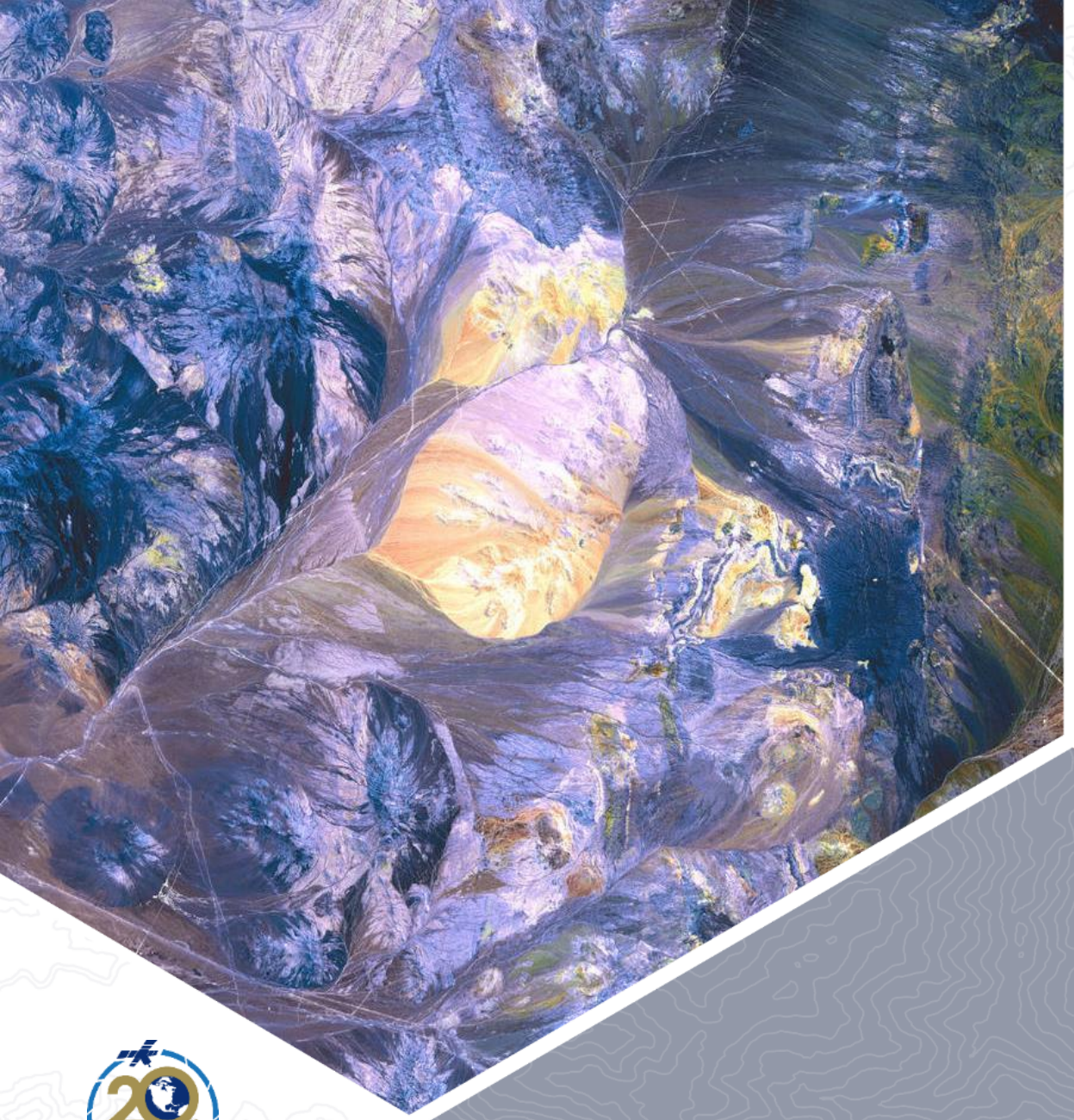


National Aeronautics and
Space Administration

2018 Summer
DEVELOP
Project Preview

20th DEVELOP ANNIVERSARY

2018 Summer Portfolio

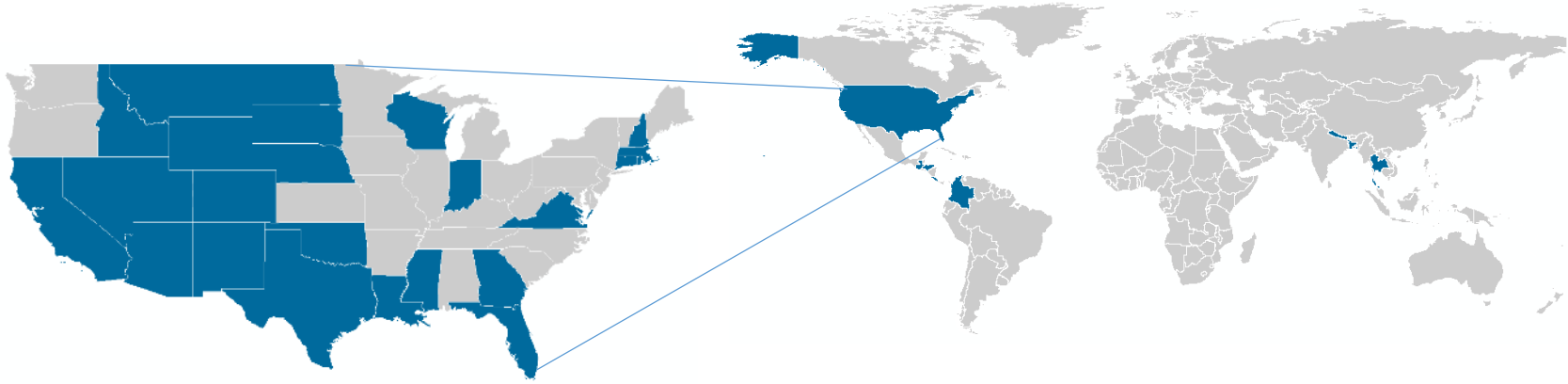
26 States, 2 US Territories & 8 Countries Impacted

2nd TERM (6)

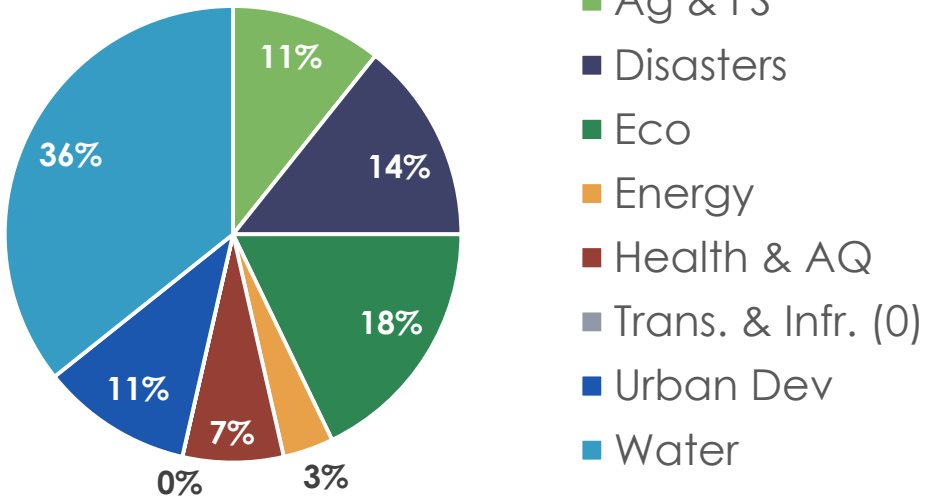
1st TERM (22)

