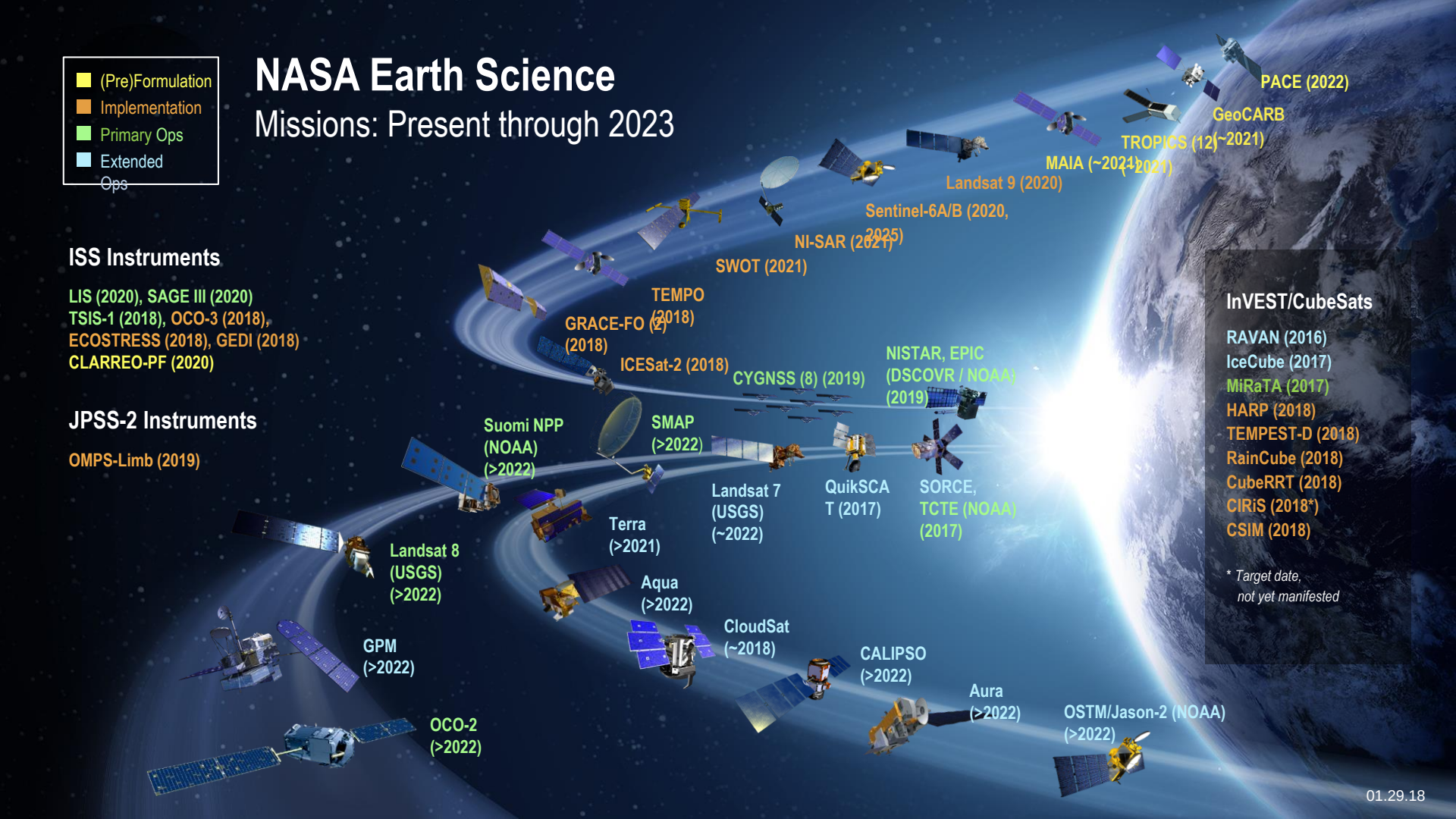
NASA Wildland Fire Program
NASA GEO GWIS Contributions

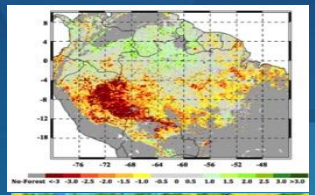
Amber Soja, Vince Ambrosia and Lawrence Friedl
NASA Applied Science Program

