DEVELOP

2020 Spring Preview

Health & Air Quality

Water Resources

Food Security & Agriculture

Disasters

Ecological Forecasting

January 27th – April 3rd

2020 Spring Portfolio

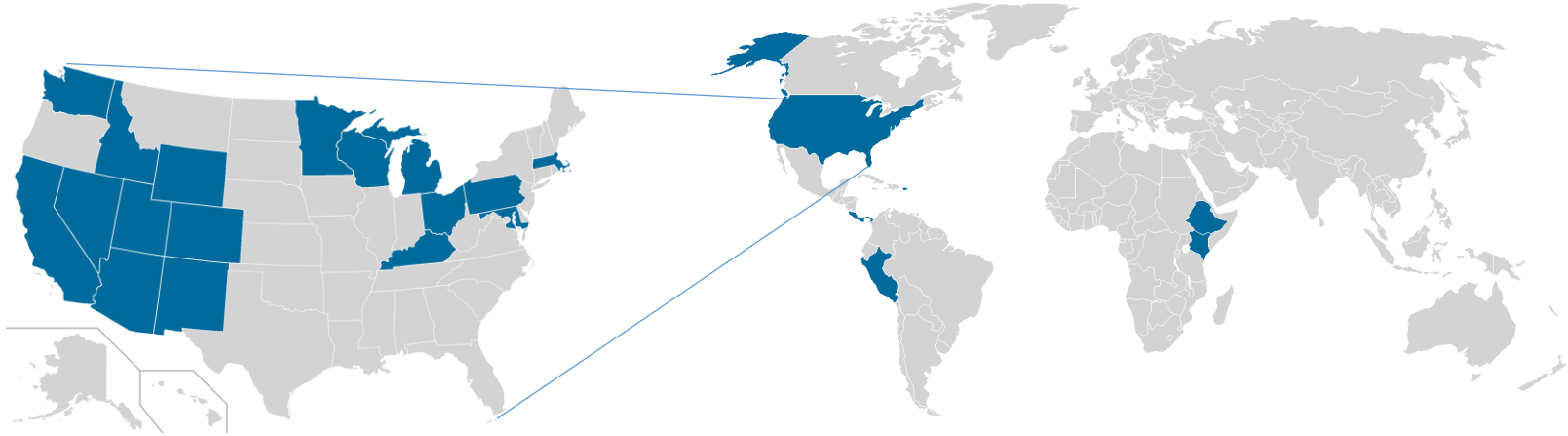
2nd Term (6)

1ST Term (10)