28 Projects

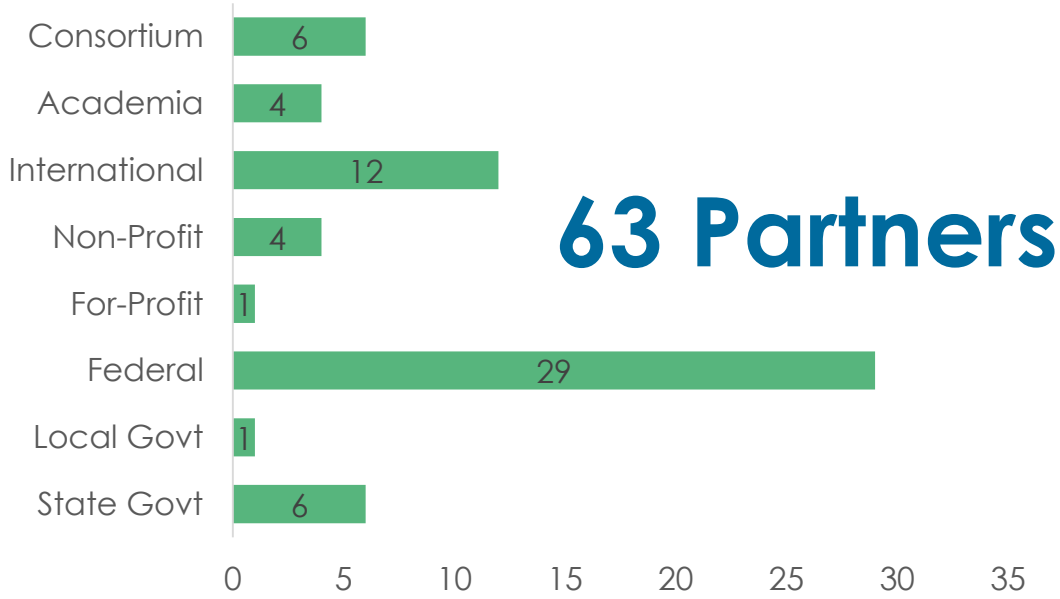
79% Domestic
21% International



Application Areas Addressed



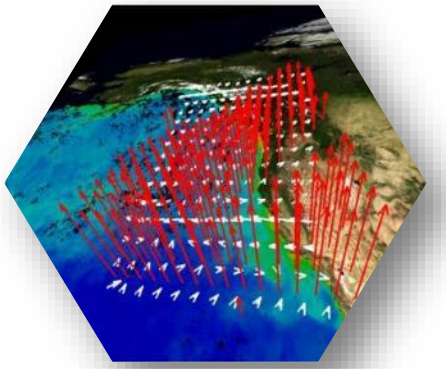
Partner Total by Type

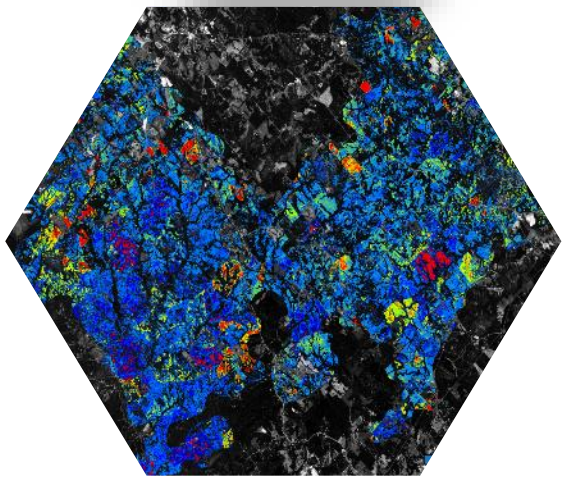


63 Partners

**Impacts and partners are tentative*

Project Characteristics





All DEVELOP projects share these core characteristics:

- Highlight the **applications** and capabilities of **NASA Earth observations**
- Address **actionable** real-world environmental issues
- Partner with **decision-making** organizations
- Conducted by **interdisciplinary** teams under guidance of DEVELOP Science Advisors
- Create a comprehensive set of **deliverables** (Project Summary, Poster, Presentation, Technical Report, Video, Imagery, Shapefiles)
- Take place in **just 10 weeks** during three terms a year (spring, summer, and fall)
- Align with one of the Applied Sciences Program's 8 **application areas**

Disasters | Health & Air Quality | Energy | Agriculture & Food Security | Ecological Forecasting | Urban Development | Water Resources | Transportation & Infrastructure

Summer Projects

Disasters

- Hindu-Kush Himalayan Disasters
- Kenai Disasters
- Puerto Rico Disasters
- Southern California Coast Disasters

Urban Development

- New Orleans Urban Development
- US Urban Development
- Washoe County Urban Development

Water Resources

- Chao Phraya Water Resources
- Fremont River Basin Water Resources II
- Grand Canyon Water Resources
- Idaho Water Resources
- Lake Michigan Water Resources
- Osa Peninsula Water Resources II
- Plum Island Estuary Water Resources II
- Southern California Water Resources II
- US Virgin Islands Water Resources
- Utah & Colorado Water Resources

Ecological Forecasting

- Colombia Eco Forecasting
- Glen Canyon Eco Forecasting
- Honduras Eco Forecasting
- Louisiana Eco Forecasting
- South Dakota Eco Forecasting

Agriculture & Food Security

- Central America Ag & Food Security
- New England Ag & Food Security
- ND & GA Ag & Food Security

Energy

- New Mexico Energy

Health & Air Quality

- Intermountain West Health & AQ
- Richmond Health & AQ

Hindu-Kush Himalayan Disasters

Alabama - Marshall

Community Concern:

- Area experiences intense thunderstorms
- Numerous lightning strike fatalities
- May 10, 2018: 29 deaths in Bangladesh
- 2011- 2016: 547 deaths in Nepal

Partners:

- Department of Hydrology and Meteorology (Nepal)
- Bangladesh Meteorological Department
- International Centre for Integrated Mountain Development
- NASA SERVIR Science Coordination Office
- NASA Global Hydrology Resource Center DAAC

Earth Observations:

- TRMM LIS
- TRMM TMI
- GPM IMERG

Impact & Benefit: Lightning risk and exposure maps will better equip local decision makers to prioritize aid during extreme thunderstorm events and raise awareness of where lightning occurs.

Image Credit: Faisal Akram

Kenai Disasters

Maryland – Goddard

Community Concern: Forests on the Kenai Peninsula are converting to grasslands following spruce beetle-induced forest mortality, which leads to increased fire risk. More frequent (~10-year) spring fires in these grasslands are killing tree seedlings and may be providing a mechanism for maintaining the grassland ecosystem, thereby creating a new ecological regime.

Partner:

- US Fish and Wildlife Service, Kenai National Wildlife Refuge

Earth Observations:

- Landsat 5 TM
- Landsat 8 OLI
- Sentinel-1 C-SAR
- Sentinel-2 MSI
- Suomi-NPP VIIRS
- SMAP
- G-LiHT

Impact & Benefit: This work will help KNWR staff understand whether the grasslands are a new ecological regime or if the land will eventually return to forest. This will help refuge staff determine fire risk and evaluate active management strategies for the Refuge.

Puerto Rico Disasters

Georgia – Athens

Community Concern: The Luquillo Mountains is home to a well-studied tropical montane cloud forest – one of only two such ecosystem sites in the United States. Organisms in this environment are regularly immersed in thick, orographically driven clouds that provide water through direct deposition. Defoliation caused by Hurricane Maria (Sept 2017), leading to lack of evapotranspiration, can pose a challenge for cloud development that threatens ecological resiliency.