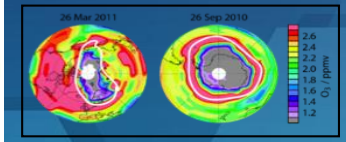
3rd GWIS and GOFC-GOLD Fire IT Meeting
1-2 October 2018
University of Maryland

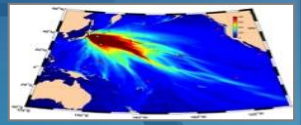

(Pre)Formulation
Implementation
Primary Ops
Extended Ops
NASA Earth Science
Missions: Present through 2023
ISS Instruments
LIS (2020), SAGE III (2020)
TSIS-1 (2018), OCO-3 (2018),
ECOSTRESS (2018), GEDI (2018)
CLARREO-PF (2020)
JPSS-2 Instruments
OMPS-Limb (2019)
PACE (2022)
GeoCARB
TROPICS (12) (~2021)
MAIA (~2021)
Landsat 9 (2020)
Sentinel-6A/B (2020, 2025)
NI-SAR (2021)
SWOT (2021)
TEMPO (2018)
GRACE-FO (2) (2018)
ICESat-2 (2018)
CYGNSS (8) (2019)
NISTAR, EPIC (DSCOVR / NOAA) (2019)
Suomi NPP (NOAA) (>2022)
SMAP (>2022)
Landsat 7 (USGS) (~2022)
QuikSCAT (2017)
SORCE, TCTE (NOAA) (2017)
Terra (>2021)
Landsat 8 (USGS) (>2022)
Aqua (>2022)
CloudSat (~2018)
CALIPSO (>2022)
GPM (>2022)
Aura (>2022)
OCO-2 (>2022)
OSTM/Jason-2 (NOAA) (>2022)
InVEST/CubeSats
RAVAN (2016)
IceCube (2017)
MiRaTA (2017)
HARP (2018)
TEMPEST-D (2018)
RainCube (2018)
CubeRRT (2018)
CIRiS (2018*)
CSIM (2018)
* Target date, not yet manifested
01.29.18

