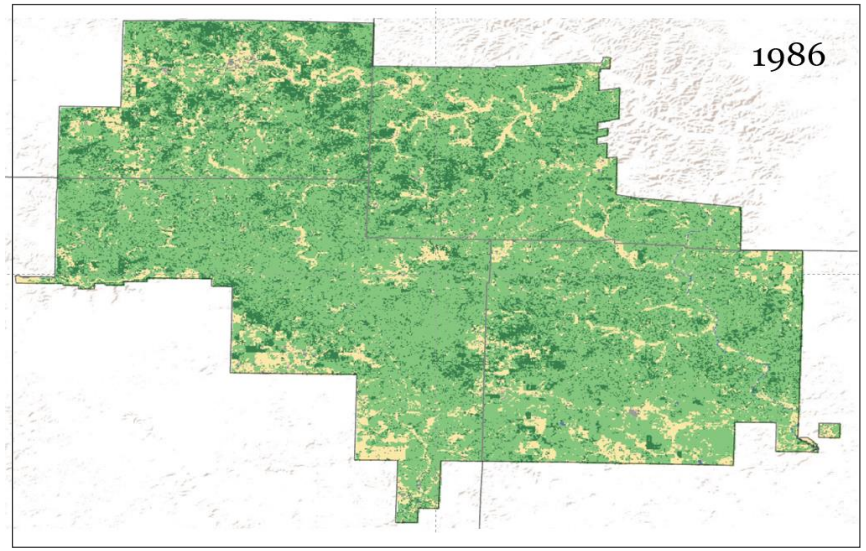




Ava District



Eleven Point District

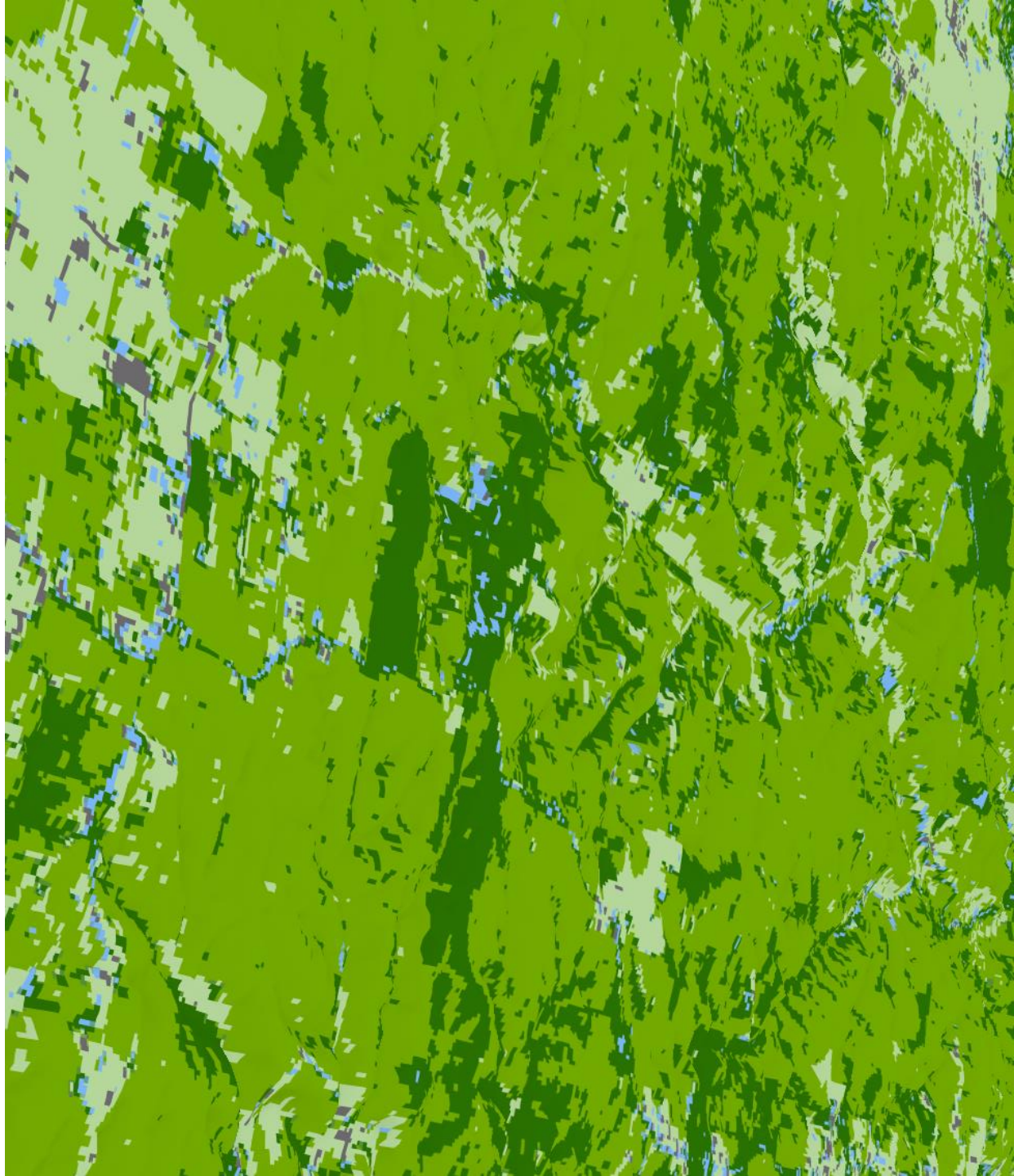


Thank You.

For further questions, please contact:
us at NASA-DL-DEVELOP@mail.nasa.gov

https://develop.larc.nasa.gov

EARTH SCIENCE
APPLIED SCIENCES



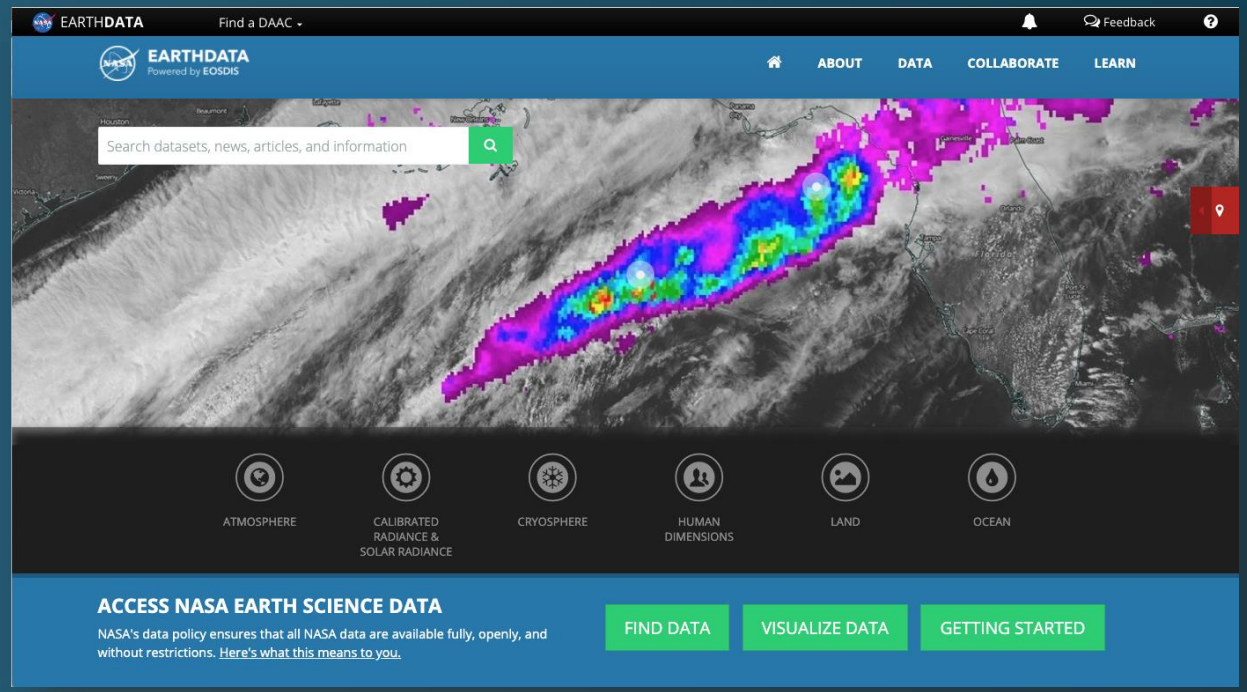
National Aeronautics and Space Administration

EXPLORE EARTH

Kevin Murphy
Program Executive Earth Science Data Systems
7/29/2020

Earth Science Data System Program (ESDS)

The Earth Science Data System Program is an essential component of the Earth Science Division and is responsible for:



- **Actively** managing NASA's Earth science data (Satellite, Airborne, and Field).
- Developing **unique** data system capabilities optimized to support rigorous science and applied science users.
- **Processing** (and **reprocessing**) instrument data to create high quality long-term Earth science data records.
- Upholding NASA's policy of **full and open sharing** of all data, tools, and ancillary information for all users.
- **Engaging** the Earth science community in the evolution of data systems.
- Providing high quality **user services and training** for researchers and applied scientists.

The Earth Science Data and Information System (ESDIS) project/GSFC maintains and operates a data and information system. The Inter-Agency Implementation and Advanced Concepts Team (IMPACT) at MSFC supports the ESDS Program and collaborates with ESDIS project.

Growing Archive

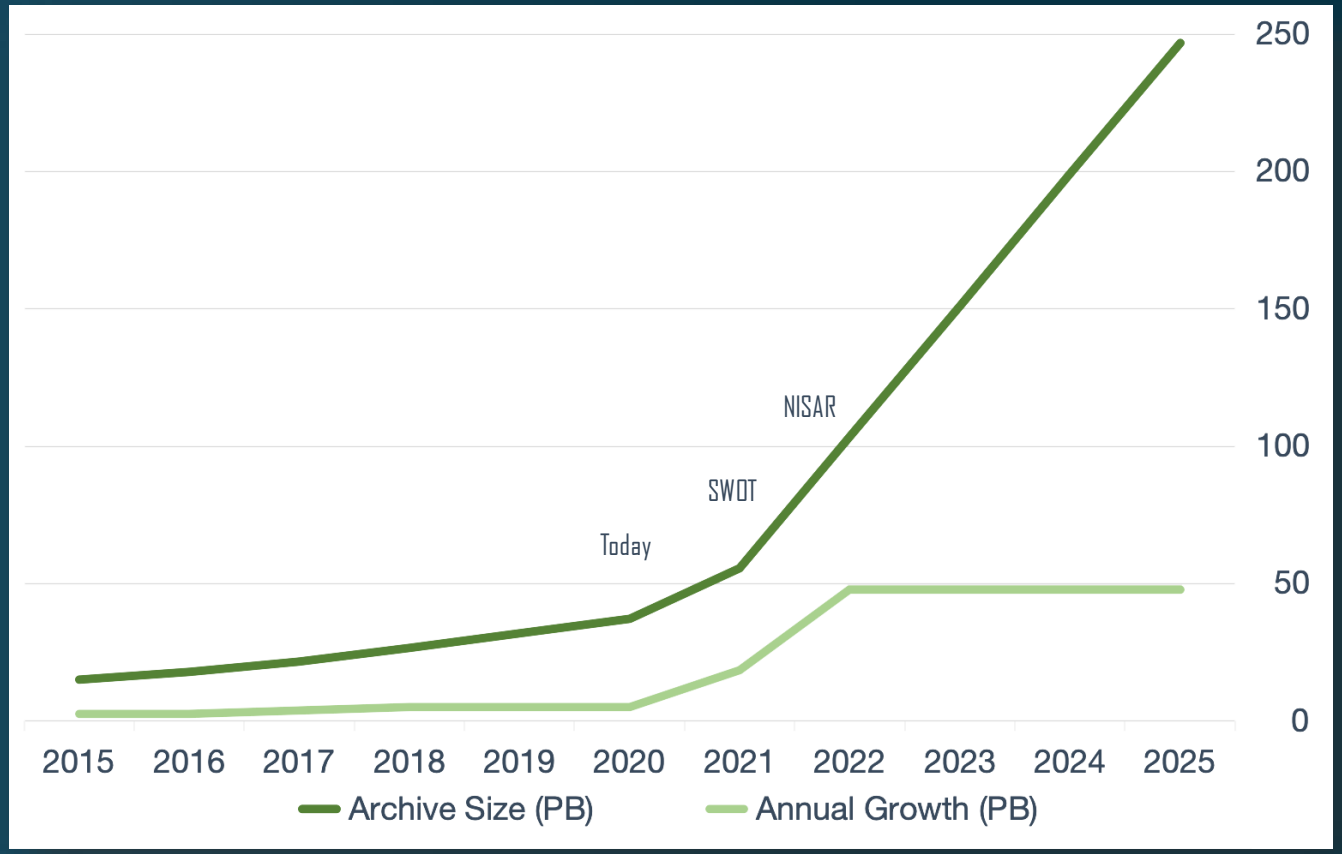
New approaches are needed to manage systems and make data available