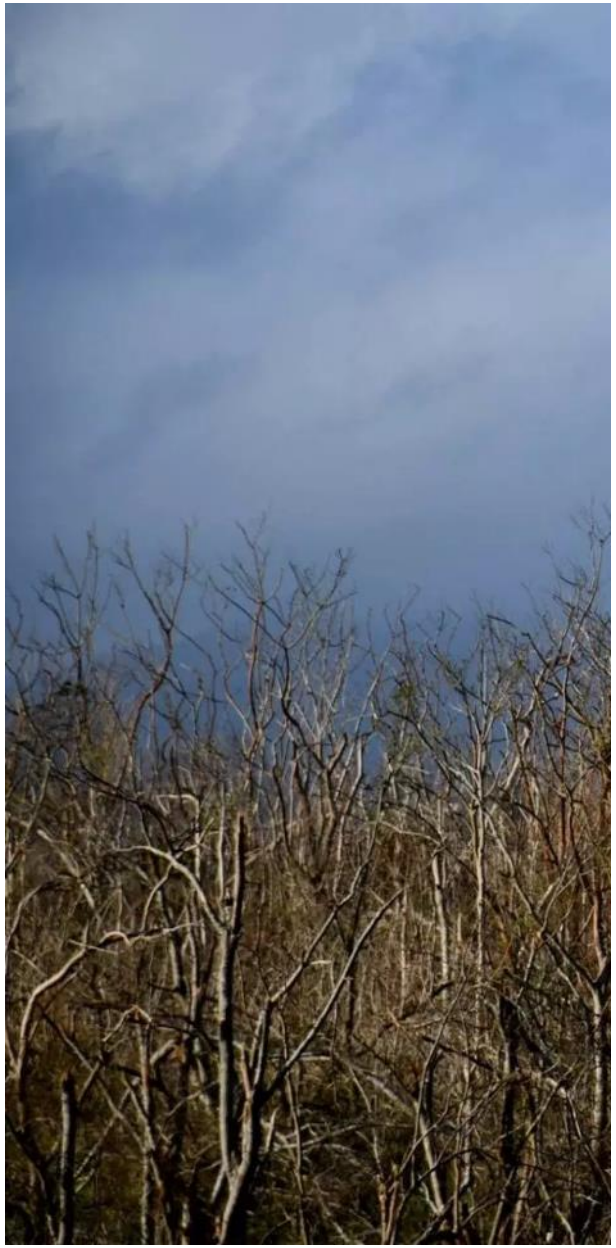
Earth Observations:

- CALIPSO
- Terra MODIS

Partners:

- USDA, US Forest Service, International Institute of Tropical Forestry (IITF)
- USGS National Research Program

Impact & Benefit: The IITF will benefit from the results of this project by developing more appropriate management strategies that reflect shifts in the cloud development and resulting effects on ET in the forest. This will also help them anticipate which areas of the forest are vulnerable to species displacement.



Southern California Coast Disasters

California – JPL

Community Concern: Storm surge and wind, a changing climate, and sea-level rise effect flooding events. Within Southern California, homes and roadways are often close to the shore and USGS is concerned that as sea level rises, many tidal flooding events will shift from being minor to extensive with increases in damage and disruptions to daily life.

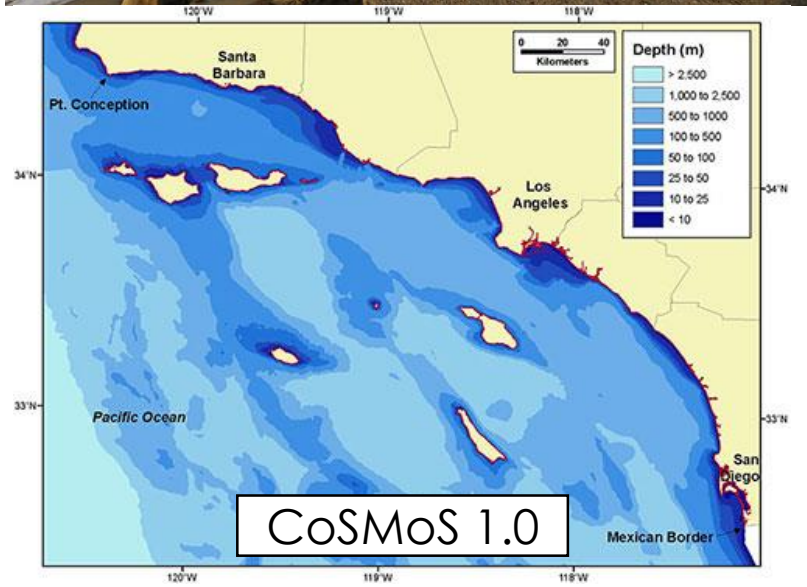
Partners:

- USGS Pacific Coastal and Marine Science Center

Earth Observations:

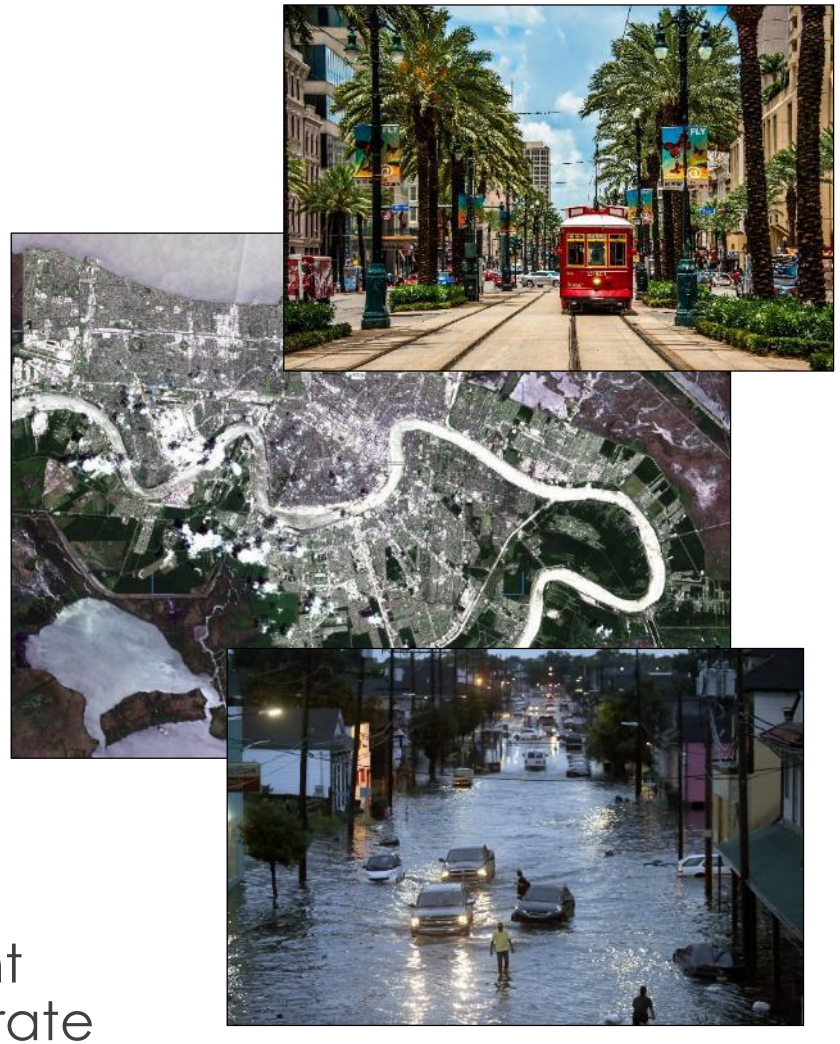
- UAVSAR
- Sentinel-1 C-SAR
- Landsat 8 OLI
- Sentinel-2 MSI
- WorldView-2

Impact & Benefit: The end products provide an invaluable and spatially-expansive data set for their CoSMoS model validation and identifying key areas of flood risk within Southern California, which allows for further refinements to their modeling procedures.



New Orleans Urban Development

Alabama – Mobile



Community Concern: The primary objective of the project is to monitor flood vulnerability in New Orleans metropolitan area over time. While much of the heavily-populated areas of the city are below sea level, one of the primary community concerns involves frequent flooding events due to tropical storms.

Partners:

- Groundwork USA, Groundwork New Orleans

Earth Observations:

- Landsat 8 OLI/TRIS
- Sentinel-2 MSI
- Sentinel-1 SAR
- Suomi-NPP VIRRS

Impact & Benefit: The project will contribute to GWNO's current techniques on mapping and monitoring tree coverage, generate flood maps, and determine the areas with higher exposure to storm surface runoff in the underserved communities in the area.

US Urban Development

Virginia – Langley

Community Concern: Increased urbanization introduces new sources of light pollution, decreasing visibility and affecting natural patterns of activity.