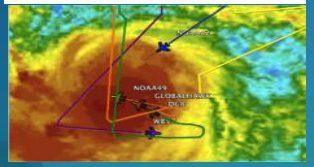
NASA's Earth Science Division

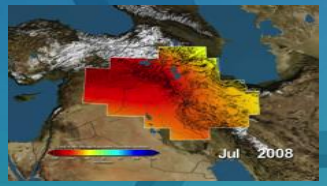
Research

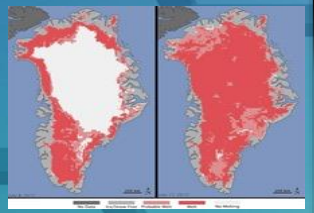






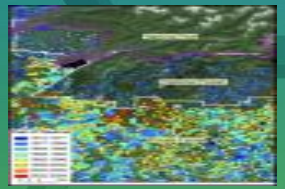


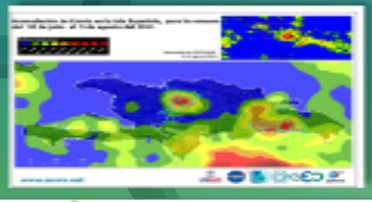


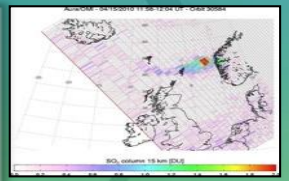


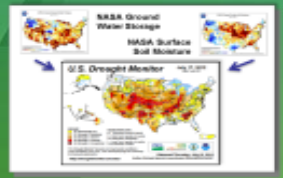
Flight

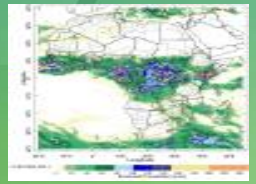
Applied Sciences



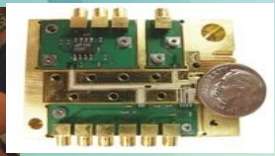








Technology



Applications Themes & Societal Benefit Areas

Emphasis in 4 Applications Areas

Health & Air Quality

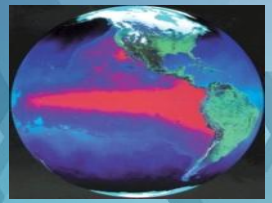
Water Resources

Disasters

Ecological Forecasting

Support opportunities in 5 additional areas

Agriculture



Climate

Weather

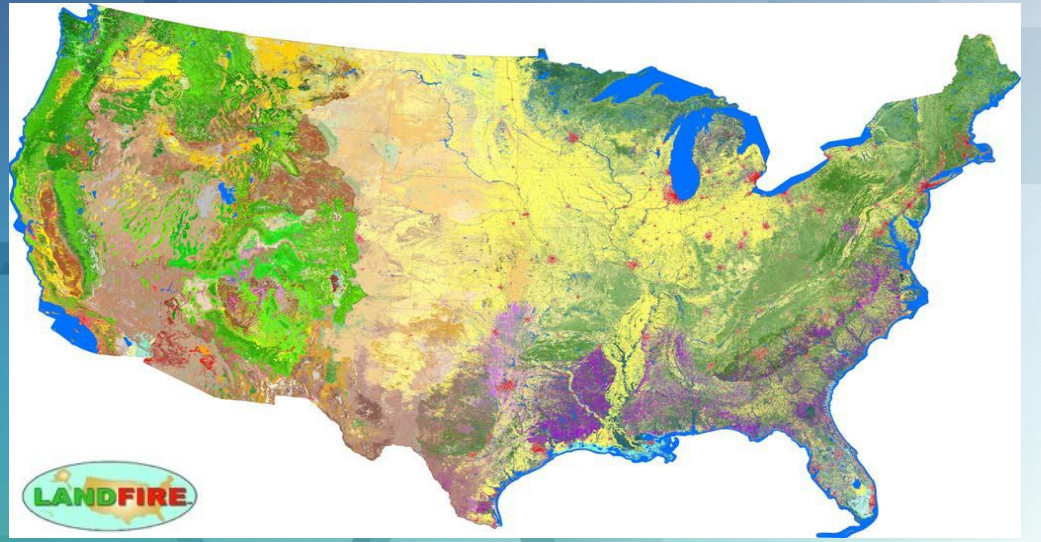
Energy

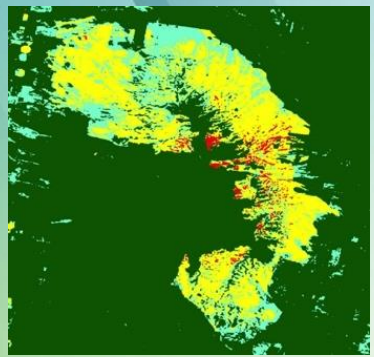
Oceans

Crosscutting theme: Wildland Fires

Wildfire Program Focus Areas

- ***Pre-Fire (Fire Risk Modeling)***
  - Vegetation density and extent
  - Soil moisture/drought severity
  - Topography
- ***Active Fire Mapping***
  - Total area currently burning
  - Fire Radiative Power (FRP) using thermal bands
- **Post-Fire Mapping**
  - Total area burned
  - Burn severity
  - Post-fire vegetation regrowth (NDVI)





Above: A USGS Landfire map.

Left: 2007 Black Pine 2 Fire, Idaho, U.S. On the left: imagery, right: burn severity. USDA RSAC.

ROSES-2011 A.35 Phase II Projects

Zachary Holden / USDA Forest Service:
A Prototype System for Predicting Insect and Climate-Induced Impacts on Fire Hazard in Complex Terrain;

Sher Schranz / NOAA:
Wildland Fire Behavior and Risk Prediction;

James Vogelmann / USGS EROS Center
Improving National Shrub and Grass Fuel Maps Using Remotely Sensed Data and Biogeochemical Modeling to Support Fire Risk Assessments;

Birgit Peterson / USGS EROS Center:
Enhanced Wildland Fire Management Decision Support Using Lidar-Infused LANDFIRE Data;

Karyn Tabor / Conservation International Foundation
An Integrated Forest and Fire Monitoring and Forecasting System for Improved Forest Management in the Tropics;

Wilfrid Schroeder / University of Maryland
Development and Application of Spatially Refined Remote Sensing Active Fire Data Sets in Support of Fire Monitoring, Management and Planning;

Josh Picotte / Stephen Howard / USGS EROS Center:
Utilization of Multi-Sensor Active Fire Detections to Map Fires in the US;

Mary Ellen Miller / Michigan Tech Research Institute (MTRI):
Linking Remote Sensing and Process-Based Hydrological Models to Increase Understanding of Wildfire Effects on Watersheds and Improve Post-Fire Remediation Efforts;

Keith Weber / Idaho State University
RECOVER: Rehabilitation Capability Convergence for Ecosystem Recovery;