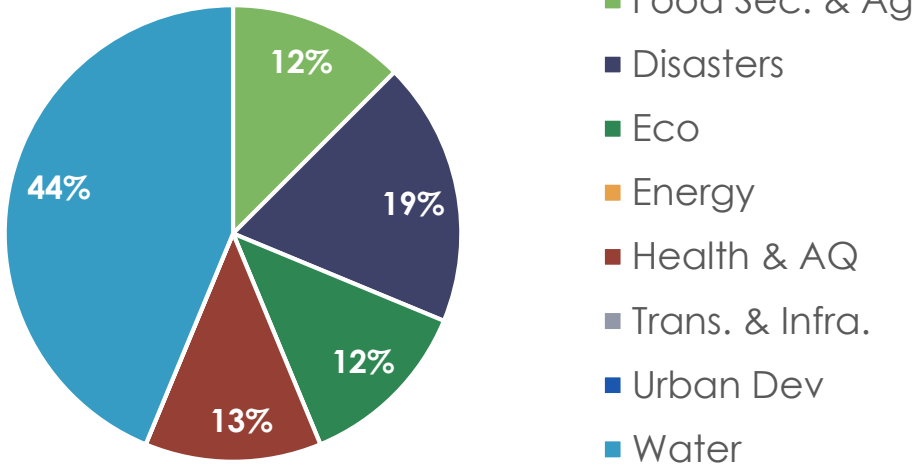
65 Participants
16 Projects

75% Domestic
25% International

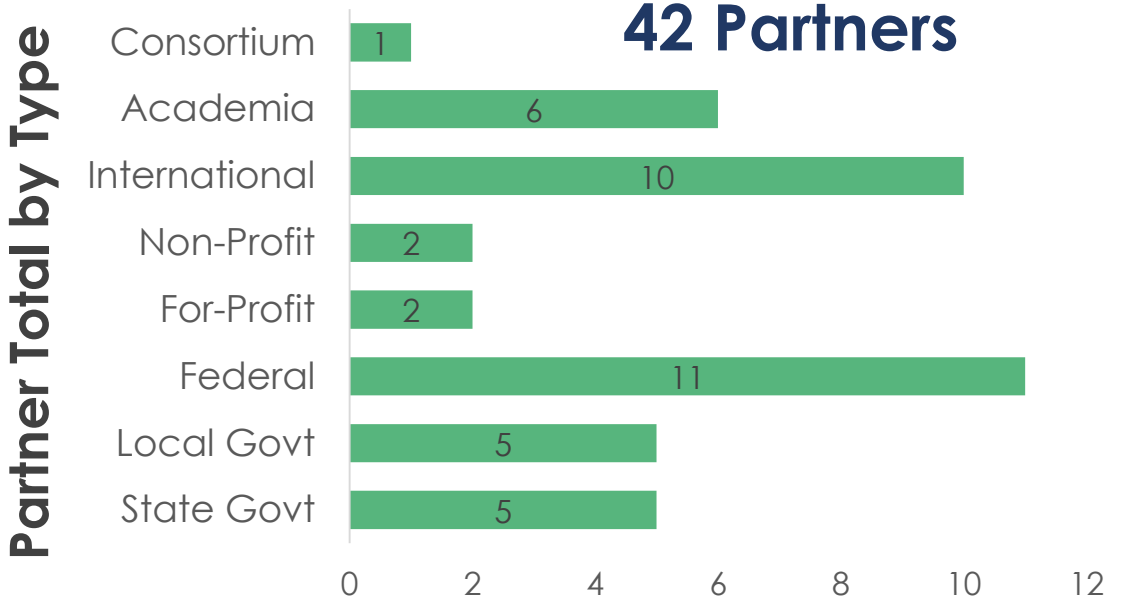
17 States &
6 Countries Impacted



Application Areas Addressed



42 Partners

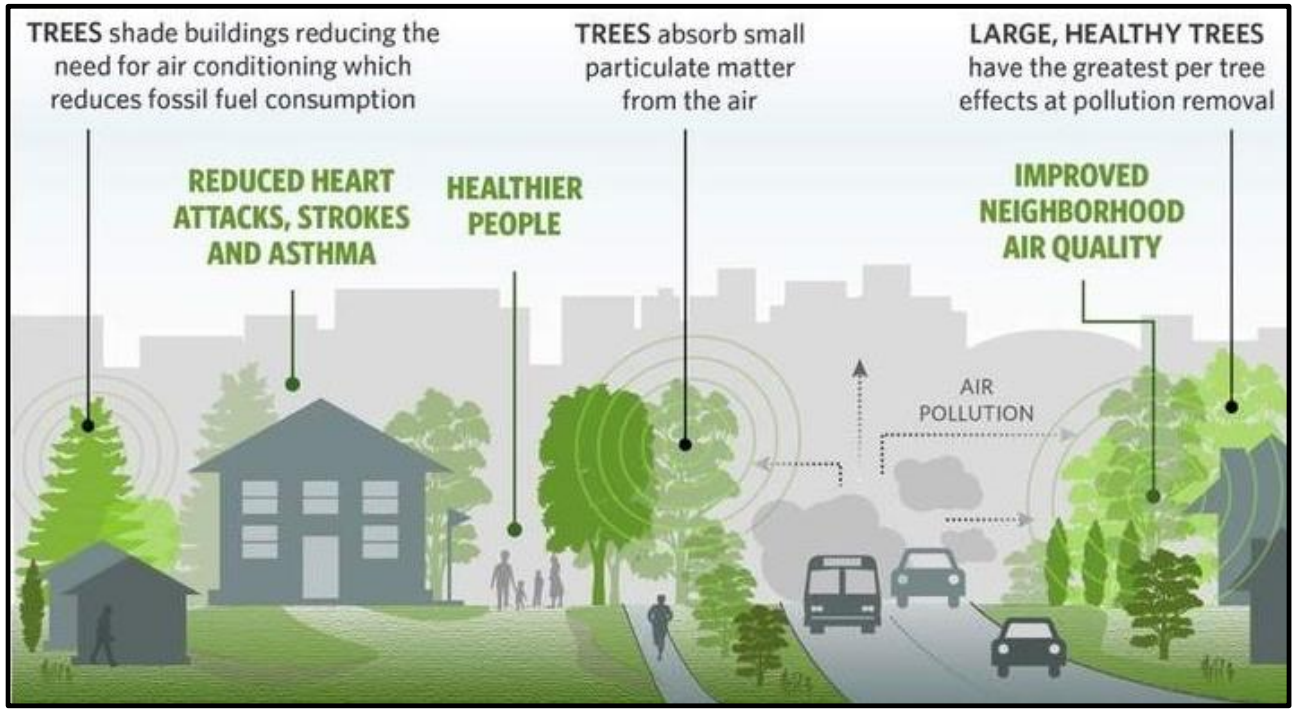


*Impacts and partners are tentative

Philadelphia Health & Air Quality

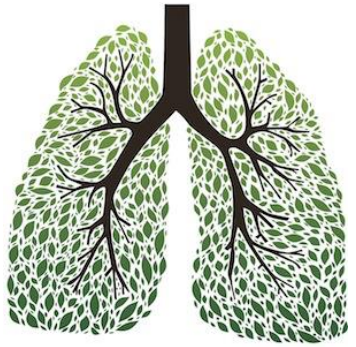
Arizona – Tempe

Community Concern: Philadelphia experiences urban heat effects and elevated air pollution. Groups of lower socioeconomic status are disproportionately affected by these issues. The partners would like to determine how to most effectively prioritize cooling and air quality improvement initiatives to most impactfully improve the health and safety of Philadelphia residents.



Earth Observations:

- Terra MODIS
- Aqua MODIS
- ISS ECOSTRESS



Partners:

- Philadelphia Department of Public Health
- City of Philadelphia, Office of Sustainability

Impact & Benefit: Results will allow the partners to efficiently combat air quality and urban heat issues through a weighted decision of where to plant urban trees. They will also be used to improve the public-facing Philadelphia Heat Vulnerability Index web map.

Washington Health & Air Quality

Alabama – Marshall

Community Concern: According to the PSCAA, over 1,100 people die each year from air pollution related illnesses in the Puget Sound Region. In this area, the pollutants posing the highest risks are particle pollution and smog. Much of the smog in this area stems from diesel exhaust from marine cargo vessels, and particle pollution emanates from the smoke of nearby wildfires. While the exhaust originating from marine vessels can be predicted, wildfire smoke is largely unpredictable from year to year. With increasingly warmer and drier summers forecasted, smog pollution is expected to increase.

Impact & Benefit: This project will provide the end user with supplementary methods to visualize and assess its Clean Air targets. The end products will enhance the agency's understanding of how Earth observations can be used in conjunction with its established reporting mechanisms to provide a more robust analysis of various air quality parameters and, if desired, can be used to inform the agency and its partners of potential increases of pollution.