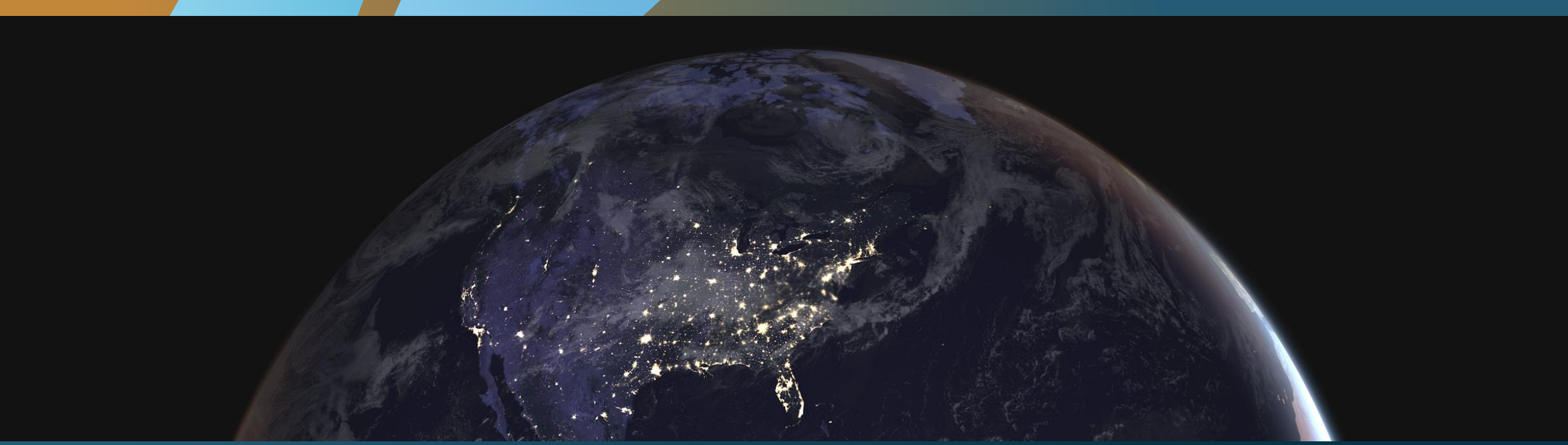
Cloud

Machine Learning

Training/User Services

Partnerships





Earthdata Cloud

Improve the efficiency of NASA's data systems operations – continues free and open access to data

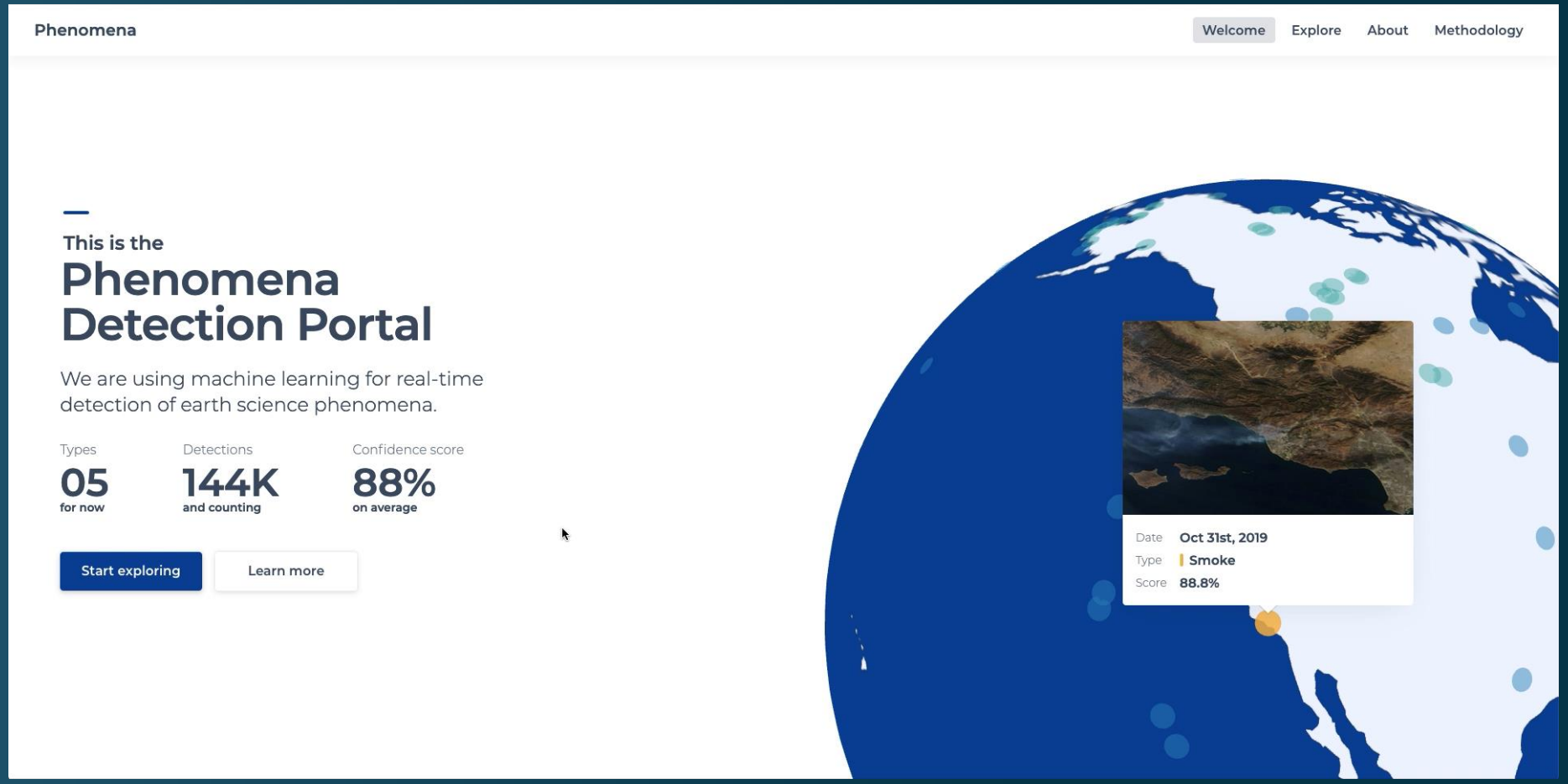
Prepare for planned high-data-rate missions

Increase opportunity for researchers, applied scientists and commercial users to access/process PBs of data quickly without the need for data management

Extendable open source processing framework

Prototype ML Efforts - Phenomena Detection

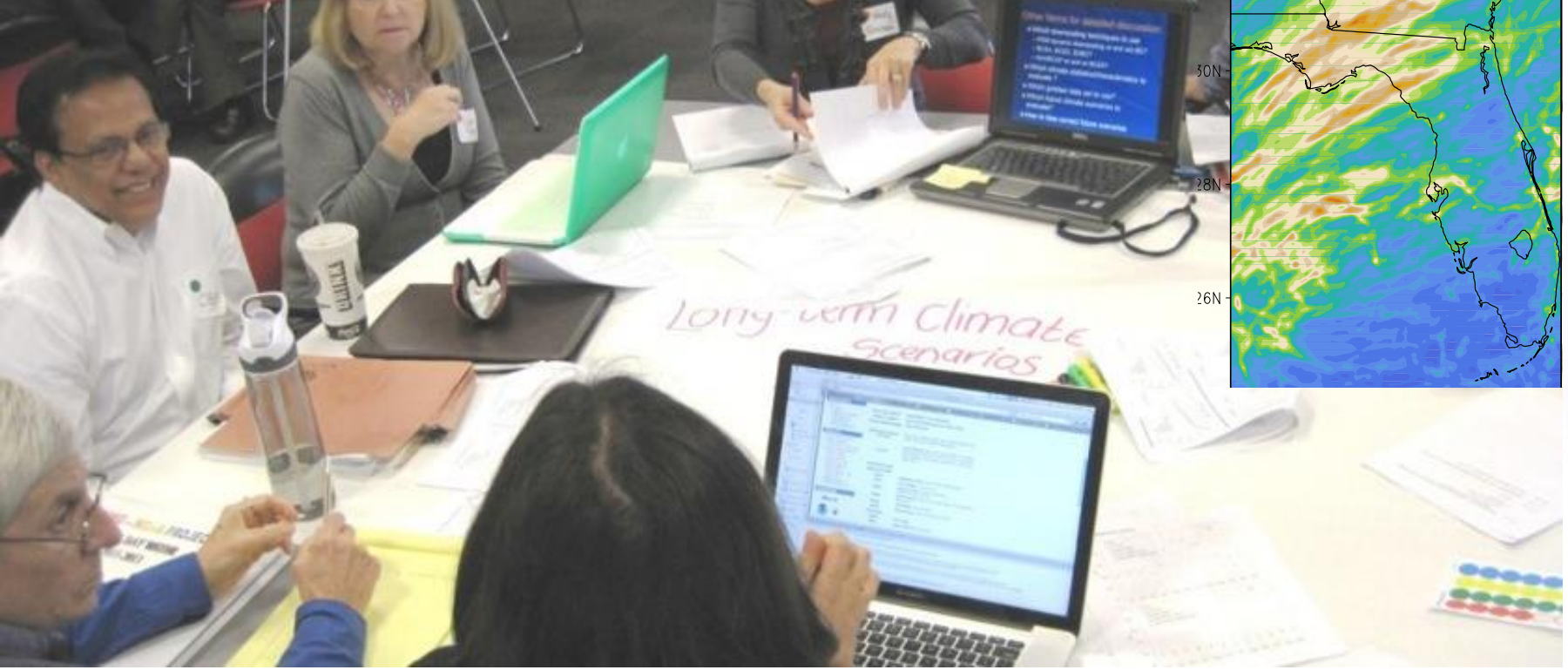
- Discover and store interesting events using ML algorithm
- Use event space/time parameters to enable search for relevant datasets
- Leverage Cumulus framework to run ML operationally
- Utilize GIBS server for image



http://phenomena.surge.sh/

Thank You

Kevin.J.Murphy@nasa.gov



UF UNIVERSITY of FLORIDA

Peace River Manasota Regional Water Supply Authority

COAPS Florida State University Center for Ocean-Atmospheric Prediction Studies

TAMPA BAY WATER

www.FloridaWCA.org

Integrating NASA Earth Systems Data into Decision-Making Tools of Member Utilities of the Florida Water and Climate Alliance