Partners:

- National Park Service, Natural Sounds and Night Skies Division, Night Skies Program

Earth Observations:

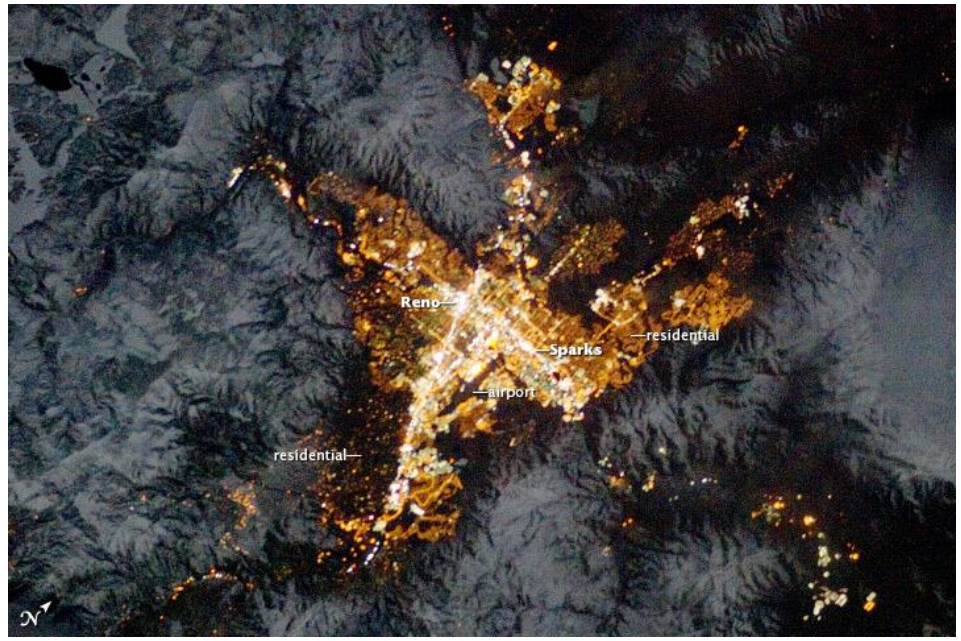
- Suomi-NPP VIIRS

Impact & Benefit: This project will use the Sky Glow Estimation Toolbox to assess artificial sky brightness and light pollution in national parks throughout the country. This will provide an opportunity to refine the tool and validate its effectiveness.

Washoe County Urban Development

Arizona – Tempe

Community Concern: Increases in urban temperatures can lead to an increase in exposure to extreme heat and poor air quality for those living throughout the Truckee Meadows Valley in Washoe County. Modifying urban form is a key strategy to reduce the urban heat island.

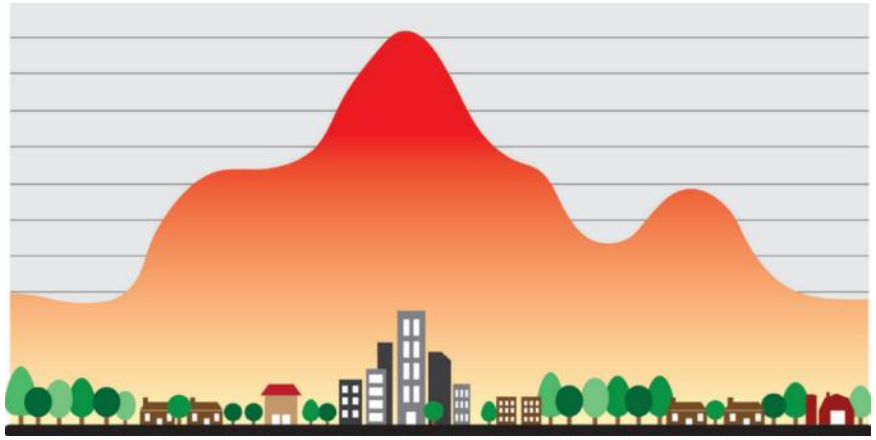


Partners:

- Washoe County Health District, Air Quality Management Division
- Stantec Consulting Service Inc.

Earth Observations:

- Landsat 8 OLI/TIRS
- Landsat 5 TM
- Sentinel -2 MSI



Impact & Benefit: The end products will better position our partners to achieve Goal 3, Strategy 1 of the Ozone Advance Program, which includes decreasing the amount of the region's hardscaped, impermeable, and heat absorbing surfaces.

Chao Phraya Water Resources

Alabama – Marshall

Community Concern:

- Bangkok 19th & 20th centuries: intense development
- Competition over water
- 2006 – 2015: lower Chao Phraya water quality deterioration


Image Credit: Bernard Spragg

Earth Observations:

- TRMM TMI
- GPM GMI
- Aqua & Terra MODIS
- SRTM
- Landsat 8 OLI
- Suomi NPP VIIRS

Partners:

- Asian Institute of Technology
- Bangkok Metropolitan Administration
- Royal Thai Embassy, Office of Science & Technology
- Asian Disaster Preparedness Center
- NASA SERVIR Science Coordination Office

Impact & Benefit: Identification of key runoff areas, modeling of sediment, and analysis of urban footprint expansion will support promotion of sustainable development within the basin.

Fremont River Basin Water Resources II

Virginia – Wise

Community Concern: There is increasing disconnect between river flow forecasts based on snowpack data and observed Fremont River flows through Capitol Reef National Park. Capitol Reef manages historic orchards and pastures that rely on irrigation water from the Fremont River, part of the Dirty Devil basin. Currently, the National Resources Conservation Service (NRCS) creates forecasts for the Dirty Devil River downstream of Capitol Reef, but it does not partition out flows for the Fremont River.

Partners:

- National Park Service, Northern Colorado Plateau Network
- National Park Service, Capitol Reef National Park

Earth Observations:

- SRTM
- Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI
- Terra and Aqua MODIS
- Suomi NPP VIIRS

Impact & Benefit: A down-scaled river forecasting model for the Fremont River at the USGS gauge at Bicknell and a time series of snow extent in the Fremont River watershed upstream of the gauge will ameliorate current methods of predicting water resources throughout the Dirty Devil River Watershed. The first term updated the M-SRM code for the study area, and now the second term will convert the code to R for our end users benefit. This term will also update the sensor to VIIRS to allow long term use of this tool.

Image Source: NPS

Grand Canyon Water Resources

Colorado – Fort Collins

Community Concern: Our partners, at the USGS and NPS are investigating the impacts of the Kaibab Plateau bison herd in GCNP. The herd is currently ~600 and expected to be 1200-1500 by 2030. If left unabated the herd will continue to increase impacts on the park natural resources such as water, vegetation, soils, and archaeological sites. Currently, there is limited information regarding available water resources for grazing bison. In addition, USGS and NPS seek to understand the vegetation changes that have occurred on the landscape from the time before bison were introduced to the area.

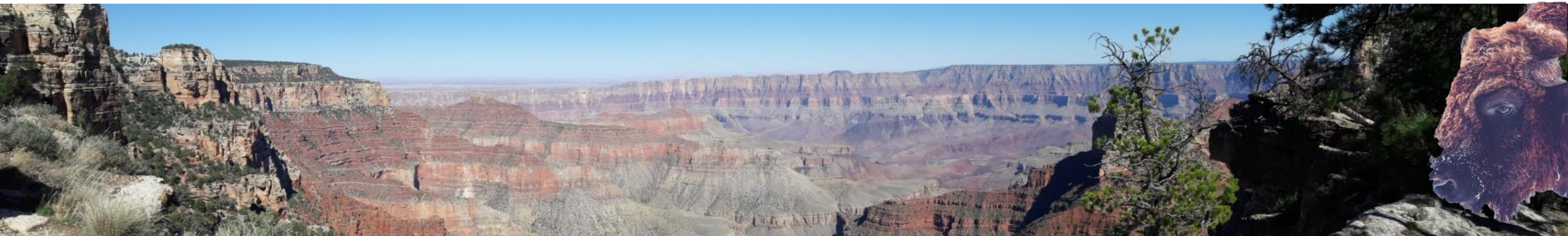
Impact & Benefit: This project will save USGS and NPS time and money by further refining monitoring and field survey efforts. The project will also enable larger scale analysis and identify new study sites that would not be possible without full utilization of NASA Earth observations. The USGS and NPS will apply the end products to more effectively mange the bison populations.