Partners:

- Puget Sound Clean Air Agency

Earth Observations:

- Sentinel-5P TROPOMI
- Aqua/Terra MODIS
- Suomi NPP VIIRS
- CALIPSO CALIOP

Central Valley Water Resources

California – JPL

Community Concern: The recent California drought was one of the most intense in its history. With the threat of decreasing water levels, governments and water agencies of critical basins are required to bring groundwater basins into balanced levels of pumping and recharge.

Partner:

- California Department of Water Resources, North Central Region Office, South Central Region Office, and Southern Region Office

Earth Observations:

- GRACE
- GRACE-FO

Impact & Benefit: This project will build extensive terrestrial water storage change results for the end users. The California Department of Water Resources will be able to use the downscaled GRACE product, in conjunction with in situ groundwater data and interferometric synthetic aperture radar, to verify sustainability plans and assessments presented to them by the myriad Groundwater Sustainability Agencies in California.

Colorado & New Mexico Water Resources

Colorado – Fort Collins

Community Concern:

- The Rio Grande cutthroat trout population has been declining for the last century largely due to habitat loss and competition as well as hybridization with non-native trout.
- The subspecies was considered for listing under the Endangered Species Act starting in 2002, and the listing was found to be warranted, but was precluded in 2008.
- Conservation efforts led by federal, state, tribal, and private entities have helped stabilize and increase Rio Grande cutthroat trout habitat and populations since the early 2000s (Bakevich et al., 2019).

Partners:

- Colorado Parks and Wildlife
- Vermejo Park Ranch

Earth Observations:

- Landsat 8 OLI
- Landsat 5 TM
- Sentinel-1 C-SAR
- Sentinel-2 MSI
- SRTM

Impact & Benefit: Our partners can use project products to (1) improve understanding of trout habitat in the project area, (2) identify potential threats to wetlands and riparian areas, and (3) prioritize conservation project areas. These products will improve the effectiveness and efficiency of their conservation work by targeting the highest priority areas.