Christopher J. Martinez, University of Florida

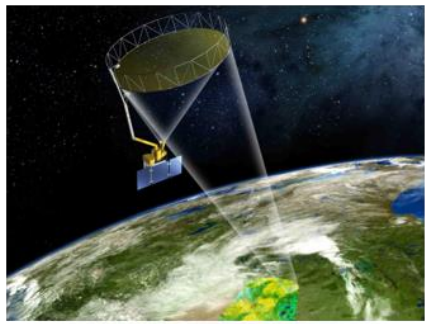
WATER RESOURCES

THE FLORIDA WATER AND CLIMATE ALLIANCE

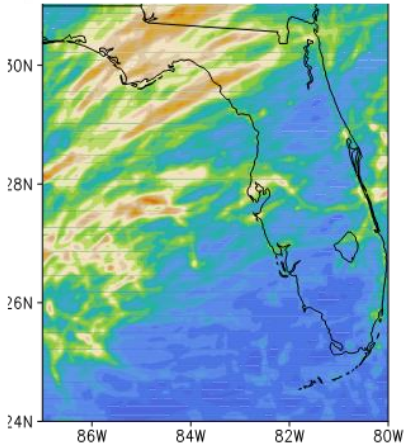
- Formed in 2010
- Stakeholder-Scientist partnership of:
  - Water utilities
  - State agencies
  - Researchers
  - Local governments
- 21 workshops
- **Goal**: Increase usability and adoption of climate information

www.FloridaWCA.org

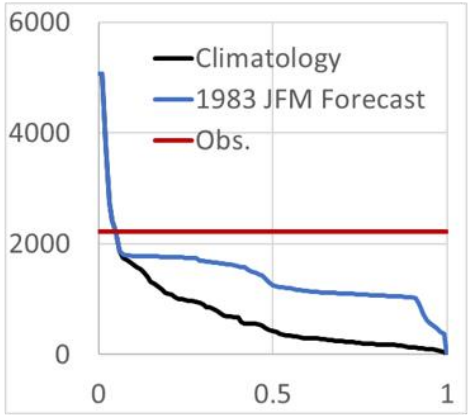
Remotely Sensed Soil Moisture, LAI



Regional Seasonal Climate Forecasts

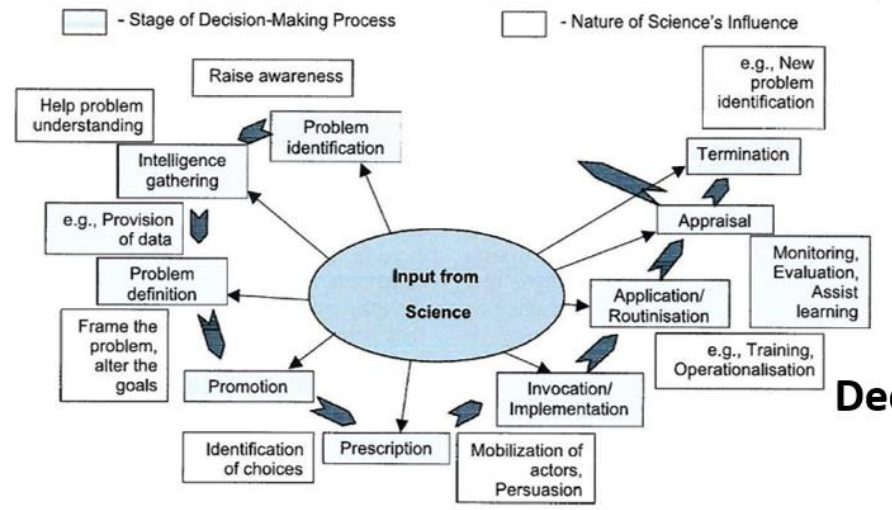


Seasonal Hydrologic Forecasts



Source Allocation

Decision Making Process



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Peace River Manasota Regional Water Supply Authority

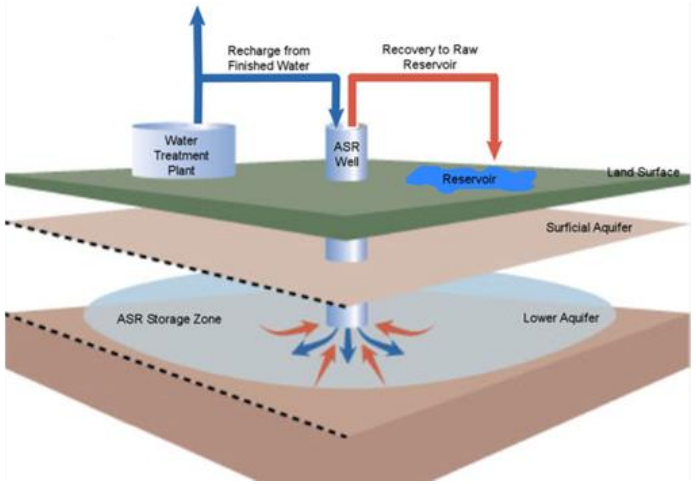
COAPS Florida State University Center for Ocean-Atmospheric Prediction Studies

TAMPA BAY WATER

www.FloridaWCA.org

MOTIVATION

- Florida has distinct wet and dry seasons
- Historically, most of Florida was dependent on groundwater for municipal supply
- Utilities are now using multiple sources to minimize environmental impacts of over-extraction of groundwater, e.g.:
  - Aquifer Storage and Recovery (ASR)
  - River withdrawals, off-line reservoirs, desalination plants



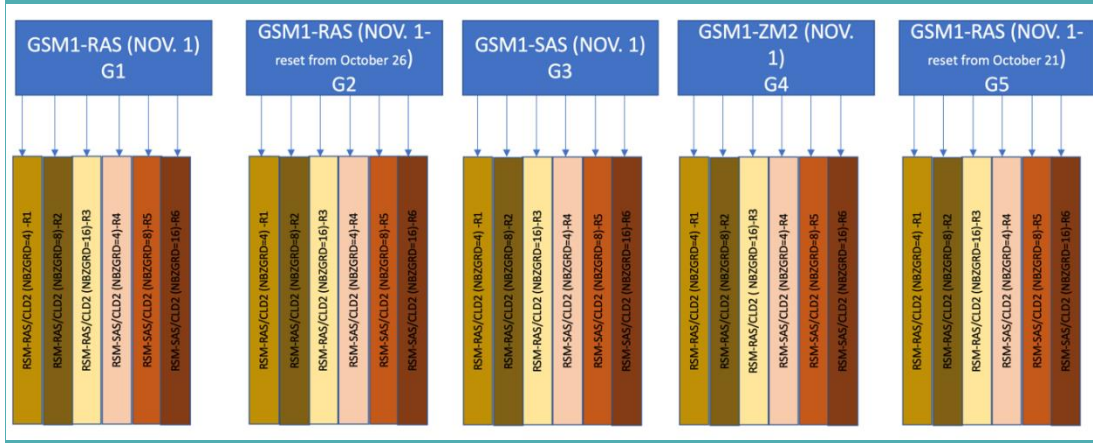
- How to use the right source of water at the right time in order to minimize costs and environmental impacts?

PROGRESS YEAR 1

- 2000-2019 Regional Climate Forecasts for:
  - November, December, January
  - December, January, February
  - 10 km resolution

- 5 Global Climate Models (GCMs) x 6 Regional Climate Model (RCM) forecasts = 30 ensemble members

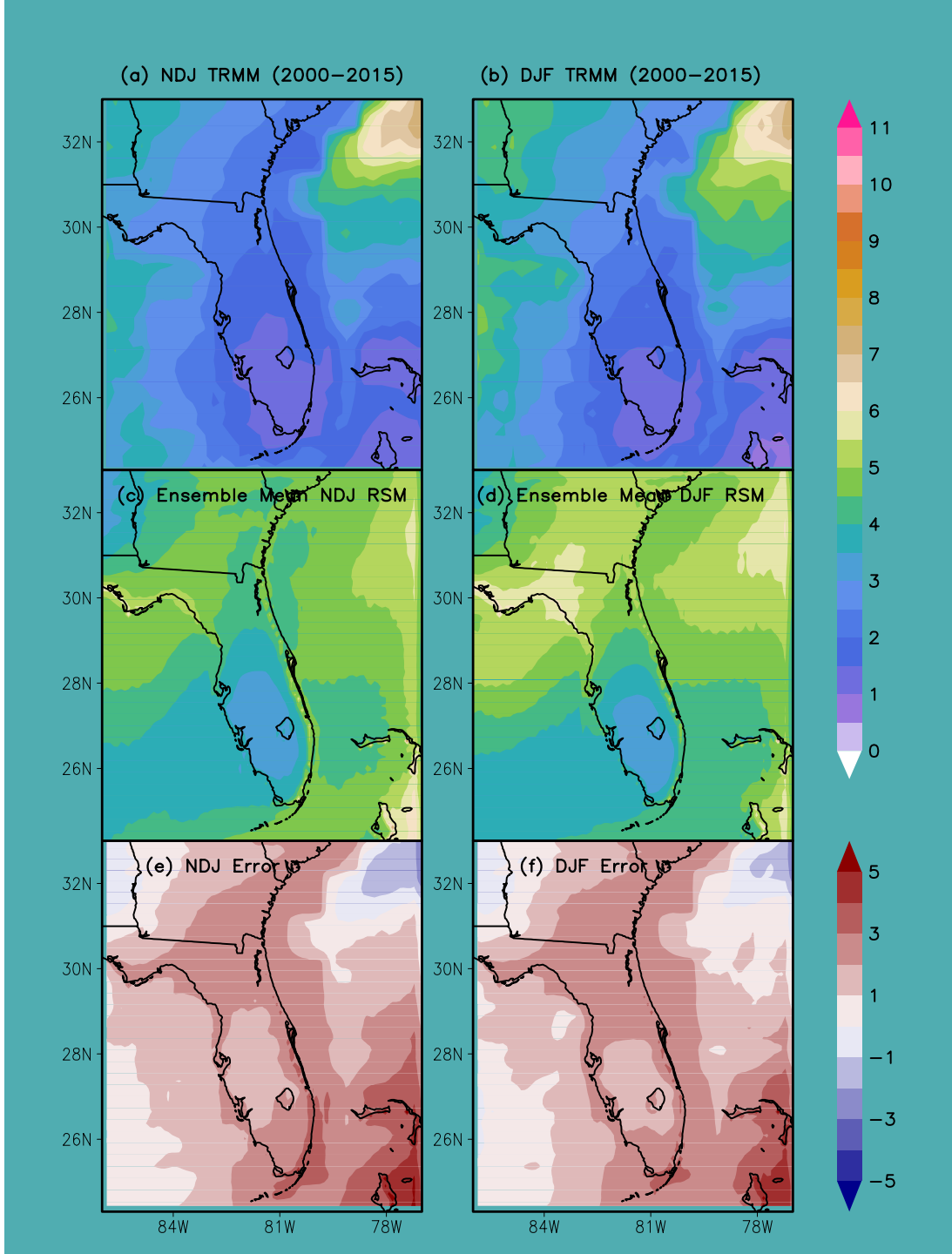
- Daily and Monthly Data for **32 variables** are available at: https://data.coaps.fsu.edu/pub/abhardwaj/PR/G_RSM/



PROGRESS YEAR 1

- Seasonal Mean precipitation for November-January and December to February forecasts compared to TRMM precipitation
  - Top row: TRMM precipitation
  - Middle row: Mean regional climate forecasts
  - Bottom row: Error between forecasts and TRMM

- These forecasts will be the baseline to compare improvement of Regional Climate Forecasts initialized with remotely sensed soil moisture

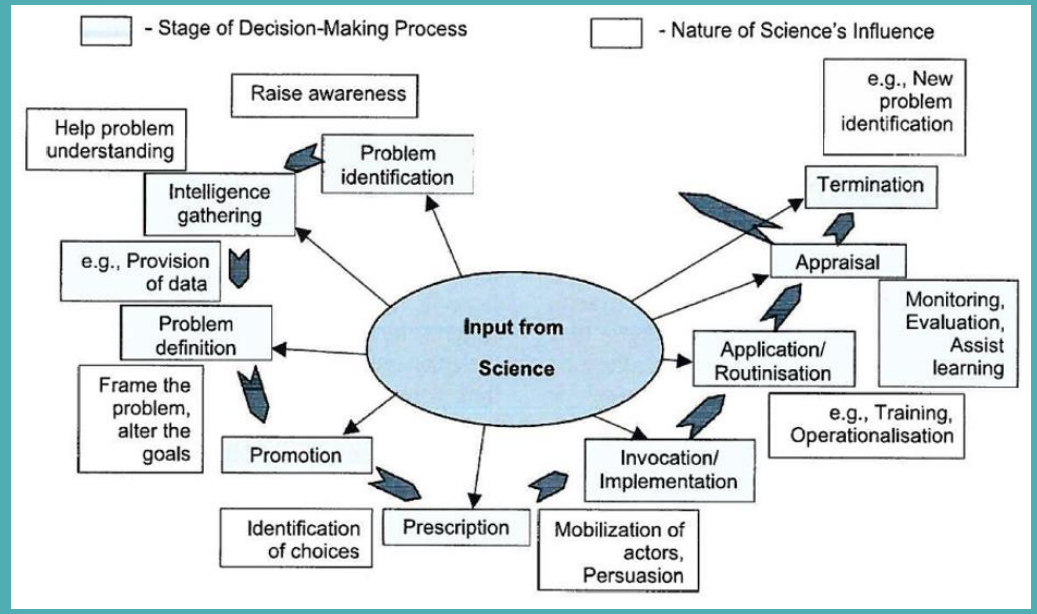


INTEGRATION OF FORECASTS INTO OPERATIONS

- Multiple hydrologic models
  - Statistical and Physical

- Aquifer Storage and Recovery (ASR) Index
  - Multiple inputs (including drought status, current streamflow, and Climate Prediction Center outlooks)
  - When to turn on the ASR wells?