Partners:

- USGS, Ft. Collins Science Center, Ecosystem Dynamics Branch
- NPS, Grand Canyon National Park

Earth Observations:

- GRACE I and II, Landsat 4 & 5 TM, Landsat 7 ETM+, Landsat 8 OLI, Sentinel-2 MSI, and SRTM



Idaho Water Resources

Idaho – Pocatello

Community Concern: Soil moisture is one of the primary determinants of ecosystem health in arid and semi-arid Idaho landscapes. Understanding soil moisture and storage capacity is also of interest to ongoing research focused on the interdependence between water resources and energy use and production.

Partners:

- US Fish & Wildlife, Eastern ID Field Office
- ID Dept of Fish & Game, Southeast Regional Office
- USDA NRCS, Pocatello Field Office
- USDA ARS, Northwest Watershed Research Center
- Idaho National Laboratory

Earth Observations:

- SMAP
- GPM GMI
- Aqua/Terra MODIS
- SRTM

Impact & Benefit: Soil water content estimates are useful for a variety of applications—from determining grazing impacts and fire susceptibility to targeting native plant recovery strategies following disturbances.

Lake Michigan Water Resources

California – Ames

Community Concern: There has been a recent resurgence of macroalgae, predominantly Cladophora, along the coastline of Lake Michigan and other Great Lakes. Although this naturally occurring algae is not toxic to human when it washes ashore and decays it leads to unsightly and foul-smelling beaching which deters visitors.

Partners:

- Groundwork USA, Groundwork Milwaukee

Earth Observations:

- Landsat 8 OLI, Landsat 7 TM, Sentinel -2 MSI, Aqua MODIS, Terra MODIS

Impact & Benefit: Groundwork Milwaukee, is actively involved in the remediation of Cladophora; with this project our partners will be able to better assess when and where the Cladophora will wash up on the city's beaches. It will also be building the capacity of Groundwork youth in using geospatial technologies.

Osa Peninsula Water Resources II

Georgia – Athens

Community Concern: Although Costa Rica is considered a pioneer for conservation, the country relies on extensive use of pesticides and fertilizers. The abounding rivers of Osa Peninsula, Costa Rica are threatened with contamination due to monoculture, animal agriculture, and human settlement, impacting Osa's extremely biodiverse and vulnerable flora and fauna.

Earth Observations:

- Landsat 5 TM
- Landsat 8 OLI
- Terra ASTER
- Sentinel-2 MSI
- PlanetScope

Partners:

- Osa Conservation

Impact & Benefit: This project will help partners assess threats to river water quality and mangrove health based on watershed and riparian land use in the Osa region. End products will be used by Osa Conservation and distributed to the National System of Conservation Areas (SINAC), Ministry of Environment and Energy (MINAE), and local communities to inform watershed restoration, legislation, monitoring, and education.

Plum Island Estuary Water Resources II

Massachusetts – Boston

Community Concern: USFWS Region 5 Refuges manage ~24k ha of coastal wetlands that are being impacted by sea-level rise and climatic forcing. Hundreds of millions of dollars have been invested into restoration projects to enhance coastal resiliency in response to marsh destabilization.

Partners:

- USGS, Woods Hole Coastal and Marine Science Center
- USFWS, Parker River National Wildlife Refuge
- Long Term Ecological Research Network, Plum Island Ecosystem LTER

Earth Observations:

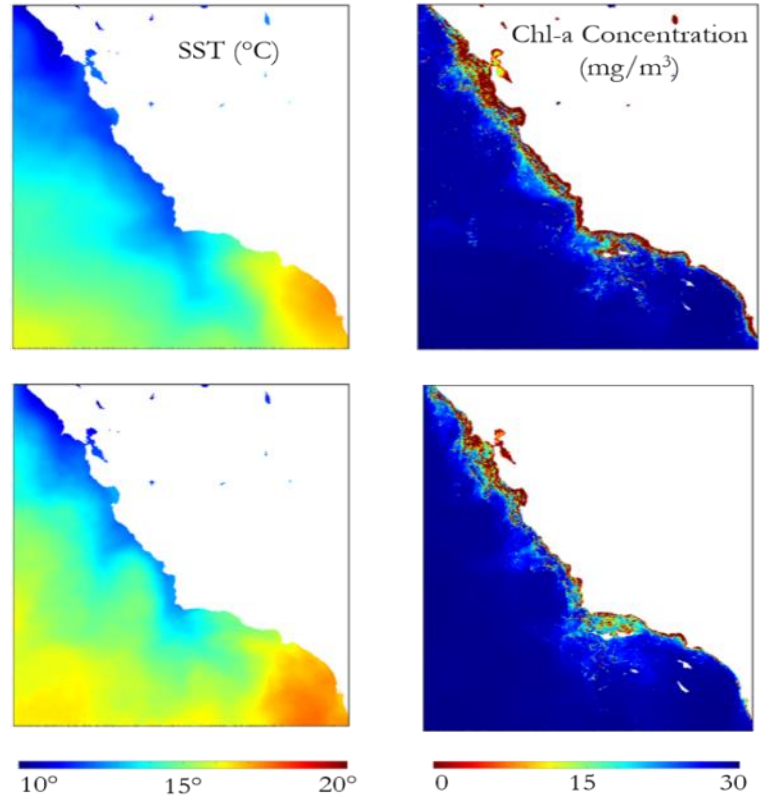
- Landsat 8 OLI
- Sentinel-2 MSI

Impact & Benefit: Sediment supply is vital for salt marsh resilience. EO of model outputs and suspended sediment concentration mapping will facilitate the estimation of surface sediment distribution and sediment flux in and out of the inlet. Results will allow the end user to better quantify sediment budgets for the Plum Island Estuary and help guide preservation and restoration practices.

Southern California Water Resources II

California – JPL

Community Concern: California grunion are found historically in the coast of California between Point Conception and the Mexican border, but recently found north up to San Francisco. The grunion plays an ecological role in the marine food web, since the fish acts as a versatile food source for marine animals, seabirds, and other fishes. Human activities, such as beach grooming, have decreased the population and this will negatively impact the species abundance at the higher trophic levels.



Partners:

- Grunion Greeters Project
- California Department of Fish and Wildlife

Earth Observations:

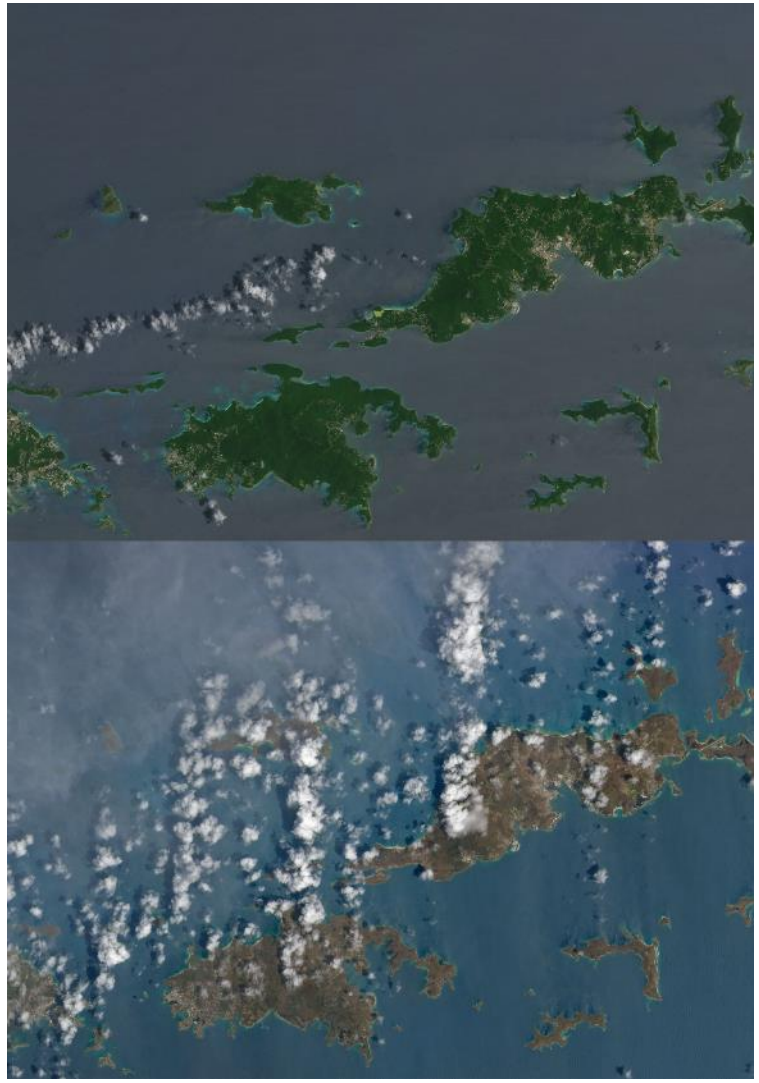
- Aqua MODIS
- SMAP

Impact & Benefit: The planned end products will help the partners and other stakeholders predict areas where future grunion spawning may take place. The maps will also help the partners save time and resources in guiding their citizen scientists' collection of *in situ* data and in protecting specific beaches.