Gila Water Resources II

Maryland – Goddard

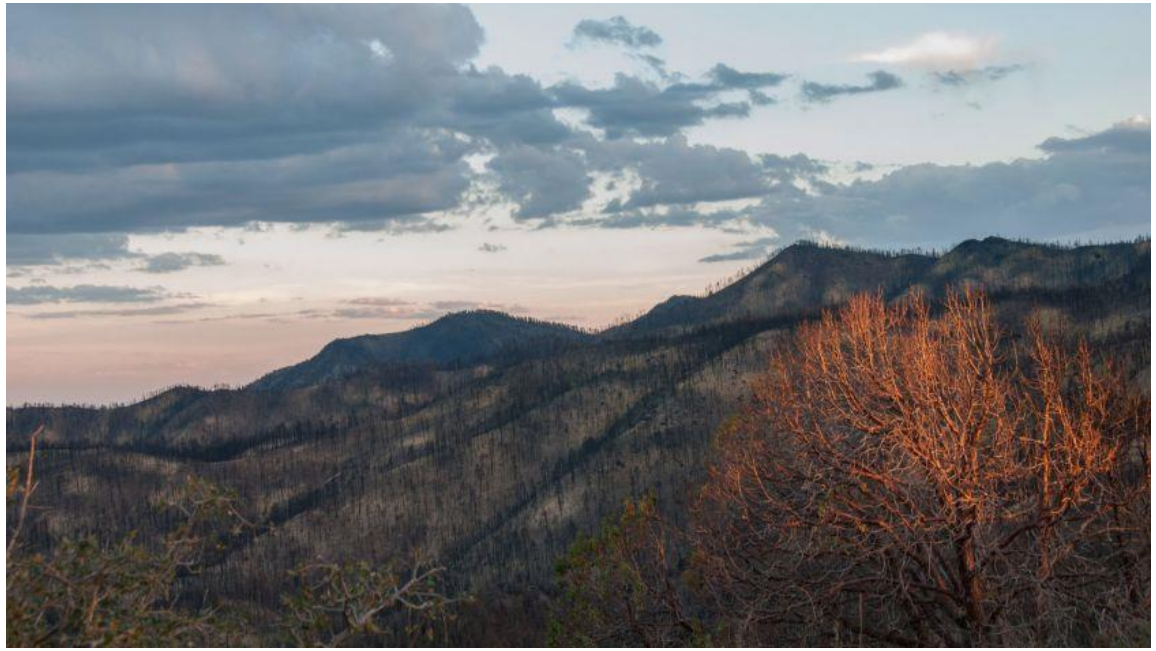


Image credit: California Times

Community Concern: USFS land managers and scientists expect that extreme events, such as the wildfires that occurred in 2012 and 2013, will become a more common occurrence in the Gila National Forest (Gila NF) and in many of the other National Forests across the country. In recent years, the Gila NF has also faced a growing demand for its water resources from downstream users. Wildfires can significantly impact watershed hydrologic functions as well as water and sediment yields and streamflow, further complicating water rights issues. Additionally, the Gila NF land managers have observed significant flooding events following large wildfires, which slow natural recovery processes and disturb downstream communities.

Partners:

- USDA, US Forest Service, Gila National Forest
- USDA, US Forest Service, Region 3

Impact & Benefit: With a better understanding of the recovery of watershed hydrological processes after a fire, forest managers at Gila NF will be able to make crucial decisions around restoration prioritization and reduction of fire and post-fire flooding events. These results will help anticipate stream recovery following wildfire events.

Earth Observations:

- Landsat 5 TM
- Landsat 7 ETM+
- Landsat 8 OLI
- GPM IMERG
- SMAP
- GRACE
- Terra MODIS

Great Lakes Water Resources II

California – JPL

Community Concern: Wetlands are a critical and vulnerable feature of our landscape, providing important ecosystem services such as controlling water quality, mitigating erosion, and bolstering the economy through recreation. Wetlands are also one of the most difficult and expensive features to map. Wetland managers, homeowners, highway engineers, and farmers all need current and accurate wetland maps to plan for conservation, home development, transportation infrastructure, and agriculture management.