- Assessment of the process, implementation and effectiveness of integration into decision-making
  - Where, and how does scientific input have an impact on adoption?
  - Don't "Build it First" and then hope it gets used…
  - What are the impacts of our champions?



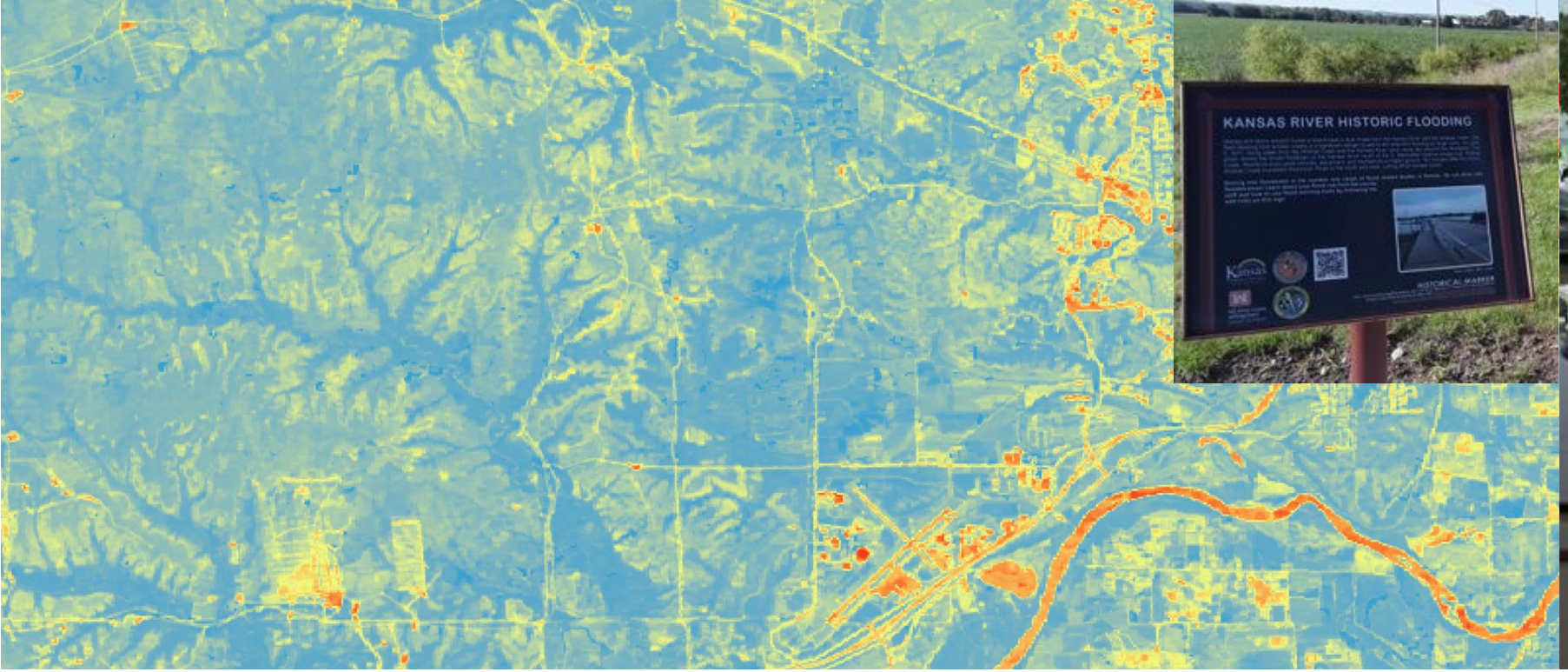
Thank You.

For further questions, please contact:
chrisjm@ufl.edu

2010

2019

WATER
RESOURCES



Riley County Water Resources: Comparing Curve Calculation Methods to Inform Local Resiliency Initiatives in Riley County, Kansas

Trista Brophy, Ella Griffith, Elizabeth Nguyen, Adelaide Schmidt

CAPACITY BUILDING

Community Concerns

- Flooding
- Increased surface runoff
- Changes in land use and land cover (LULC)

Project Parnters

- The City of Manhattan, Kansas
- Riley County Department of Planning and Development
- Kansas Department of Health and Environment
- Kansas Forest Service
- Riley County Conservation District
- Kansas State University