US Virgin Islands Water Resources

California – Ames

Community Concern: On September 6, 2017, Hurricane Irma swept through the Caribbean with Hurricane Maria following two weeks later. The 103,00 residents were, and continue to be, affected by the devastation of these storms. **Nearshore habitats**, which draw tourist and fishermen, were pounded with turbulent waves, uprooting plants and displacing animals. **High water turbidity** during and after the storms mixed sediment into the water column, reducing the efficiency of photosynthesis and suffocating shallow-water benthic communities.



Partners:

- US Virgin Island Department of Planning and National Resources, Coastal Zone Management
- University of the Virgin Islands
- College of Charleston
  Kent State University

Earth Observations:

- Landsat 8 OLI, Landsat 5 ETM, Sentinel 2 MSI, PERSIANN-CDR, GPM (IMERG)

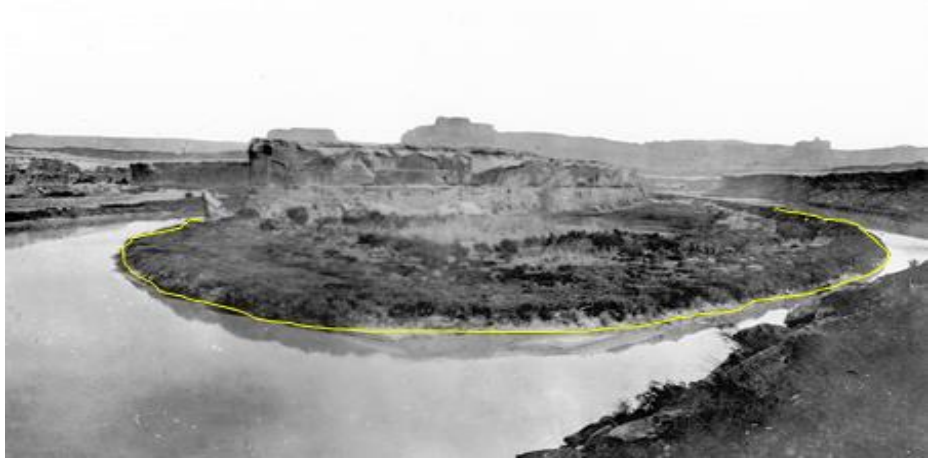
Impact & Benefit: The products will provide the end user with a better understanding of the prevailing water quality conditions surrounding important shallow-water ecosystems during acute events such as a hurricane impact. They will also provide an analysis of how vegetation was impacted during the recent 2017 hurricane season.

Utah & Colorado Water Resources

Colorado – Fort Collins

Community Concern: NPS is tasked with recovery of four of endangered fish species. Specifically, our partners focus on fish management, habitat restoration, and instream flow identification and protection. Currently, the NPS does not effectively monitor in-channel riparian or sediment features. Their methodology is time-consuming, expensive, and does not effectively utilize NASA Earth observations.

Impact & Benefit: This project will save the NPS time and money by further refining monitoring and survey efforts. The project will enable analysis across larger scales and new study sites that would not be possible without full utilization of NASA Earth observations. End products will be integrated into the decision making and management processes of the NPS to more effectively facilitate hydrology management and endangered species conservation within the region.



Partners:

- NPS, Water Resources Division
- NPS, Inventory & Monitoring Division, Northern Colorado Plateau Network
- Upper Colorado River Basin Endangered Fish Recovery Program

Earth Observations:

- Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI, Sentinel-2 MSI, and SRTM

Colombia Eco Forecasting

Virginia – Langley

Community Concern: Deforestation is a significant problem in Colombia, with Caqueta being a hot-spot in the last decade. Therefore, the ability to remotely detect deforestation throughout the country is a high priority.

Partners:

- Colombian Institute of Hydrology, Meteorology, & Environmental Studies (IDEAM)
- University of the Andes

Earth Observations:

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

Impact & Benefit: This project will test the use of the new Colombia Data Cube to assess deforestation and will provide a case study for validation of deforestation and land change algorithms.

Glen Canyon Eco Forecasting

Virginia – Langley

Community Concern: Cultural features and artifacts throughout Glen Canyon National Park are at risk from erosion and other natural forces.

Partners:

- National Park Service, Glen Canyon National Recreation Area

Earth Observations:

- Landsat 5 TM
- Landsat 7 ETM+
- Landsat 8 OLI
- Sentinel-2 MSI

Impact & Benefit: The ability to remotely monitor vegetation and loss of cryptobiotic crust can aid in prioritizing specific archaeological sites for increased preservation efforts.

Honduras Eco Forecasting

Georgia – Athens

Community Concern: Conservation areas in Honduras have been successful in the past, however there are no current initiatives or tools in place to evaluate changes in these areas to determine the extent of potential disturbances. These checks are often critical to ensure conservation areas are undisturbed by a multitude of threats including invasive species or anthropogenic sources.

Earth Observations:

- Landsat 5 TM
- Landsat 7 ETM+
- Landsat 8 OLI
- MODIS
- Sentinel-1 C-SAR
- Sentinel-2 MSI

Partners:

- Instituto de Conservación Forestal (ICF)
- Zamorano University

Impact & Benefit: The ICF does not currently have an efficient way to evaluate conservation areas for disturbance. This project would be the first step in establishing an independent assessment of conservation area resiliency. Using remotely sensed data will help ICF to improve large-scale conservation management practices.

Louisiana Eco Forecasting

Virginia – Wise

Community Concern: Roseau cane is a tall grass that tends to occur on the higher elevations of coastal marsh (e.g., by natural levees), stabilizing sediment and providing valuable wildlife habitat in the Mississippi River Delta. Due to in part to extensive restoration efforts of Roseau cane, the erosion on the Louisiana River Delta has declined since 2008; however, time, money, and effort put into the restoration is at risk due to the Roseau cane mealy bug outbreak. In just a few months, the Roseau cane mealy bug devastated large areas of Roseau cane along the Mississippi River. It is unclear exactly how much Roseau cane has become victim to this invasive species, but the insect has reportedly caused damage to 80% of the Pass Loutre Wildlife Management Area's of 110,000 acres.

Partners:

- National Wildlife Federation

Earth Observations:

- SRTM
- Terra & Aqua MODIS
- TRMM
- Landsat 5 TM, Landsat 7 ETM+, Landsat 8 OLI

Impact & Benefit: Products will assist the National Wildlife Federation in tracking the loss of Roseau cane, as well as identifying potential areas at risk of infestation. Roseau cane is essential to shoreline stability, and losing the cane would set back almost a decade worth of restoration and threaten navigation routes by exponentially increasing the amount of sediment in the Mississippi River Delta. By enhancing the use of current remote sensing practices, areas of importance will be elicited with more detail allowing for improvement of mitigation practices and better allocation of resources.