Impact & Benefit: This project will build the partners' capacities to use a coding platform with optical and radar imagery to detect wetlands remotely. This enables near real-time wetland detection, which may help reduce the costs to maintain up-to-date wetland maps.

Earth Observations:

- Landsat 8 OLI
- Sentinel-1 C-SAR
- Sentinel-2 MSI

Source: University of Michigan

Partners:

- US Fish and Wildlife Service, National Wetlands Inventory
- Minnesota Department of Natural Resources
- US Environmental Protection Agency, Office of Research and Development
- Ducks Unlimited
- University of Minnesota
- NOAA, Office for Coastal Management
- Michigan Technological University
- Natural Resources Canada, Canada Centre for Mapping and Earth Observations, Canada Centre for Remote Sensing

Lambayeque Water Resources

Virginia – Langley

Community Concern: **Mesquite** is a keystone species in coastal Peru that underpins the region's high biodiversity. These semi-arid forest ecosystems have provided food, fuel, and resources to local inhabitants for thousands of years. The Lambayeque Regional Government is interested in understanding the relationship between **tree mortality** and the **hydrologic cycle** to inform their management and policy decisions pertaining to the forests and other lands they manage.

Partners:

- Regional Government of Lambayeque, Office of Natural Resources and Environmental Management and Office of Regional Agriculture
- Universidad Nacional Pedro Ruiz Gallo
- Clark University, George Perkins Marsh Institute
- Clark Labs

Impact & Benefit: This project will help end users in Peru better understand spatiotemporal trends in various hydrologic parameters and how these parameters relate to **overall forest health**. Understanding the hydrodynamics of the lands they manage will aid in the **prioritization of forest restoration** projects.

Earth Observations:

- GPM IMERG
- TRMM TMPA
- SMAP L-Band Radiometer
- GRACE Tellus
- GRACE-FO Tellus
- Terra and Aqua MODIS
- ECOSTRESS

Ohio River Basin Water Resources

North Carolina – NCEI

Community Concern: The Ohio River Basin is home to 27 million people and covers 204,000 mi^2, providing freshwater resources to manufacturing, energy, and agricultural industries. This region experiences cycles of drought and excess moisture. September 2019 was the driest September on record for the state of Kentucky, which resulted in declines in soil moisture and growth of algal blooms.

Partners:

- NOAA, National Weather Service, Ohio River Forecast Center
- Kentucky Climate Center
- NOAA, Earth System Research Lab, Physical Sciences Division

Earth Observations:

- Landsat 8 OLI
- GPM IMERG
- ECOSTRESS
- SMAP

Impact & Benefit: A performance assessment of drought indices calculated using NASA Earth observations will help the partners decide which parameters best represent the observed drought impacts of September 2019. Understanding which metrics serve as leading indicators of flash drought potential in the region will benefit their efforts for advanced drought monitoring and communication.

Western Massachusetts Water Resources

Massachusetts – Boston

Community Concern: After populations were decimated in the 1700s, beavers are returning to the landscape of Western Massachusetts. Flooding caused by their dams often affects human engineered infrastructure, such as roads, crops, homes, wells, and septic systems. Associated changes in aquatic biogeochemical cycling, water quality, and habitat availability also affect the conservation of many local species.

Impact & Benefit: Given the many potential impacts of beavers and their dams, understanding the spatial and temporal patterns in the distribution of beaver activity is of interest from both scientific and management perspectives. This project will create an interactive monitoring tool capable of identifying beaver-induced flooding events through characterization of the spectral-temporal response of beaver activities. Maps and time series will be created to help partners at Mass Audubon manage potential environmental and human impacts as well as monitor the growing beaver population.


Flickr (Mark Giuliucci)

Partners:

- Massachusetts Audubon Society

Earth Observations:

- Landsat 5 TM
- Landsat 7 ETM+
- Landsat 8 OLI
- Sentinel 1 C-SAR

Kenya Food Security & Agriculture II

Alabama – Marshall

Community Concern: Agriculture and livestock production equate to approximately ¼ of the GDP of Kenya. With nearly 80% of the country considered arid or semi-arid, this pastoral economy is commonly plagued by severe drought. In 2011 and 2012, an extreme drought invoked a catastrophic food crisis that resulted in tens of thousands of deaths due to starvation. To lessen the threat of drought-related crises, local authorities are working to establish regulations for the sustainable management of drought to prevent acute agro-pastoral loss. Currently, vegetation indices like NDVI are used to monitor drought, however, these indices indicate drought once the vegetation is affected. By using soil moisture and precipitation indices in conjunction with vegetation indices, drought can be identified earlier and its threats mitigated proactively.