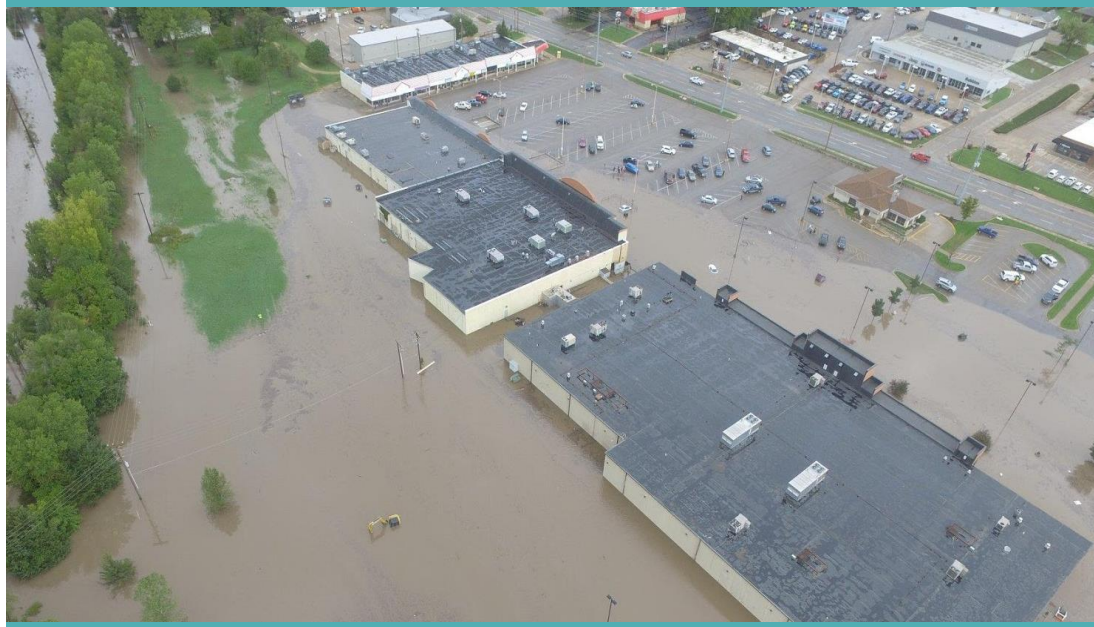


Image credits: Riley County PD and Kyle Powers

METHODOLOGY

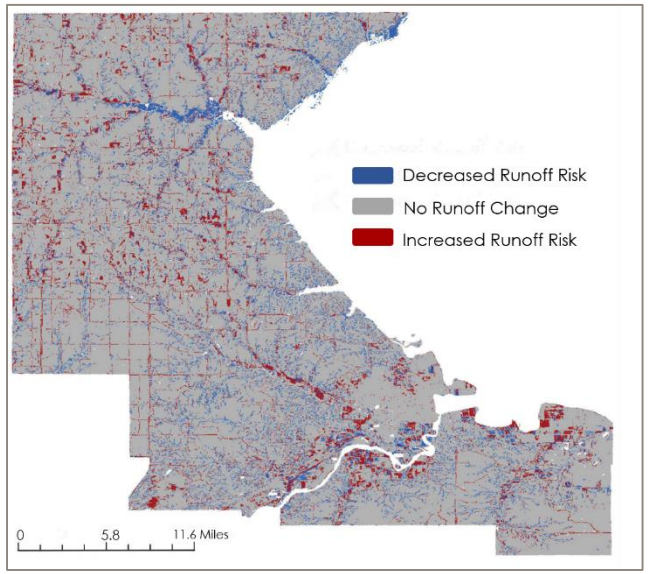
Conventional Curve Number

Synthetic land use/land cover maps

Slope map to determine farming practices

Hydrological soil group map

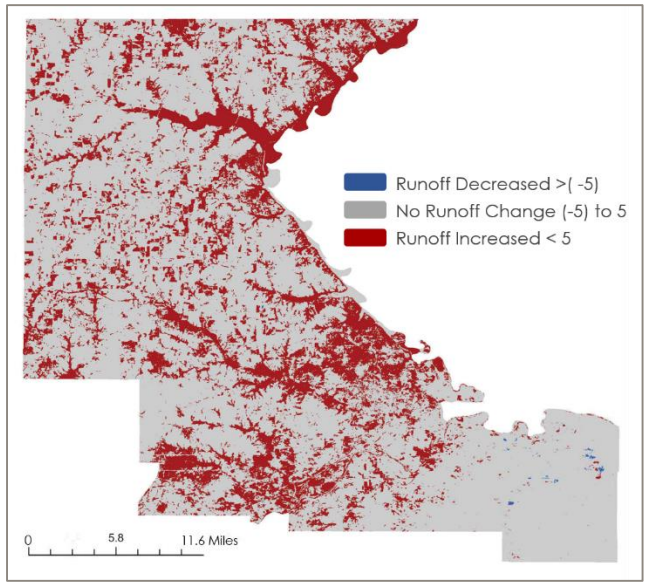
CN Lookup Table

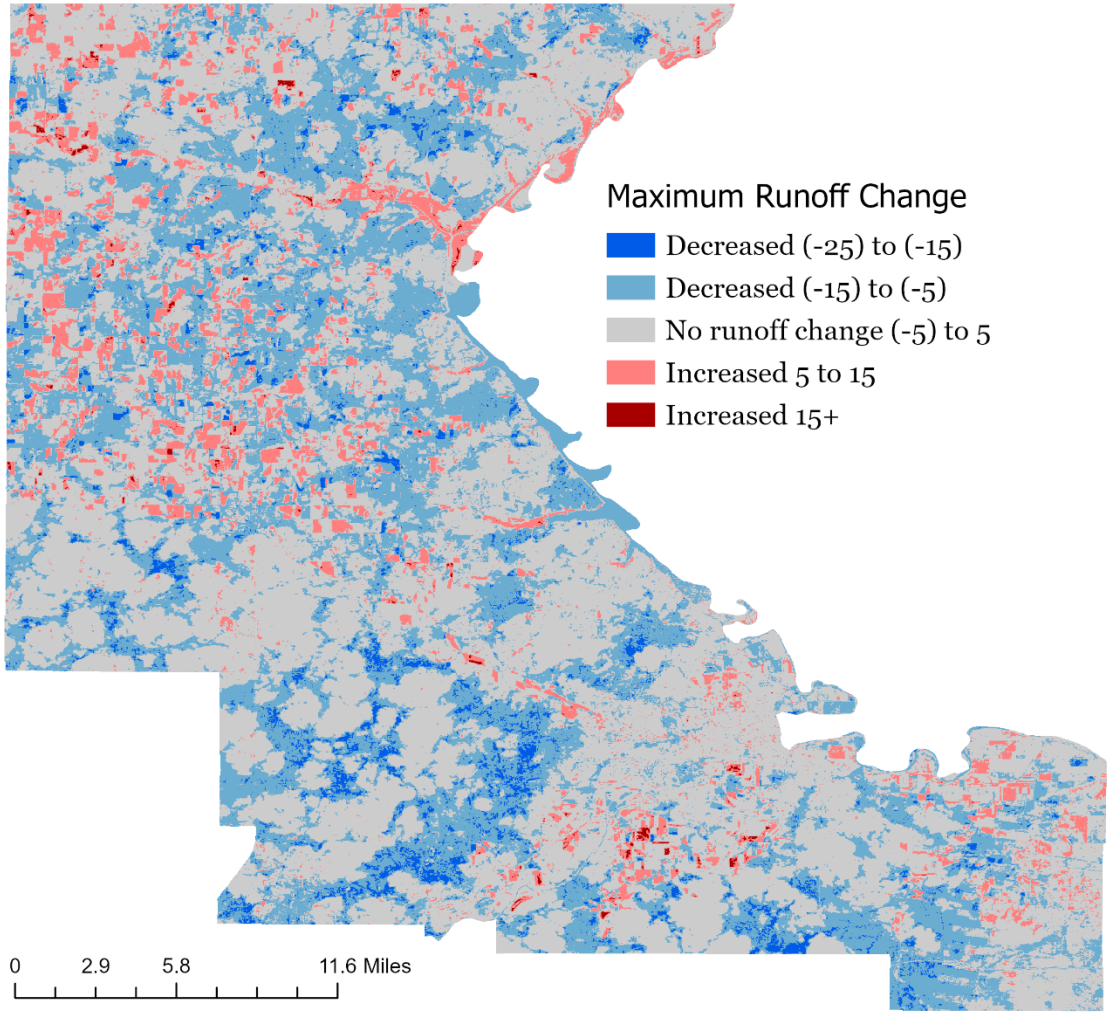


Dynamic Curve Number

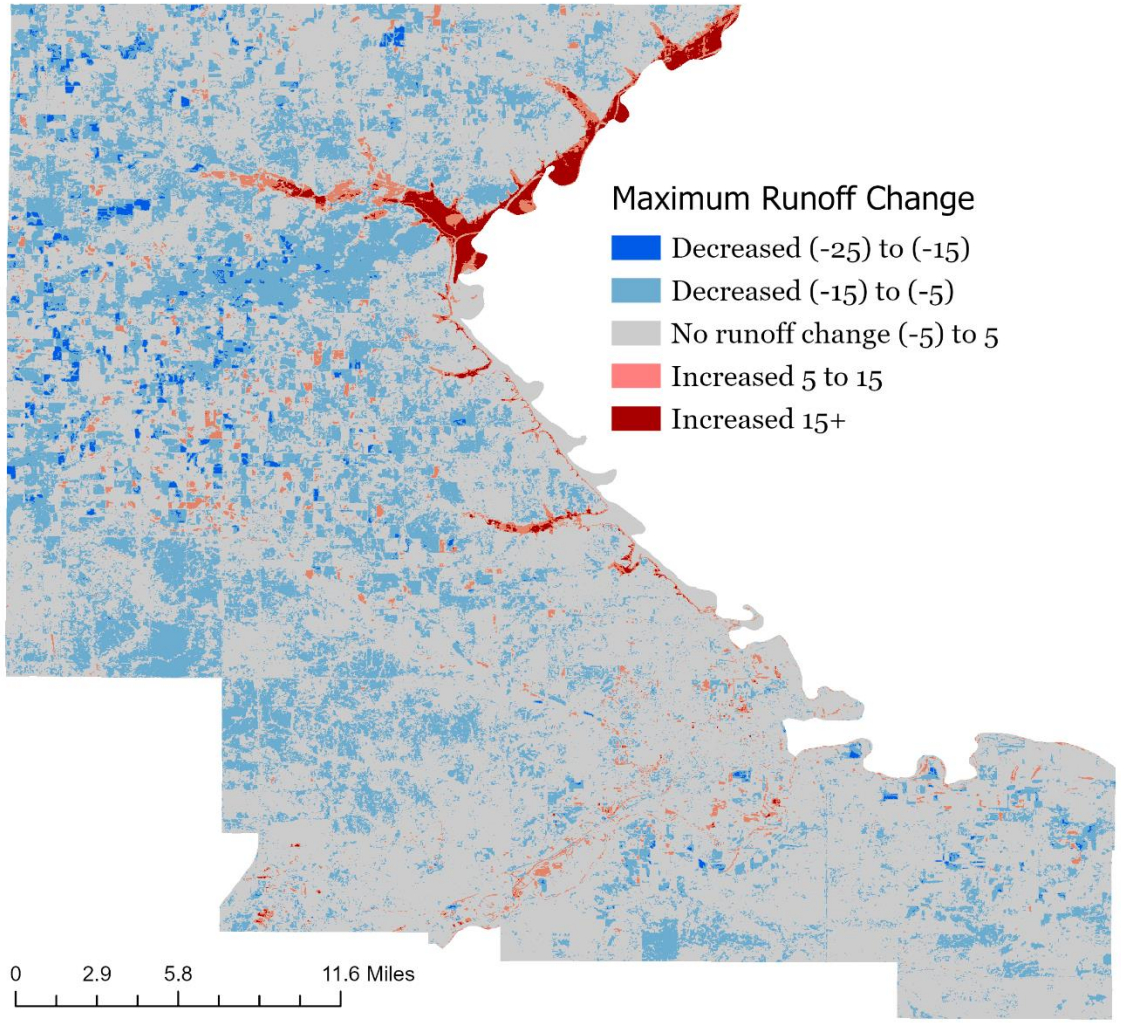
NDVI in Google Earth Engine

Curve Number in ArcGIS Pro





Early Rainy Season 2006-2019