NASA Earth Observations Support Rapid Assessment & Recovery Operations on Ft. McMurray Wildfire

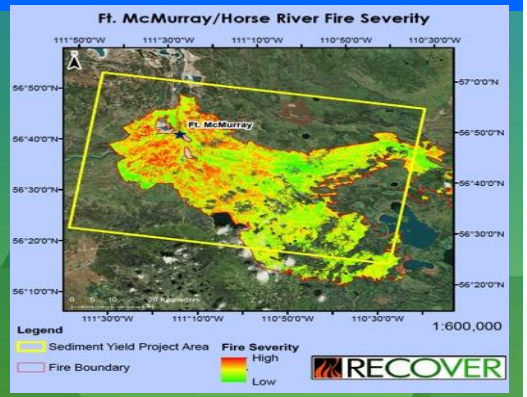
Situation: Ft. McMurray (Horse River) Fire in Alberta burned 1 May to 5 July 2016, and consumed 1.5 M acres. It was the costliest disaster in Canadian history ($3.58B).

Approach: Use MODIS and Landsat measurements, coupled with soils and terrain information to model burn severity and create inputs to hydrological forecast models in near-real-time.

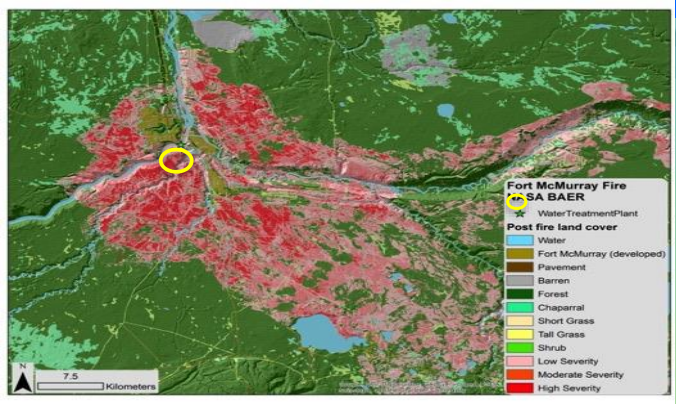
Results / Implications:

- Supported managers with tools to pinpoint active fire, develop post-fire burn severity and model hydrologic processes for rapid remediation actions;
- Helped prioritize watersheds to concentrate post-fire treatment areas and save resources and mitigation costs.

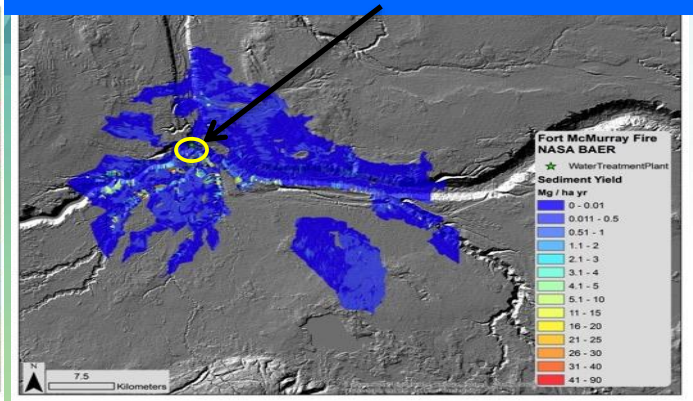
Landsat-derived Differenced Normalized Burn Ratio