Impact & Benefit: This project will provide the NDMA with resources to integrate the existing RHEAS model into its current methodologies to enhance the timeliness of its drought warning systems. RHEAS utilizes a land surface model that allows for unlimited variables, and end products derived from the model are easily customized and interfaced for use with the end user's current systems. The integration of this new information into Early Warning Bulletins will improve agro-pastoral management practices. The workflow manual and video tutorials will provide extensive instructions on RHEAS and the best way to evaluate and visualize its outputs.

Partners:

- NDMA of Kenya
- RCMRD
- NASA SERVIR SCO

Earth Observations:

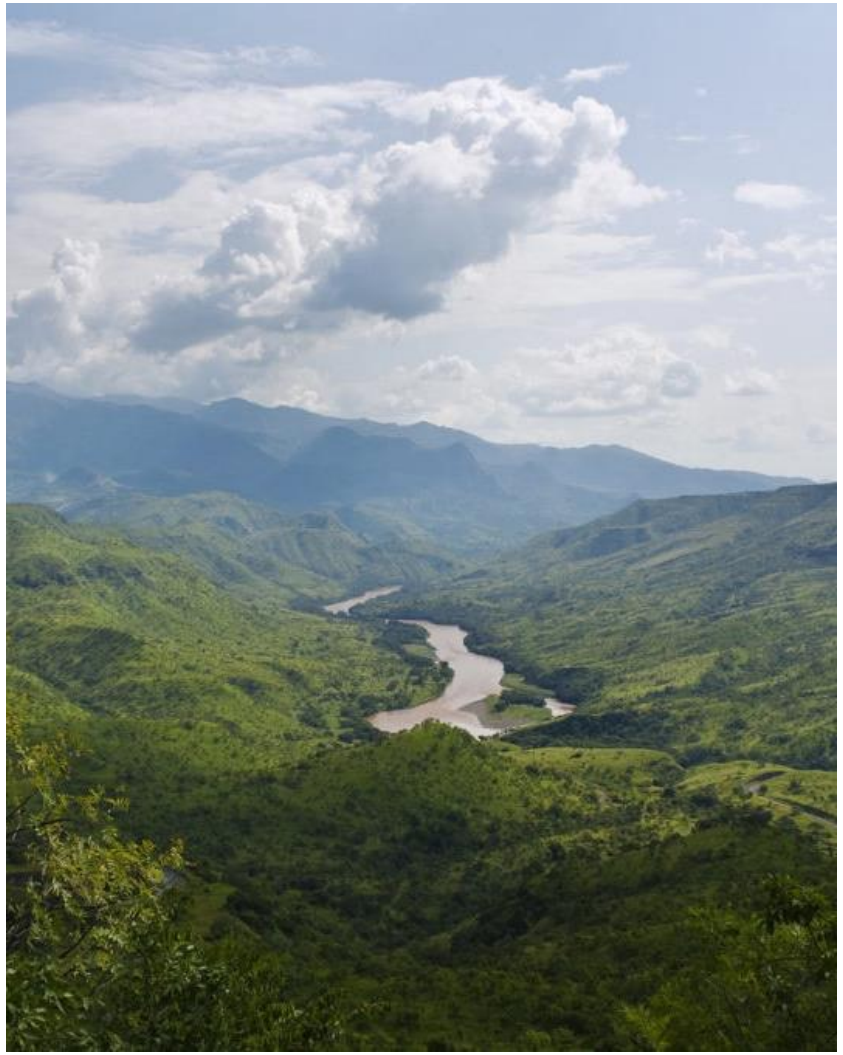
- SMAP L-band Radiometer
- Suomi NPP VIIRS
- Aqua/Terra MODIS
- Aqua AMSR-E
- GPM DPR

Lower Omo Food Security & Agriculture

Colorado – Fort Collins

Community Concern:

- The lower Omo River Valley is a rich cultural and ecological region in southern Ethiopia, home to multiple indigenous peoples and a plethora of plants and wildlife species.
- Recently, a massive hydroelectric dam was constructed upstream from the lower Omo River Valley. This has prompted land grabs for large-scale plantations now that the river can be regulated and used to provide a reliable year-round water source.
- Much of this agricultural expansion has gone unregulated at the expense of local peoples' livelihoods and the health of the ecosystem they depend on.