Late Rainy Season 2006-2019

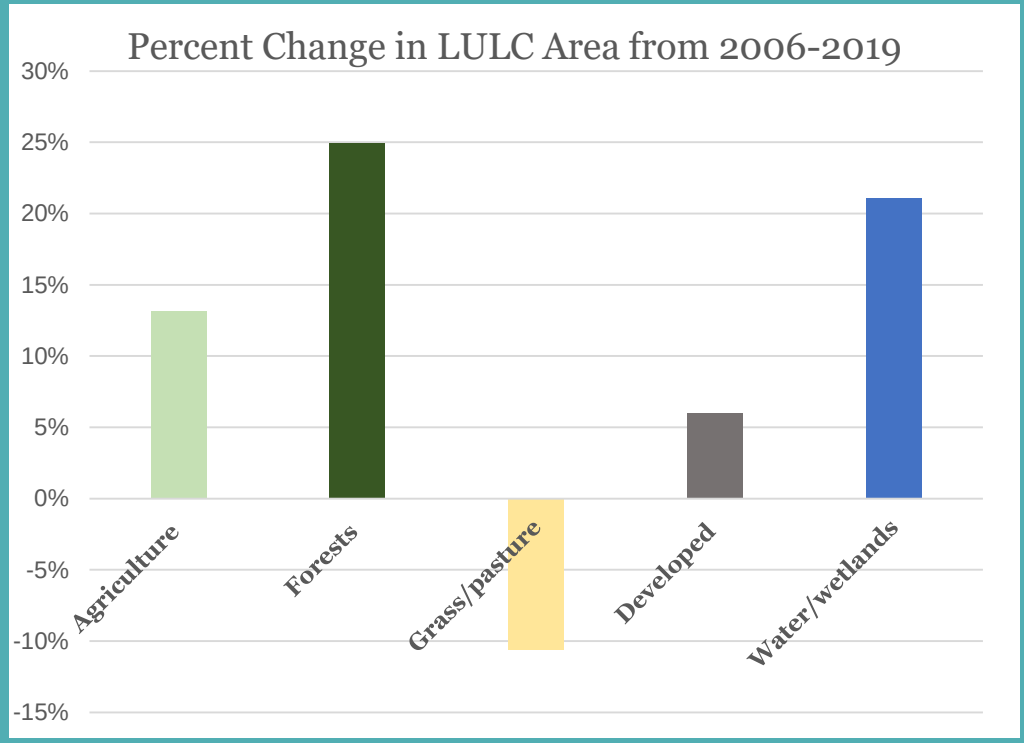
OUTCOMES & CONCLUSIONS

Updated land use land cover maps

Tutorials on calculating a curve number to inform flood resiliency planning

Seasonal variation analysis through dynamic calculation

Flood risk increased in 2.67% of the county

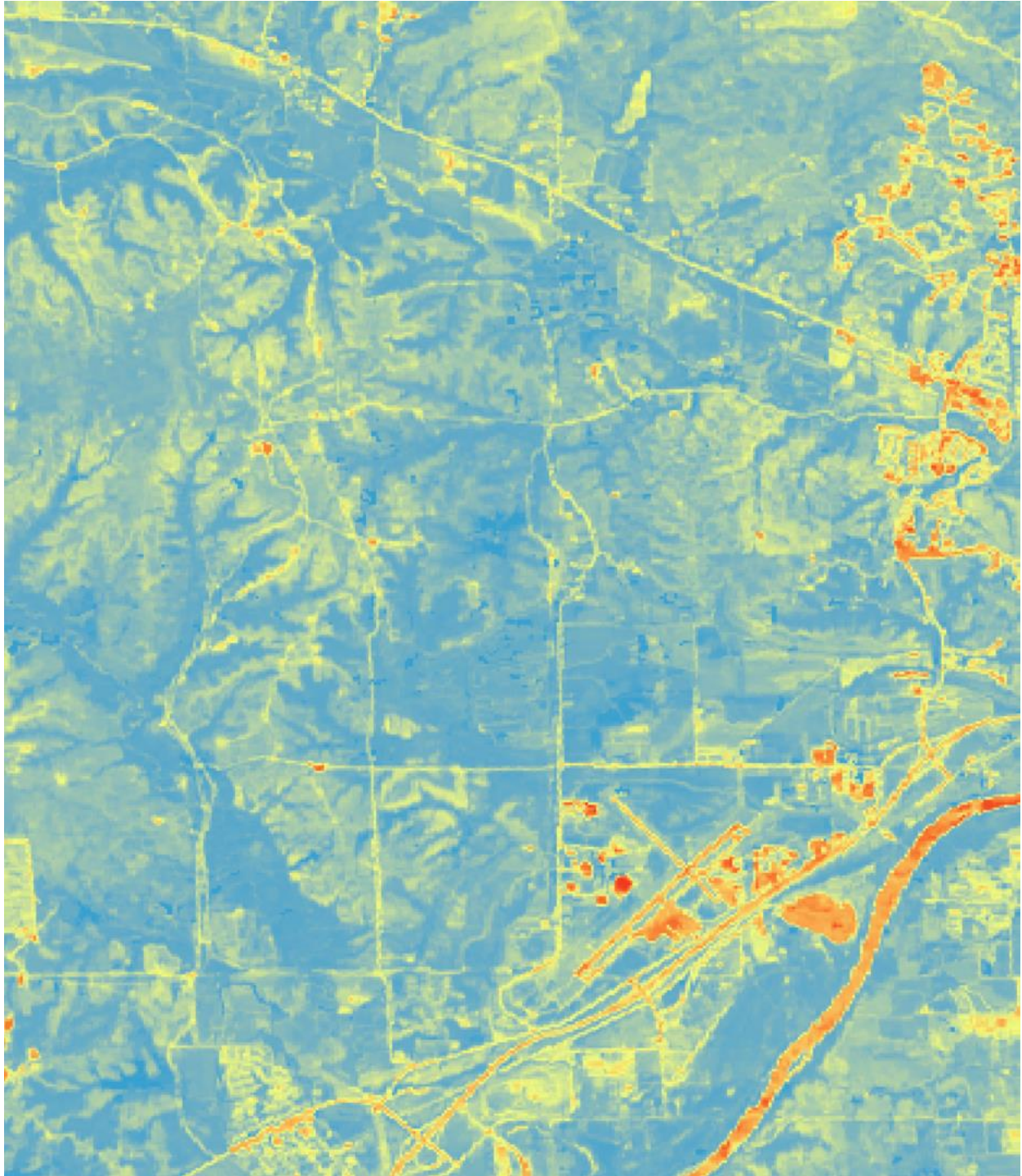


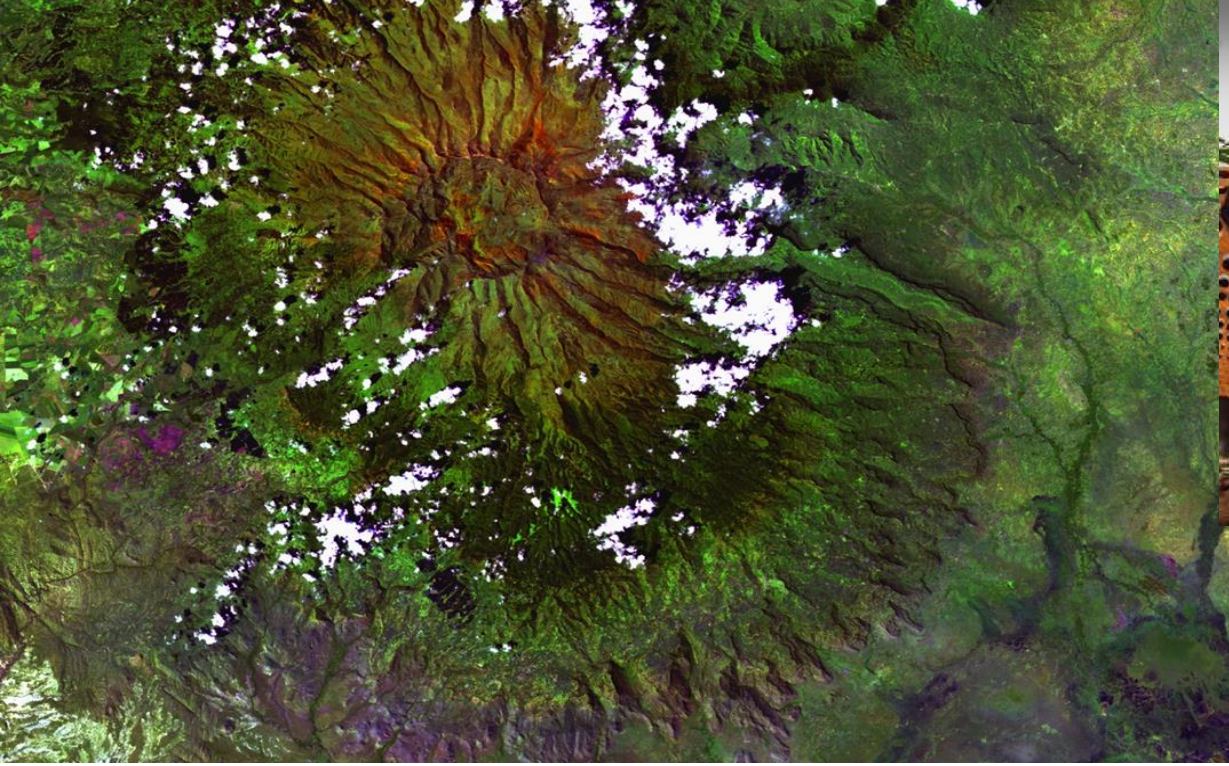
Thank You.

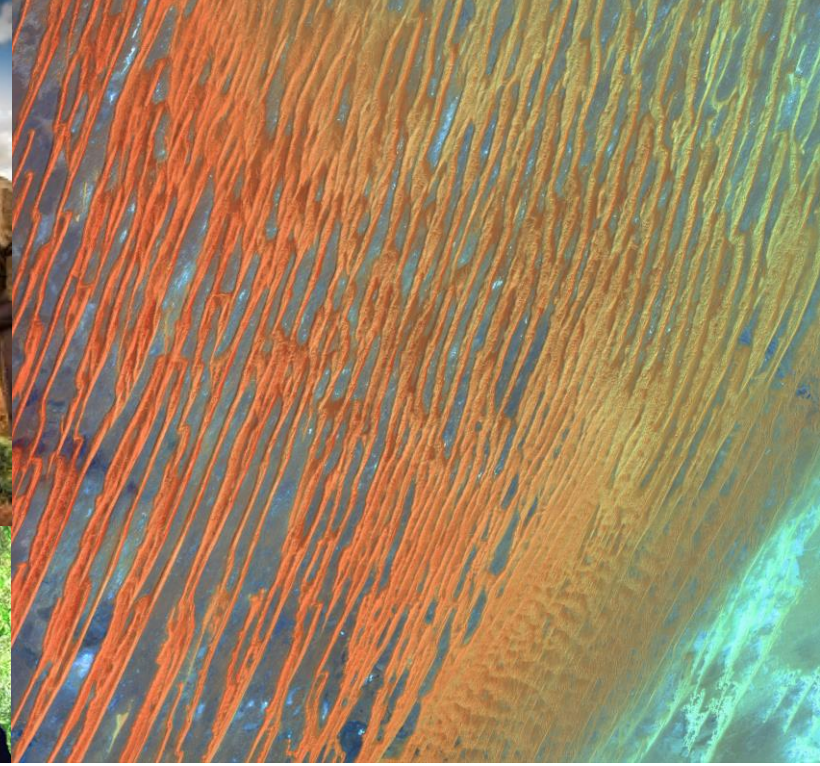
For further questions, please contact us at NASA-DL-DEVELOP@mail.nasa.gov