Post-fire land cover / burn severity modeled classification

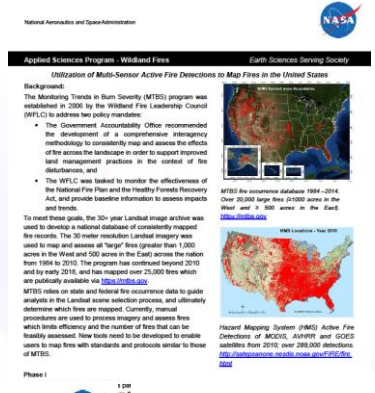


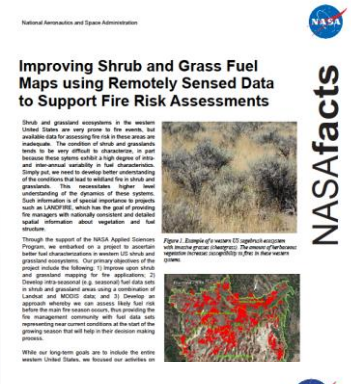
High sediment / runoff predictions

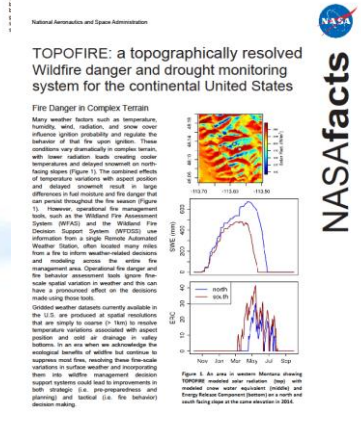


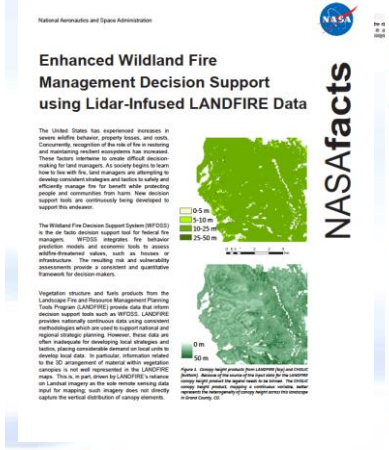
Advertising our Successes

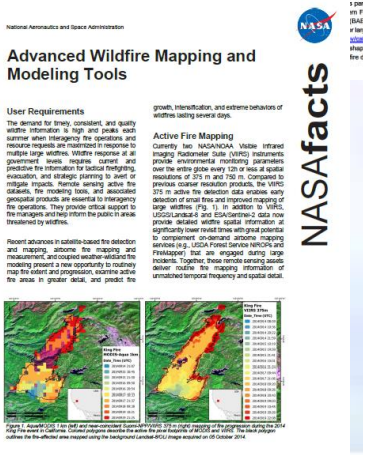
2-page **Fact Sheets** (IAWF, USFS, CI, USGS, AFE, TFRSAC, ESRI, other Partners)

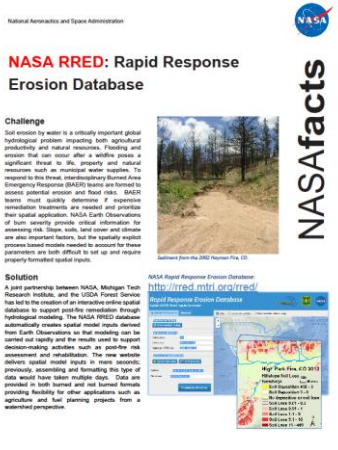












NASA ROSES-16 GEO Solicitation

A.50 Group on Earth Observations Work Programme

- Solicitation offered by NASA Earth Science and Applied Science Program
- To demonstrate a strong ability to support and advance GEO, to further U.S. and NASA interests, and to demonstrate U.S. and NASA commitments to GEO;
- To foster broader domestic involvement in a U.S. national approach to GEO and the Work Programme;
- Advance the use of Earth observations to inform decisions and actions and broaden the organizations routinely using them;
- Increase international collaboration and partnering across GEO and broaden the GEO community;

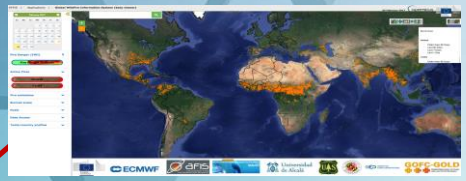
GWIS Timeline

Creation of Forest Fire Experts Group in EC

2001-GOFC-Fire holds a joint workshop with the CEOS LPV on Fire Product Validation in Lisbon

2011-GOFC / EARSeL-FF-SIG Propose GWIS in Stresa, Italy

2013 - Copernicus and GEO support development of GWIS as a extension of EFFIS

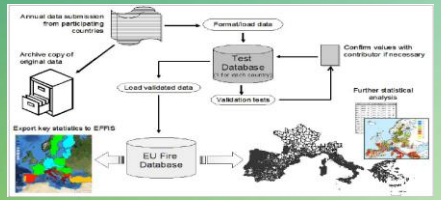


1998 | 2000 | 2001 | 2004 | 2010 | 2016 | 2018 | 2020

EFFIS becomes operational in 2000

2003--Rapid damage assessment was introduced to EFFIS; quasi-real time maps of burned areas in southern Europe.