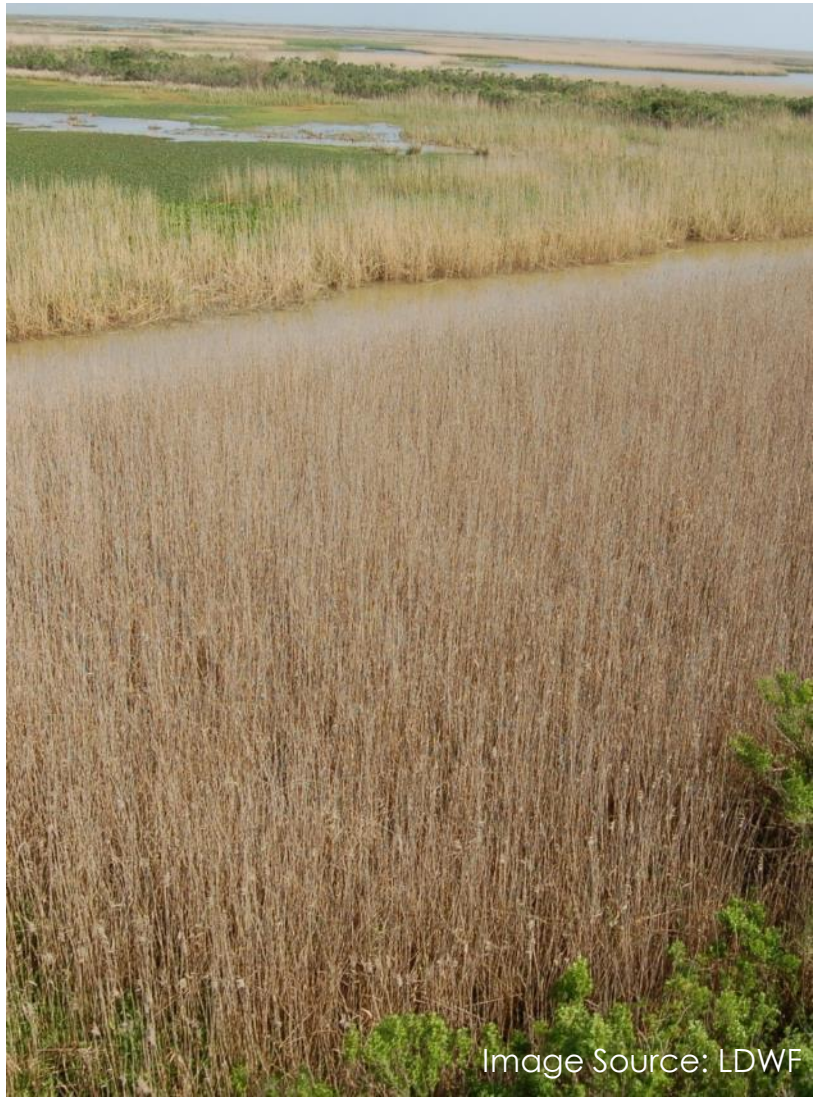


Image Source: LDWF

South Dakota Eco Forecasting

North Carolina – NCEI

Community Concern: Invasive grasses often survive the seasonal plains fires better than native species and more quickly move into burned out areas to displace native grasses. The displacement of native grasses complicates cattle grazing for livestock managers as well as the grazing patterns of local plains fauna.

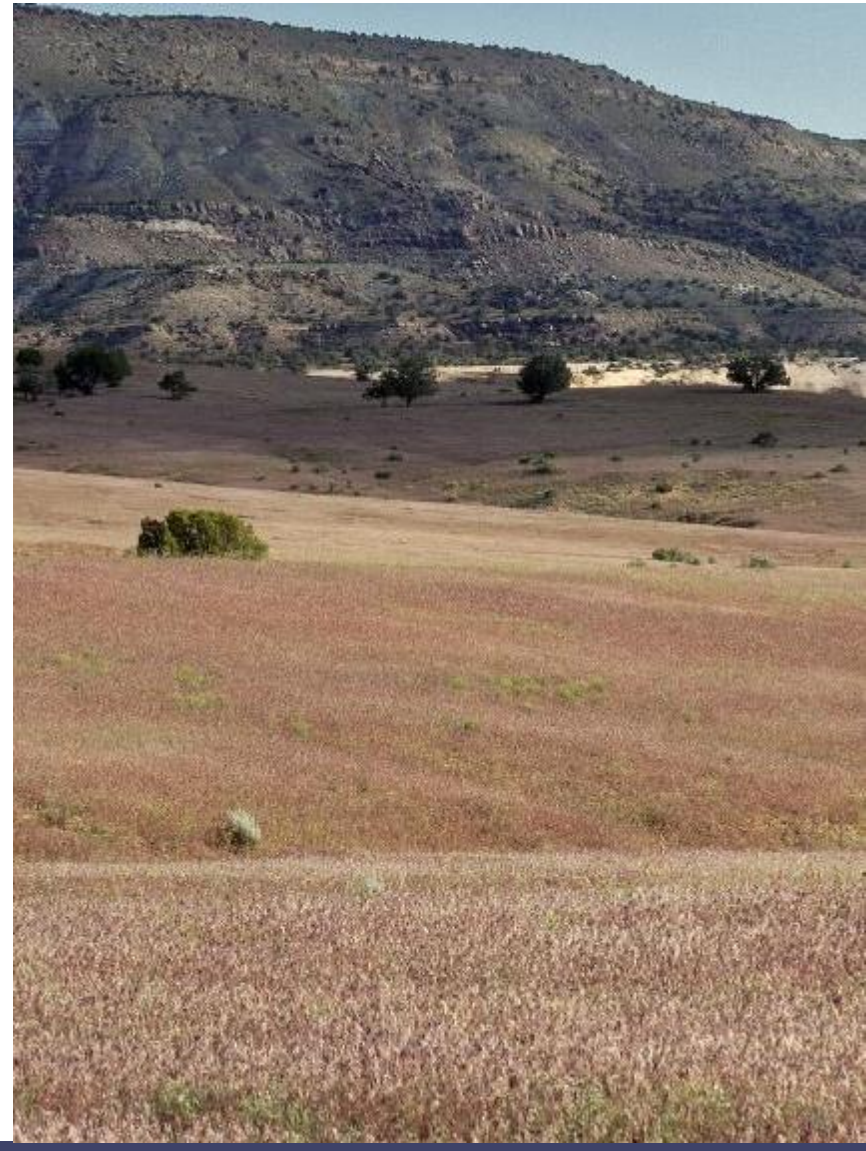
Partners:

- DOI National Invasive Species Council Secretariat
- USDA ARS, High Plains Grasslands Research Station

Earth Observations:

- SMAP
- MODIS
- Landsat

Impact & Benefit: Analysis of the historic spread of invasive grasses in South Dakota will provide a case study to be extended across the Great Plains.



Central America Agriculture & Food Security

North Carolina – NCEI

Community Concern: Drought in Central America is causing crop loss in agricultural areas vital to the production of coffee. In Guatemala, coffee is the primary source of income. In drought, coffee plants are at risk from coffee rust, a deadly fungus that deprives the plants of nutrients.

Partners:

- USAID, Feed the Future Alliance for Resilient Coffee
- International Center for Tropical Agriculture

Earth Observations:

- Terra MODIS
- SMAP
- GOES

Impact & Benefit: . End users will gain from this project actionable drought and plant health data taking into account crop conditions, elevation, and precipitation to inform decisions on coffee cultivation on a local and regional scale

New England Agriculture & Food Security

Maryland – Goddard

Community Concern: Globally, bees are the most important pollinator of food crops. However, over the last ten years, beekeepers in the United States have reported annual honeybee hive losses of over 30% leading to concerns about food security and ecosystem health.

Partners:

- Urban Beekeeping Laboratory and Bee Sanctuary, Inc.
- The Bee Informed Partnership, Inc.
- University of Maryland, vanEngelsdorp Honey Bee Research Lab

Earth Observations:

- Landsat 8 OLI
- Sentinel-2 MSI
- SMAP
- SRTM
- Terra MODIS
- GPM IMERG

Impact & Benefit: A correlation assessment tool will integrate environmental parameters from NASA Earth observations to guide and support partners' current work and future efforts to measure and understand the risks and hazards faced by honeybee populations.

ND & GA Agriculture & Food Security II

Virginia – Langley

Community Concern: In regards to crop classification, there is a growing need to incorporate radar data into traditional classification methods in order to improve their accuracy in determining specific crop types.