https://develop.larc.nasa.gov

EARTH SCIENCE
APPLIED SCIENCES





SERVIR Africa Overview & Locust Project Highlights

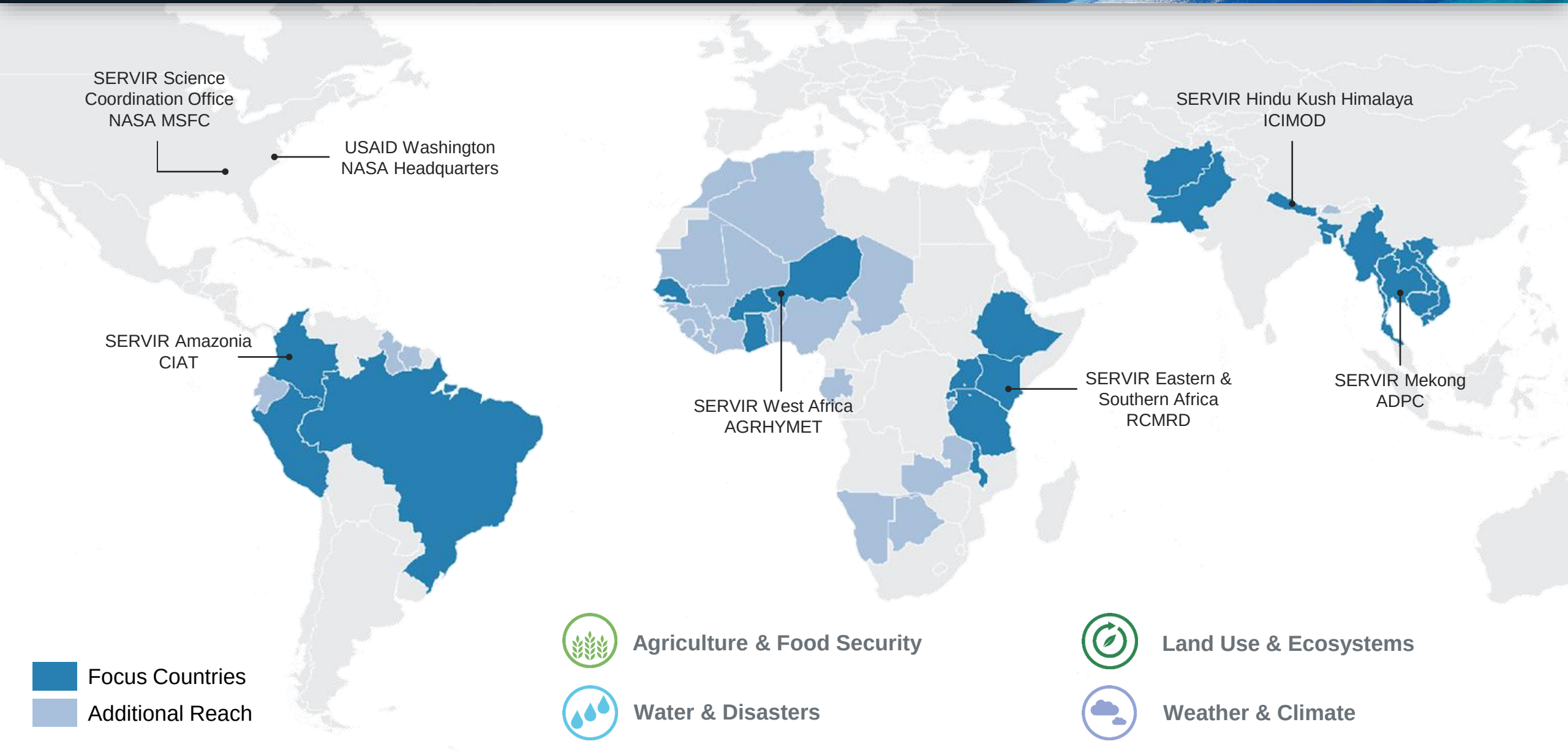
Emily Adams

Eastern and Southern Africa Science Coordination Lead & Gender Point of Contact

USAID FROM THE AMERICAN PEOPLE

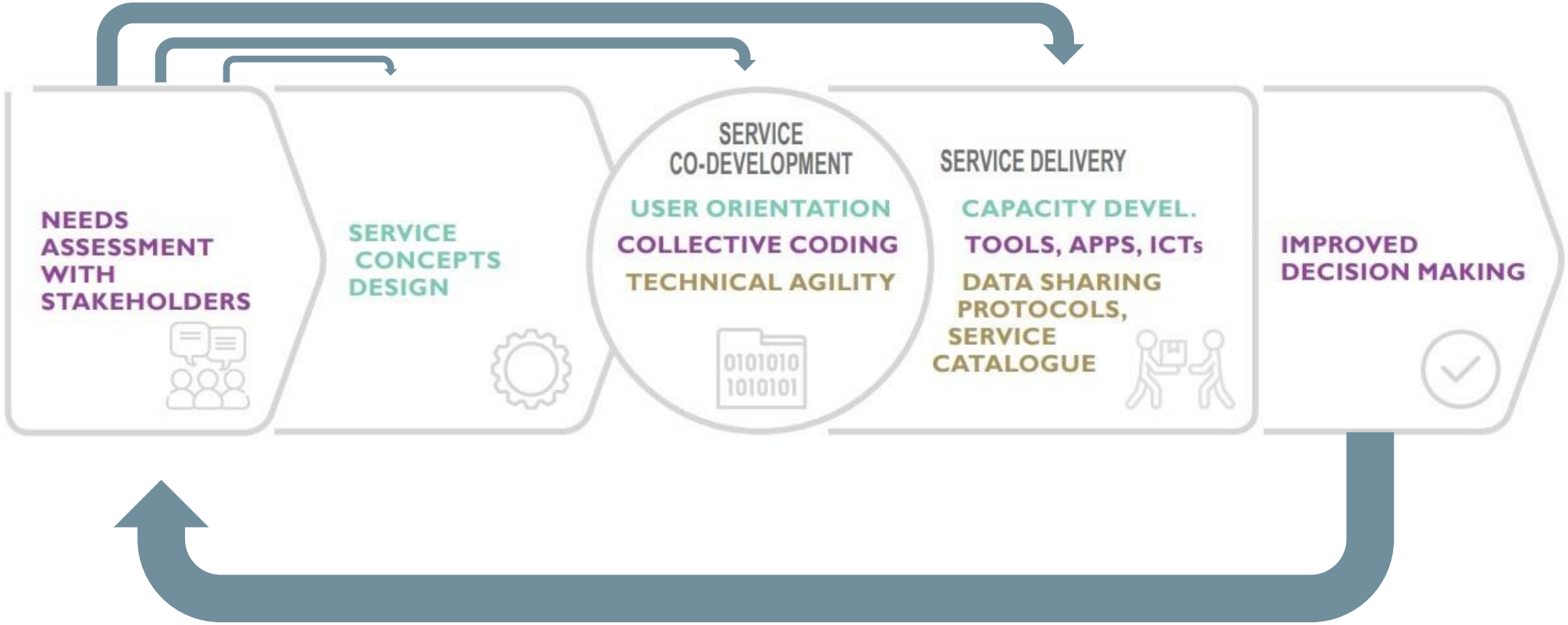
NASA EARTH SCIENCE APPLIED SCIENCES

SERVIR Focuses on Asia, Africa, & the Americas



SERVIR GLOBAL

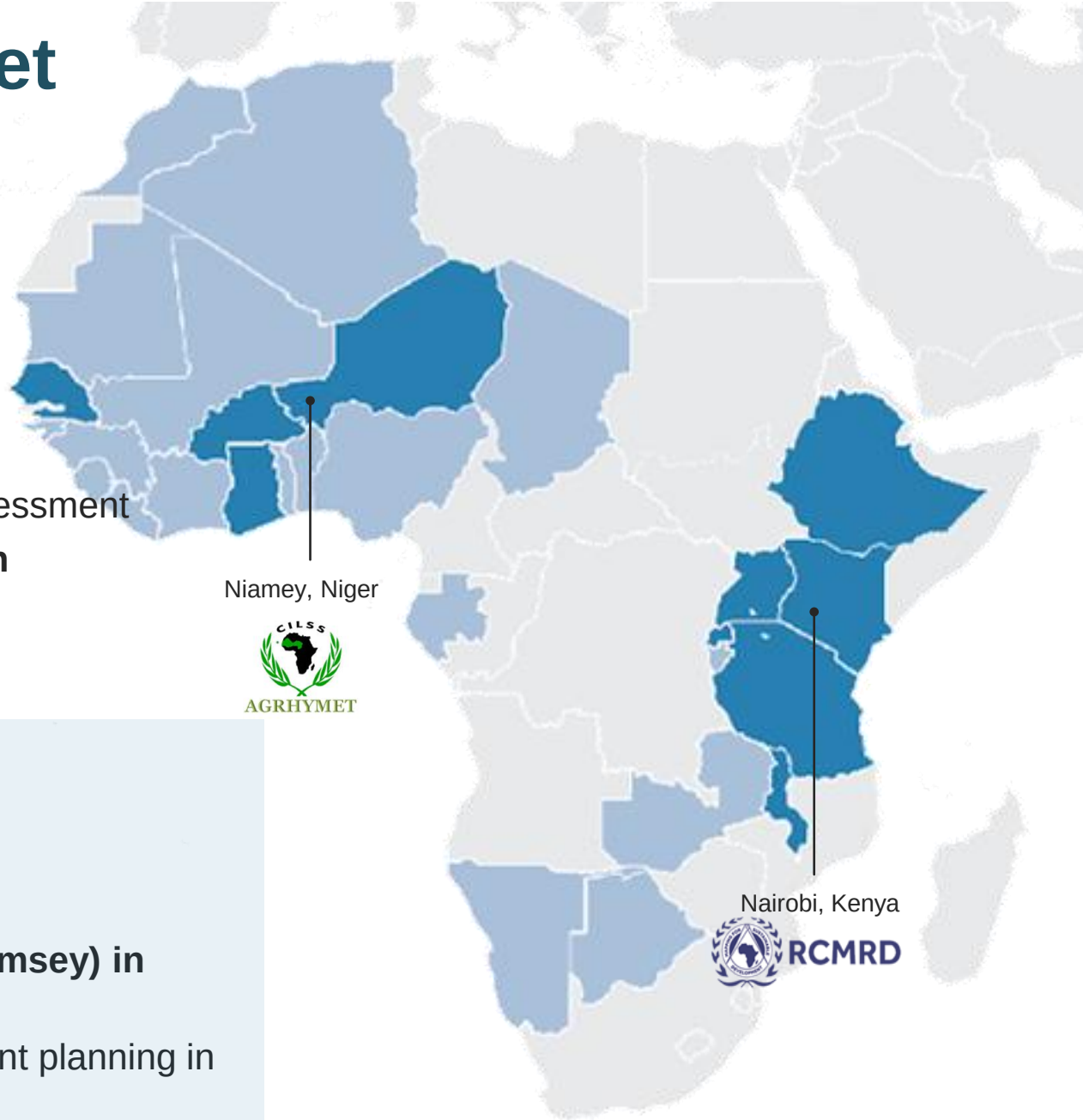
CONNECTING SPACE TO VILLAGE



Services: SERVIR services meet needs in Africa

SERVIR Eastern & Southern AFRICA

- Drought monitoring and assessments
- Frost monitoring
- Streamflow and flood forecasting
- Land cover mapping
- Climate vulnerability, impacts, and assessment
- **Crop monitoring and area estimation**



SERVIR West AFRICA

- Surface water body mapping
- Ground water monitoring and modeling
- Charcoal production monitoring
- Locust infestation monitoring
- **Monitoring of artisanal mining (Galamsey) in Ghana**
- Support for commune-level development planning in Burkina Faso

ICRISAT AFRIGIST CERSGIS ACMAD CSE 30 ANS Centre de Suivi Ecologique

Bringing Innovative Science to West Africa: The Applied Sciences Team

Norm Jones
Brigham Young University

Geospatial Information Tools That Use Machine-Learning to Enable Sustainable Groundwater Management in West Africa

Jasmeet Judge
University of Florida

Linking deforestation, urbanization, and agricultural expansion for land use decisions in Ghana

Pontus Olofsson
Boston University

Supporting continuous monitoring and sample-based estimation of land change and forest degradation in West Africa

Shrad Shukla
University of California, Santa Barbara

Integrating satellite observations and sub-seasonal climate forecasts to enhance agricultural and pastoral water-management decision-making using 21st century agro-pastoral water deficit predictions

Bringing Innovative Science to E&SA Africa: The Applied Sciences Team

Evan Thomas
University of Colorado Boulder

In-situ data collection with remote sensing for machine learning parameter estimates and improved hydrologic models for flood, drought and agricultural yield forecasting

Niall Hanan
University of New Mexico

Range monitoring for decision support, pastoral livelihoods and food security in arid and semi-arid East and Southern Africa

Catherine Nakalembe
University of Maryland / NASA Harvest

Earth Observation for National Agricultural Monitoring

Frank Davenport
University of California, Santa Barbara

Using Earth Observations and Statistical Models to Enhance Drought, Food Security, and Agricultural Outlooks in Eastern and Southern Africa

Services: Monitoring Illegal Mining (Galamsey) in Ghana

- Galamsey driven **deforestation doubled** between 2015 and 2018 contributing to **water pollution** and **land degradation**
- Mapping identified areas of illegal mining activities informs where **monitoring** and **restoration interventions** are needed

Photo credit: Jordi Perdigo

SERVIR WEST AFRICA

The Regional Cropland Assessment and Monitoring Service

- AST Nakalembe supported the development of the regional and country **crop conditions bulletins**
- Associated satellite derived crop masks and sampling framework **reduced costs by 70%** to the Kenya State Department of Agriculture, allowing for insurance protection to **expand from 900 to 425,000 farmers**.
- In 2019, more than **12,000 farmers were compensated** for crop losses

Photo Credit Catherine Nakalembe

SERVIR EASTERN & SOUTHERN AFRICA

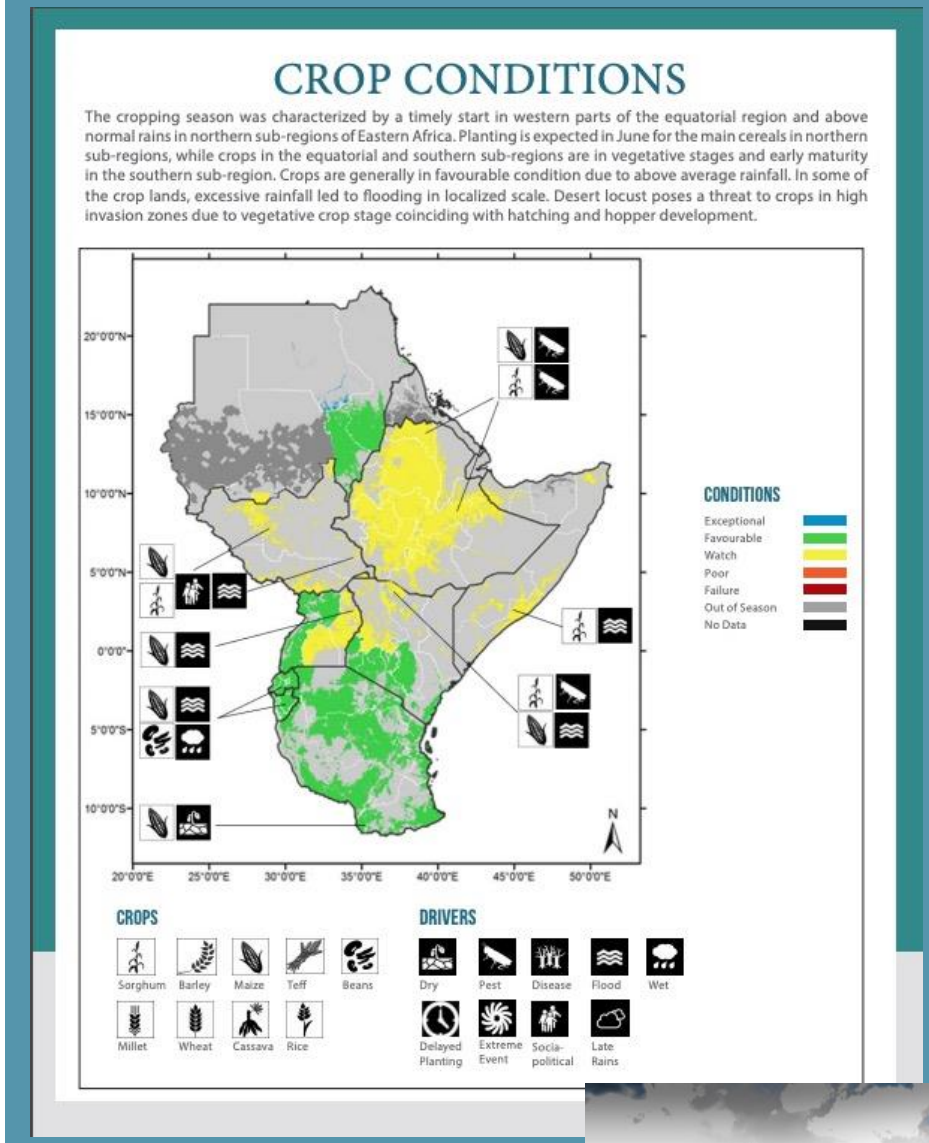
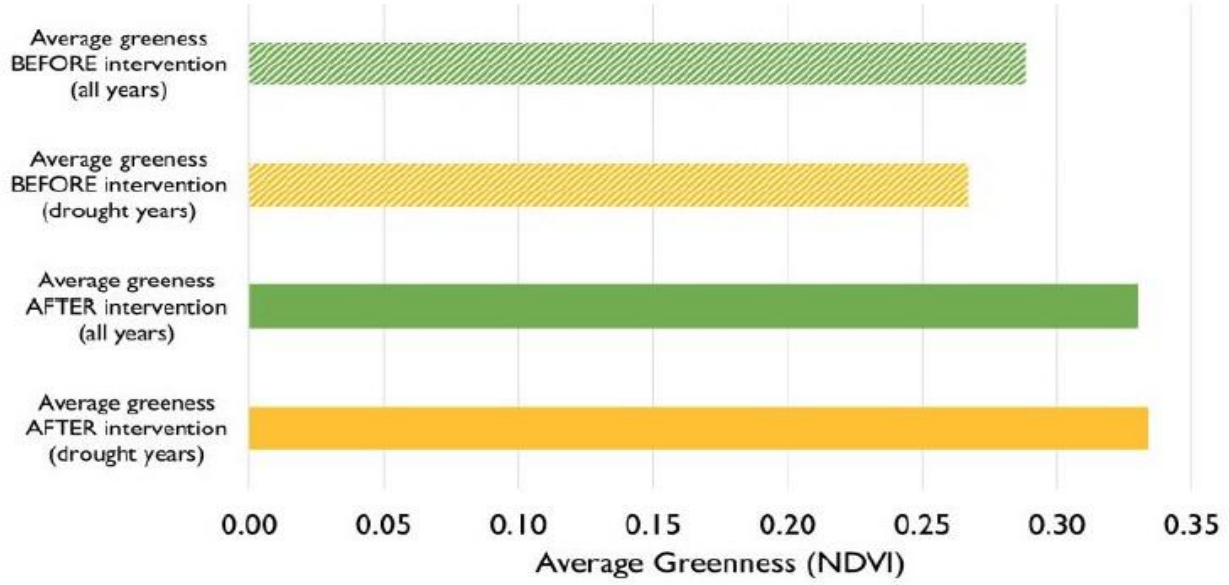


Photo Credit USAID

Assessing Landscape Scale Resilience Change

SERVIR analysis helps illustrate the benefit of water infrastructure programs implemented by USAID in Tigray, Ethiopia