2004--EFFIS Fire Database was established



2001-20xx GOFC-GOLD Fire Implementation Team Meetings to promote joint developments of global fire monitoring and EEFIS

GWIS Operational

NASA Supports 3 GWIS Teams
Luigi Boschetti, Robert Field
Schroeder / Giglio

NASA ROSES-16 GEO Solicitation

A.50 GEO Work Programme Solicitation

- **Funding Opportunity Number:** NNH16ZDA001N-GEO
- **Number of New Awards:** ~20-25 (increased to 32)
- **Max Duration of Awards**: 36 months
- **Total Amount of NASA Funding (FY17-20):** $8M (increased to ~$15M)
- **Expected Level of Awards:** $30K - $200K per year
- **Proposal Due Date:** March 10, 2017
- **Notify PIs:** September 18, 2017 (about 2-3 weeks late)
- **Expected Project Start Date:** December 1, 2017

GEO solicitation POC: Lawrence Friedl

- **GEO GWIS POC:** Vince Ambrosia

GEO GWIS Selected Proposals

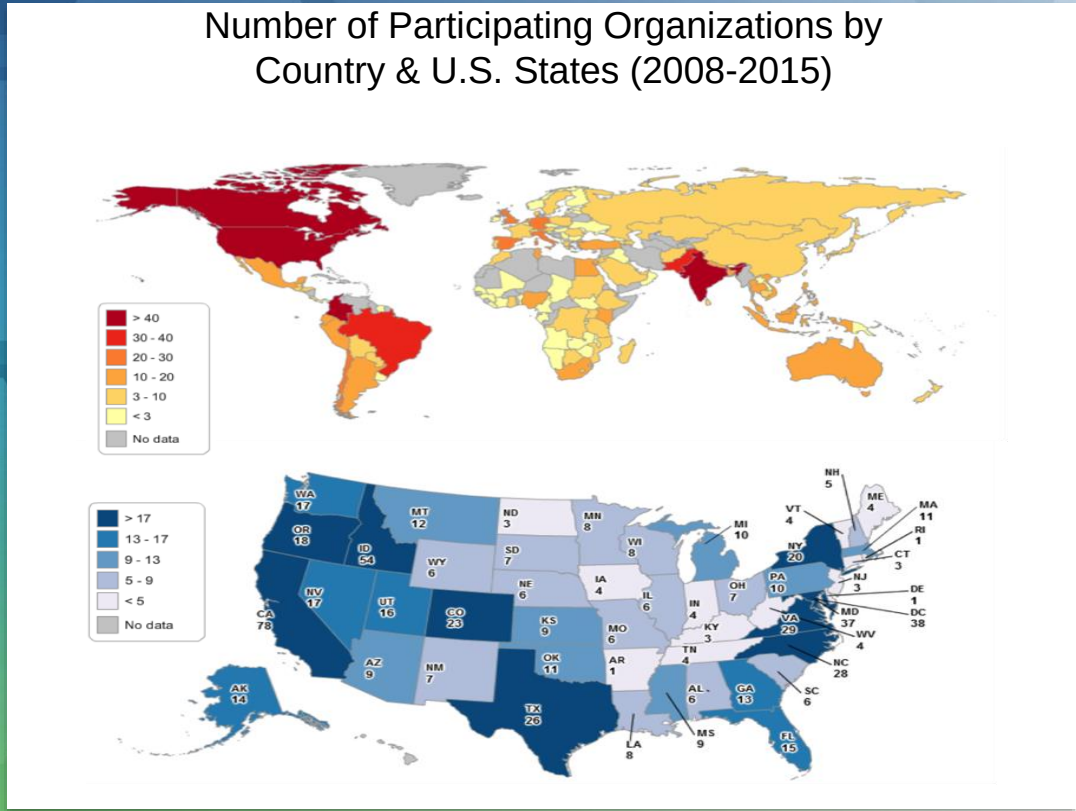
A.50 GEO Work Programme

3.8 Global Wildfire Information System (GWIS)

- **Robert Field (Columbia University)**
  - *"Enhancements to the Global Wildfire Fire Information System: Fire Danger Rating and Applications in Indonesia"*
- ***Louis Giglio / Wilfrid Schroeder (University of Maryland / NOAA)***
  - *"Development of a Harmonized Multi-Sensor Global Active Fire Data Set"*
- ***Luigi Boschetti / David Roy (U. of Idaho & So. Dakota State Univ.)***
  - *"Using the NASA polar orbiting fire product record to enhance and expand the Global Wildfire Information System (GWIS)"*

ARSET Trainings

- 66 Trainings Completed
- 4,000+ participants worldwide from:
  - 1,400+ organizations
  - 130+ countries
- More participants trained in 2015 than all previous years combined



http://arset.gsfc.nasa.gov

ARSET 2018 Wildfire Applications Webinars:

GEO-GWIS

- **Objectives:** Provide an overview of relevant uses of GWIS and navigation through the GEO-GWIS tools and map services

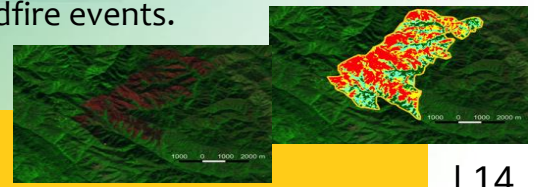
- **Date:** 19 July 2018
- **Agenda / Schedule:** Usually one, 1-hour session per week for 5-weeks. Materials can be accessed on own time following the completion of the webinar.
- **Audience:** National and international entities involved in wildfire management or responsible for providing fire statistics on regional or national wildfire events. Professionals interested in implementing satellite capabilities for wildfire management activities.

Burned Area (small Landfire)

- **Objectives:** Utilize an open source tool (QGIS) to download Landsat imagery to identify suitable imagers for fire mapping, and subsequently create an automatically-derived, MTBS-like threshold burn severity products. Provides a much needed tool to allow worldwide users to track and map fires.

Josh reported success
400+ attendees

- **Date:** 12 July 2018
- **Agenda / Schedule:** Workshop with Josh Picotte (USGS-EROS)
- **Audience:** National and international entities involved in burn severity assessment or providing fire statistics on regional or national wildfire events.



https://arset.gsfc.nasa.gov

Points of Contact

NASA Applied Science Program – Wildfire and GEO-GWIS

http://appliedsciences.nasa.gov/

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International Space Station

Earth Science Operating Missions

External Logistics Carriers: ELC-1, ELC-2, ELC-3
External Stowage Platforms: ESP-3
Alpha Magnetic Spectrometer
Columbus External Payload Facility
Kibo External Payload Facility

- Formulation
- Implementation
- Primary Ops
- Extended Ops

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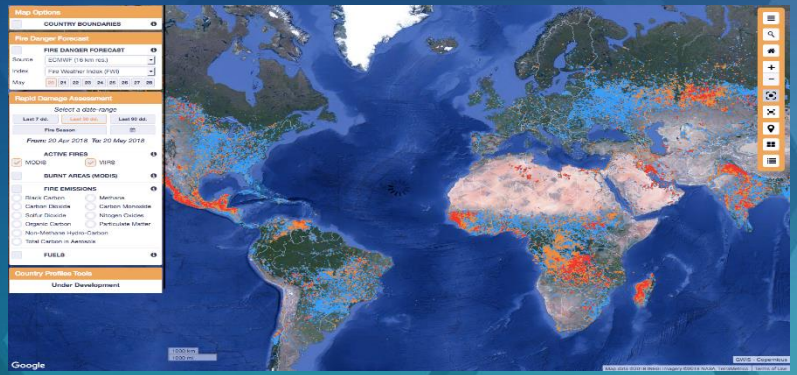
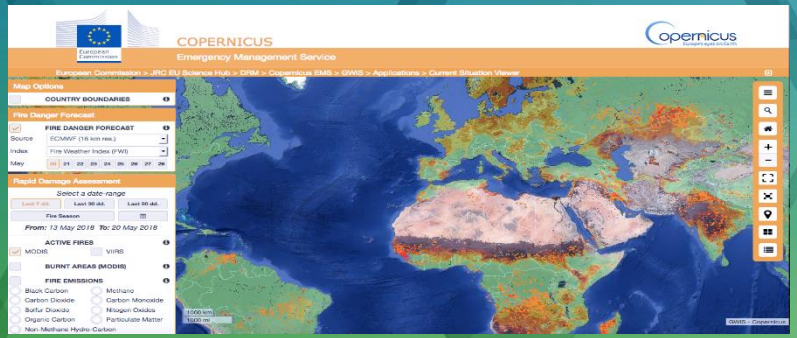
NASA ARSET 2018 GWIS Webinar





- **Objectives:** Provide an overview of relevant uses of GWIS and navigation through the GEO-GWIS tools and map services;
- **Dates:** July 19, 2018
- **Audience:** National and international entities involved in wildfire management or responsible for providing fire statistics on regional or national wildfire events. Professionals interested in implementing satellite capabilities for wildfire management activities.