Partners:

- Ethiopian Wildlife Conservation Authority

Earth Observations:

- Landsat 8 OLI
- Landsat 5 TM
- SRTM

Impact & Benefit: Our partner can use project products to (1) provide context to the speed at which land-use is converting to agriculture, (2) visually analyze the spatial extent of these conversions relative to other land uses, and (3) contextualize how this has affected protected areas. These products will improve effectiveness and efficiency of their conservation work by covering a large spatial area using NASA Earth observations that would not be feasible without remote sensing.

Eastern Washington Disasters

California – Ames

Community Concern: Years of poor land management have led to dramatic land cover changes in Eastern Washington, leaving the land vulnerable to intense wildfires that threaten local communities and ecosystems. Lightning-caused wildfires were responsible for approximately half the acres burned in the state over the last decade, and in 2018, 45,203 lightning strikes were recorded in the Pacific Northwest. Research into the spatiotemporal distribution of lightning strikes can help managers evaluate fire sources as well as identify fuel types and conditions predisposed to ignition.

Partners:

- The Nature Conservancy, Washington Chapter
- Washington State Department of Natural Resources, Forest Health and Resiliency Division

Impact & Benefit: This project will provide TNC and the Washington DNR with an analysis of trends in historic lightning-caused wildfires to inform current efforts to rebuild forest resiliency. The project end products will also serve as a baseline for future research (Summer 2020) on wildfire smoke-related air quality issues.

Earth Observations:

- ISS Lightning Imaging Sensor
- Aqua MODIS
- Terra MODIS
- Suomi NPP VIIRS
- NOAA-20 VIIRS
- Landsat 5 TM
- Landsat 8 OLI

Ellicott City Disasters II

Maryland – Goddard

Community Concern: Over the past ten years, Ellicott City, MD, has experienced multiple detrimental flooding events, which have claimed human lives and caused millions of dollars in property damage. Flooding events are projected to worsen with changing environmental conditions and increased urban development, thus escalating the need for better flood monitoring and prediction. Accurate, timely, and detailed data reports are necessary to mitigate the effects of severe flooding in the region.

Partners:

- Howard County Government, Office of Emergency Management
- Howard County Government Storm Water Management
- NOAA, National Weather Service, Baltimore-Washington Weather Forecast Office

Earth Observations:

- Aqua AMSR-E
- TRMM TMI
- SMAP L-Band Radiometer

Image credit: Craig Kristen

Impact & Benefit: The statistical flood risk model and map of suggested stream gauge locations will enhance emergency management actions of the Howard County OEM and can influence early warning decisions about potential flooding. This will ensure that resources are allocated to maximize safety for vulnerable residents.

Toa Baja Disasters

Virginia – Langley

Community Concern: Toa Baja, located just outside of San Juan in northern Puerto Rico, is known as "*La Ciudad Bajo Aguas*" or **"the underwater city"** due to its propensity to flood. During tropical storm events, the city is inundated by storm surge at the northern coast and flooding of Rio de la Plata. Following the 2017 hurricane season, over 14,000 homes were flooded, and damages in the city amounted to over $1.3 billion. In addition to these concerns, Toa Baja has the highest proportion of **unmet housing needs** in Puerto Rico.

Earth Observations:

- Landsat 8 OLI
- Sentinel-2 MSI
- Sentinel-1 C-SAR
- GPM IMERG
- TRMM TMPA

Partners:

- Municipio Autonómo de Toa Baja
- ResilientSEE
- MIT Urban Risk Lab

Impact & Benefit: Historical flood maps and a static flood susceptibility map will indicate to city planners what areas are at the **greatest risk** for future flooding events. In conjunction with the risk maps, a flood mapping tool will help highlight flood prone areas with vulnerable populations, and end users will be able to **monitor flood extent remotely** as events occur.

Costa Rica & Panama Eco Forecasting II

Georgia – Athens

Community Concern: The 202,230 square miles of Central America is home to 7% of all scientifically known life forms. Due to a lack of biodiversity conservation in the area, Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, and southern portions of Mexico banded together in 1997 to create the Mesoamerican Biological Corridor, with the idea of preserving biodiversity and supporting sustainable economic development. Since establishment, deforestation has continued to plague the area and sustainability of the corridor continues to be a challenge, with indigenous land rights impacted, agriculture and development expansion, and the strain of financial and natural resource management. Countries within the corridor region have spent money on transboundary and conservation initiatives as well as trained officials, but communication and conservation strategies have not been concrete.