2006

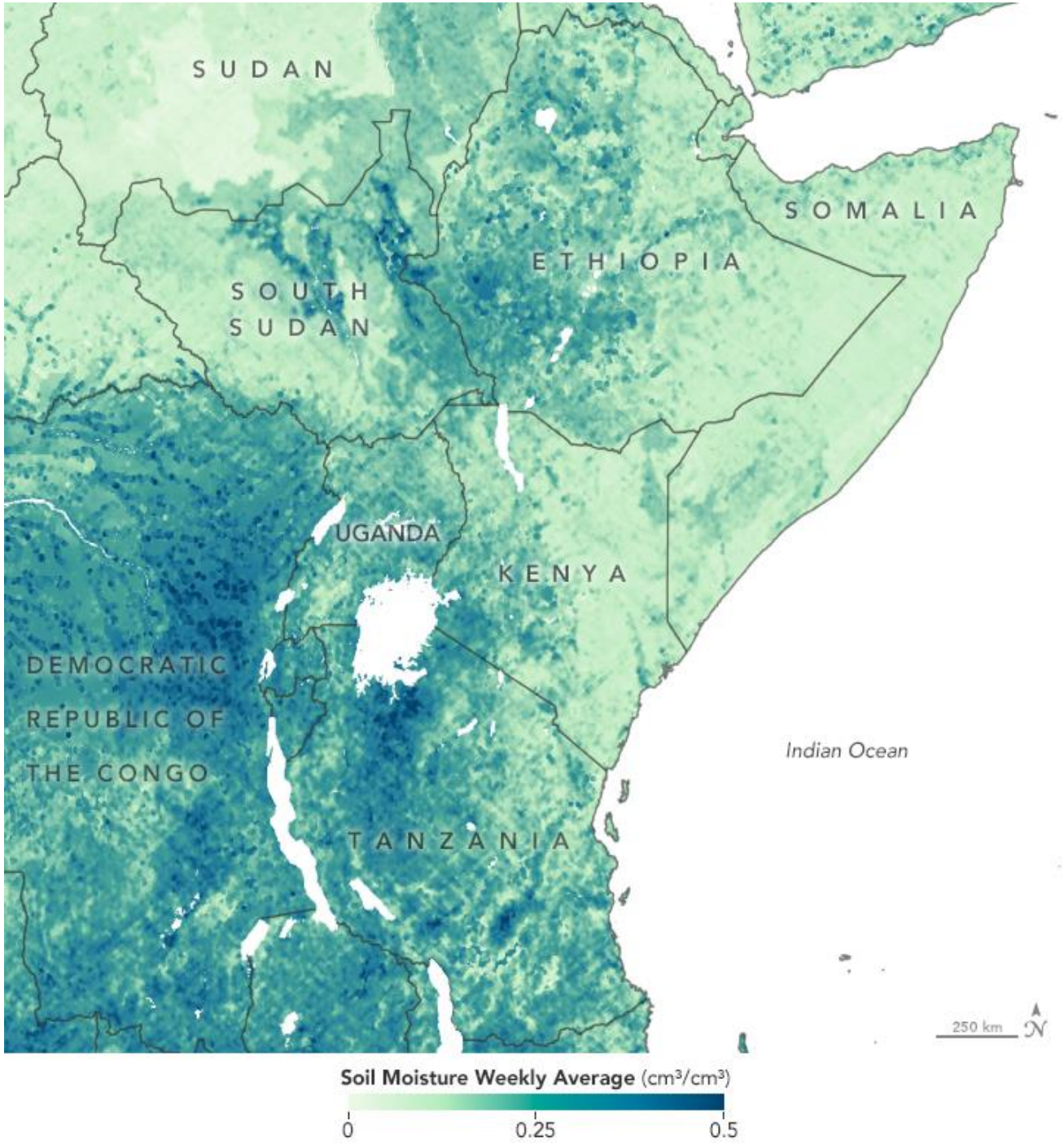
2019

- Average greenness at project sites is higher than pre-intervention greenness
- Increased water availability in drought years
- Faster vegetation recovery at locations where water infrastructure exists
- Water access improved during cropping seasons and allowed for a second cropping season in some cases
- Methodology being scaled to support additional work in Ethiopia and efforts in Niger

Improving Locust Monitoring and Modeling across Africa

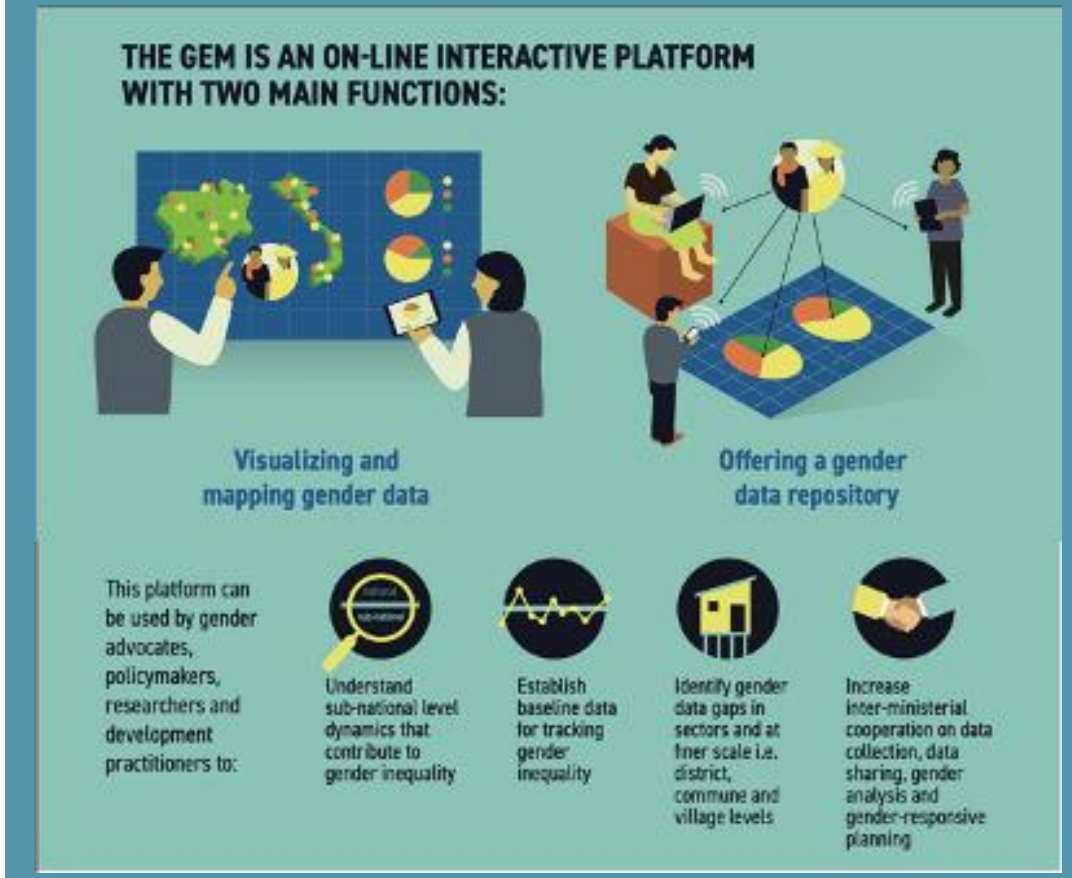
In response to the recent unprecedented upsurge in Desert Locust activity in East Africa, SERVIR, in collaboration with NASA Harvest and Disasters, & FAO to map and model high-resolution **soil moisture** to identify areas at high risk for egg laying to **target control measures**

These methods were supported by work done with SERVIR West Africa



Gender Integration and Action

1. Building women leaders and gender champions in SERVIR
2. Empowering women and girls to explore STEM fields
3. Integrating gender considerations in service planning
4. Using remote sensing and GIS to address development issues that are inclusive of underrepresented groups



Thank You.

For further questions, please contact:
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emil.cherrington@nasa.gov (SERVIR W. Africa)

EARTH SCIENCE
APPLIED SCIENCES



Global Partnerships Program

Dr. Shanna N. McClain

EARTH SCIENCE
APPLIED SCIENCES

ACHIEVING TOGETHER WHAT NEITHER WOULD ALONE

Together, we *amplify* our collective abilities to *visualize* and *understand* Earth as an integrated system and *enable* societal benefits through science-based decision making.

- Advance Earth system science, enable societal benefits, and reach new audiences and users.
- Explore emergent opportunities in the commercial and NGO sectors (cutting-edge technology, science, socioeconomic, etc.) at relatively low cost.
- Share in clear, self-determined benefit from the partnership and the use of NASA Earth observations.
- Develop new expertise that allows ESD to more efficiently interact with commercial and NGO partners.

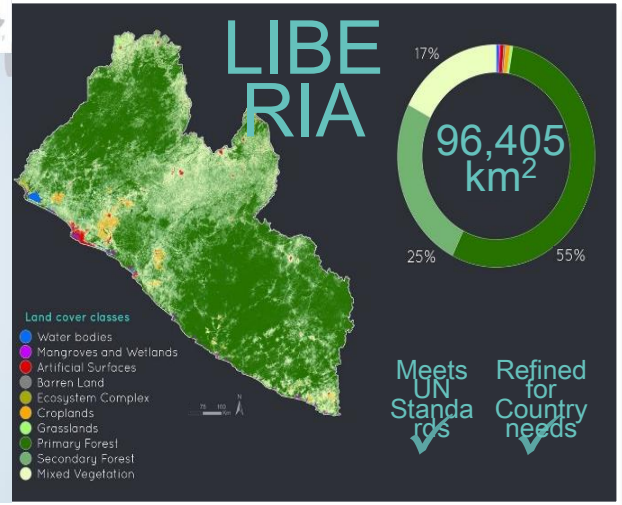
CONSERVATION INTERNATIONAL

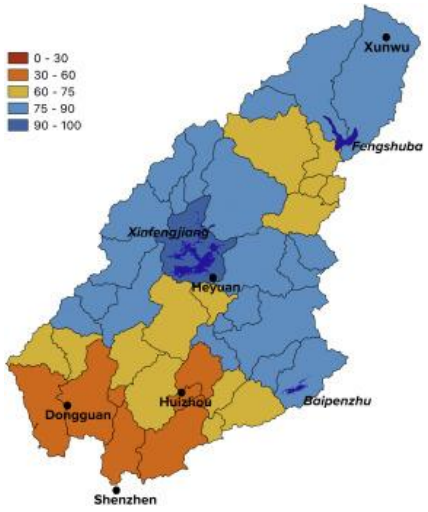
Microsoft

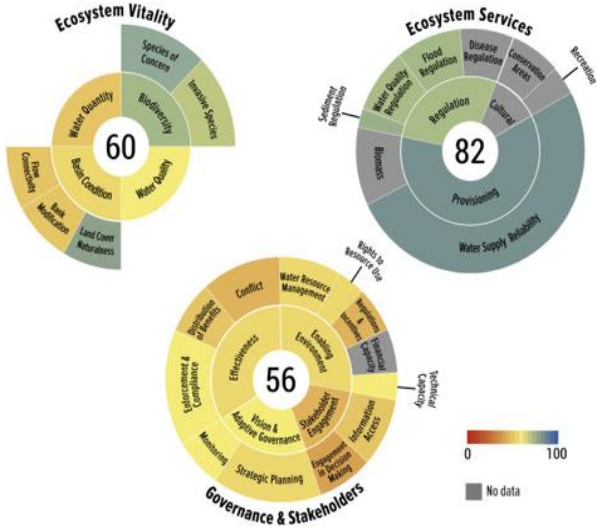
Google

MERCY CORPS

GABARONE DECLARATION FOR SUSTAINABILITY IN AFRICA







FRESHWATER HEALTH INDEX

NASA + Google

Scenes from Space

“Waterways from Space” published on Google Earth

Data Inventory & Enhancement

Societal Benefits through Sustainable Development

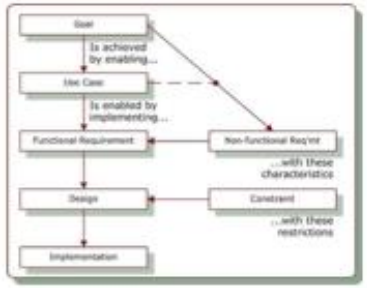
- Building resilience in fragile contexts
- Capacity building exchange between partners
- Climate-smart agricultural digital products for small-holder farmers

NASA + MERCY CORPS

Urban Heat Resilience

NASA + Microsoft

Design Charette & Data Collection



Lead Sponsor

Solution Prototype

Project Manager

Trend & Intervention Analyses

User Testing

GOALS

- Accessible by multiple users from several different City departments
- Tool can display additional non-NASA dataset
- Solution quantifies temperature impacts of interventions
- Urban heat can be tracked over time and at a neighborhood-level

Microsoft Azure

Thank You.

For further questions, please contact:
shanna.n.mcclain@nasa.gov

EARTH SCIENCE
APPLIED SCIENCES