Partners:

- USDA ARS, Southeast Watershed Research Lab
- USDA ARS, Northern Great Plains Research Lab
- USDA, National Agricultural Statistics Service, Spatial Analysis Research Station

Earth Observations:

- Sentinel-1 C-SAR
- ALOS-PALSAR
- ERS-2
- RADARSAT-1
- JERS-1
- Landsat 5 TM
- Landsat 8 OLI
- Sentinel-2 MSI
- Terra ASTER

Impact & Benefit: This project will compare crop classification methods incorporating Synthetic Aperture Radar (SAR) to more traditional crop classification methods.

New Mexico Energy

Alabama – Marshall

Community Concerns:

- 2004: Renewables Portfolio Standard – 20% of total sales from renewable energy
- By 2030: 4.85 GW potential
- Social and ecological impact
  - Eagles
  - Military airspace

Partners:

- New Mexico Energy, Minerals & Natural Resources Department, Energy Conservation & Management Division
- New Mexico Department of Game & Fish
- Department of Energy, National Renewable Energy Laboratory

Earth Observations:

- SRTM
- Landsat 8 OLI


Image Credit: Julie*S

Impact & Benefit: Wind farm suitability maps will assist in meeting New Mexico's Renewables Portfolio Standard goals, while creating resources to mitigate social and ecological conflict. Partners will consider techniques for replication in other states or regions.

Intermountain West Health & Air Quality

Virginia – Langley

Community Concern: Air pollutants such as NO_x can affect air quality, ecosystem health, and visibility. The National Park Service is federally mandated to protect natural resources from these pollutants.

Partners:

- National Park Service, Intermountain Region

Earth Observations:

- Aura OMI
- Sentinel-5 Tropomi

Impact & Benefit: Spatial and temporal trends in NO_2 are useful in monitoring concentrations of pollutants. These trend maps can be used to better coordinate the National Park Service's efforts to keep the air clean.

Richmond Health & Air Quality

Virginia – Langley

Community Concern: Increasing urbanization typically leads to an exaggerated urban heat island effect through the introduction of impervious surfaces and reduction in tree canopy cover. It is important to understand where people are most at risk for heat-related illness.

Partners:

- Groundwork USA, Groundwork RVA

Earth Observations:

- Landsat 5 TM
- Landsat 8 OLI
- Landsat 8 TIRS
- Sentinel-2 MSI

Impact & Benefit: An assessment of surface temperature coupled with a social vulnerability analysis will be useful in determining which areas are ideal candidates for urban heat mitigation projects.

Project Deliverables

Required Deliverables:

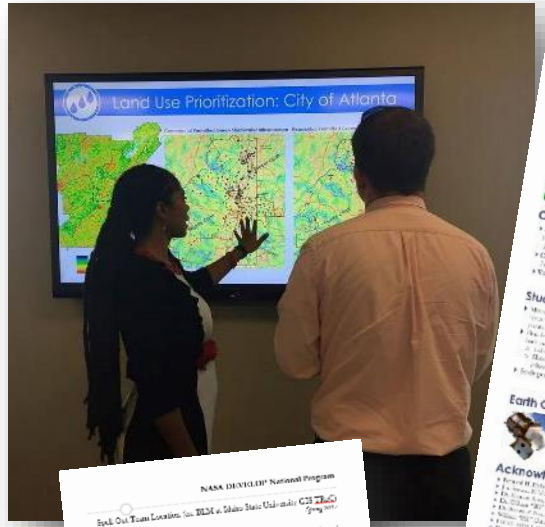
Created by all DEVELOP teams.

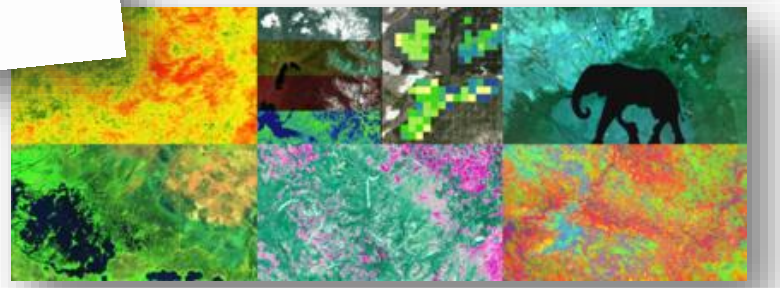
- Project Summary
- Poster
- Presentation
- Technical Report
- Video
- Study Area Shapefiles
- Imagery

Optional Products:

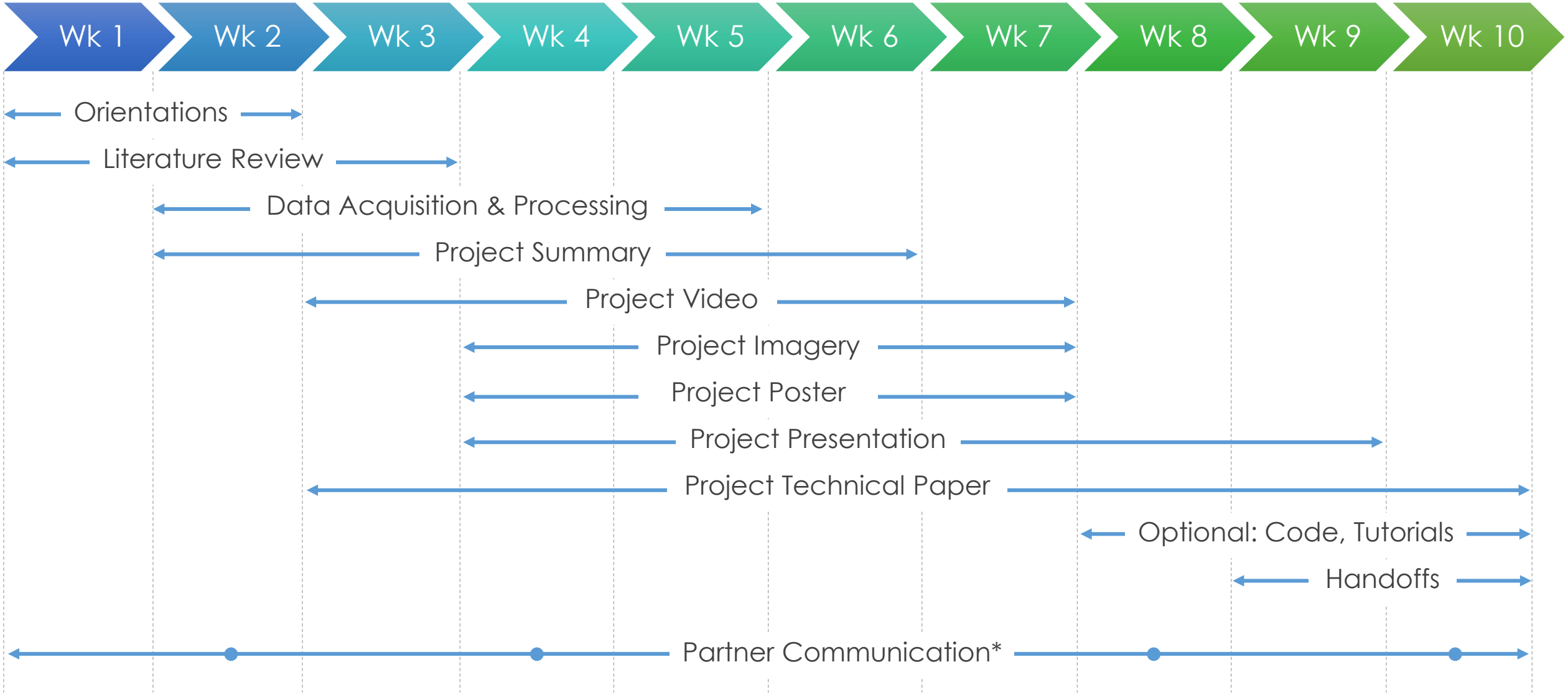
Created by some teams based on specific partner needs and identified ahead of time with team.

- Tutorial
- Code
- Brochure





Summer Schedule



**Notional schedule of bi-weekly meetings, each team coordinates a cadence of communication that works for their partners.*