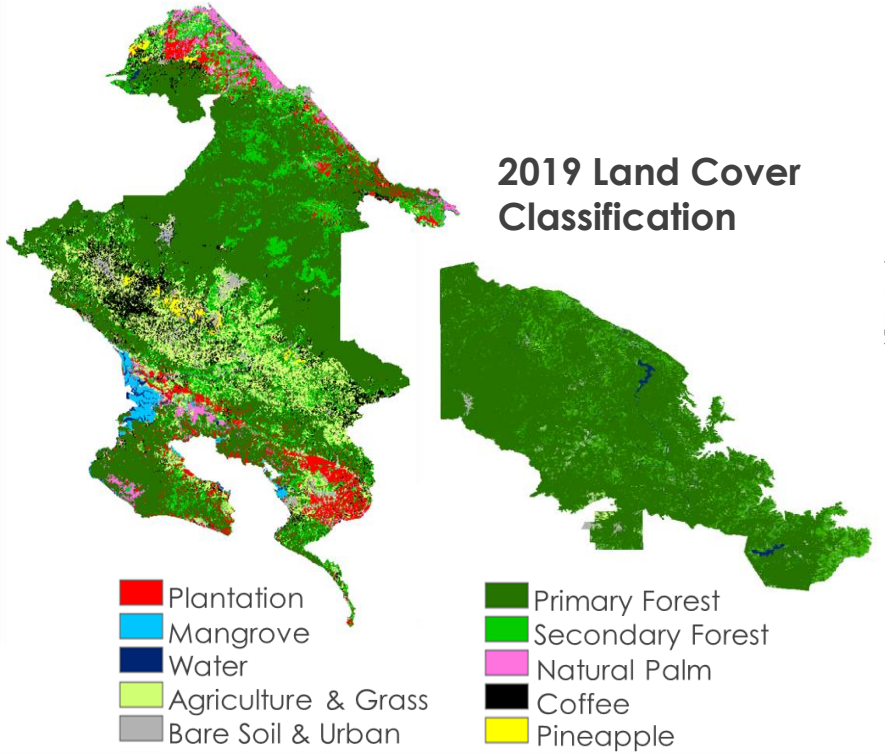
Earth Observations:

- Terra MODIS
- Landsat 7 ETM+
- Landsat 8 OLI
- Sentinel-2 MSI

Partners:

- Ministerio de Ambiente y Energía, Centro Nacional de Información Geoambiental (Costa Rica)
- Autoridad Nacional del Ambiente (Panama)

Impact & Benefit: Areas in La Amistad International Park that are at risk of forest cover and soil type changes that could impact biodiversity will be evident and officials will be able to decide on the future course of action in those areas. The short-term forest change tool and potential conflict maps will assist partners in communicating the impact of local agriculture and development on biodiversity in La Amistad.



Great Basin Ecological Forecasting II

Idaho - Pocatello

Community Concern: Wildfires caused by natural or human ignition have increased in severity, size, and frequency across the US in recent years. Because of these increases, wildfires cause billions of dollars in damages, suppression, and rehabilitation of the burned areas. A major component of fire management is monitoring LFM, or the water content in biomass fuels in wildfire hotspots. There are currently only 155 measurement sites across the entire Eastern Great Basin (EGB). A more complete map of changing Live Fuel Moisture (LFM) during the fire season for this large area will allow land managers to make more accurate risk assessments and determine where to allocate resources to preemptively combat fires on a timescale of two week increments during the summer months.

Earth Observations:

- Terra MODIS
- Aqua MODIS
- NOAA – 20 VIIRS
- Landsat 8 OLI

Impact & Benefit: LFM is used to allocate resources and plan for fires more efficiently by land managers. Estimates of LFM can predict fire intensity, severity, and size without having to wait for the fire to combust. These models will allow the partners to use NASA EOs to gain a stronger estimate of LFM across this wide geographical area, making it easier to decide what resources need to be where, and when. *In situ* measurements will still be needed to verify the model in future fire seasons, but these models will make a more spatially complete understanding of the LFM in the EGB for the partners, saving on cost of fire prevention, mitigation, and human loss.

Partners:

- Idaho Fish and Game, Southeast Regional Office
- Great Basin Coordination Center
- Bureau of Land Management, Upper Snake Field Office
- NOAA, National Weather Service