https://arset.gsfc.nasa.gov

ARSET Workshop: Wildfires in Boreal Systems

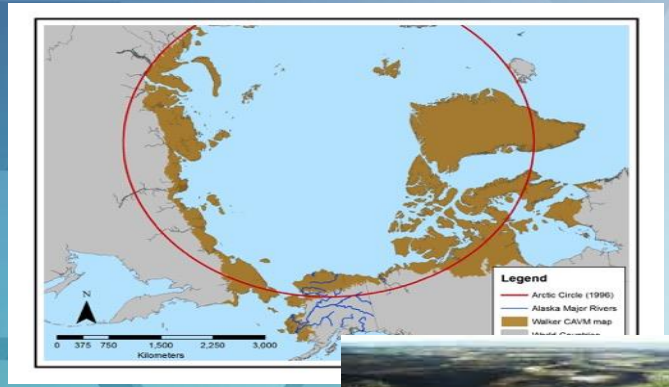
Workshop: Opportunities to Apply Remote Sensing in Boreal / Arctic Management & Science

April 4-6, 2017; Univ. of Alaska, Fairbanks, AK.

- **Objective:**

  Convene an international, interdisciplinary workshop of remote sensing scientists, ecologists, hydrologists, and agency fire managers and decision-makers to develop new opportunities for use of remotely sensed data in boreal / arctic wildfire management and science.

- Three-day workshop (April 4-6, 2017) University of Alaska - Fairbanks
- Workshop supported by NASA under a ROSES E2 solicitation. Workshop concept derived from IARPC white paper on satellite and airborne systems available for wildfire observations (Ambrosia, et al).

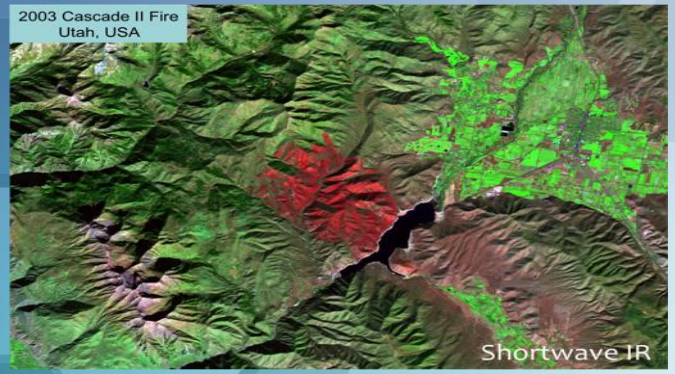


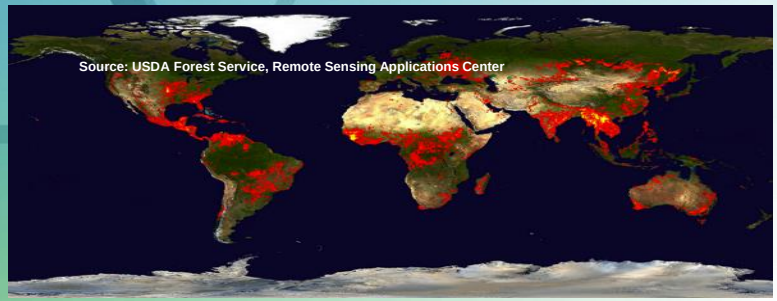
https://akfireconsortium.uaf.edu

First ARSET Wildfire Applications Webinar:

Webinar: March 31 - April 28, 2015

- **Objectives:** Provide an overview of relevant NASA Earth science data products, tools, and access portals for wildfire applications for enhanced decision-making and assessment methods.
- **Overview Statistics:** 278 participants, 178 organizations, 42 countries, 33 states
- **Attendees:** USDA Forest Service, National Park Service, National Weather Service, Bureau of Land Management, US Geological Survey, US EPA, CAL FIRE, Idaho Army National Guard, Alaska Fire Science Consortium, Ministry of Environment and Natural Resources, El Salvador (MARN), Risk Management Solutions Inc., Western States Air Resources (WESTAR) Council, United Nations, Nature's Foster, ESRI, African Wildlife Foundation, Conservation International, etc.





Source: NASA's Fire Information and Resource Manager's System/NASA LANCE

https://arset.gsfc.nasa.gov/wildfires/webinars/intro-wildfire-applications

ARSET Workshop: Wildfire Applications at ISS²

Workshop: November 14, 2016

- **Objectives:** Provide an overview of relevant NASA Earth science data products, tools, and access portals for wildfire applications for enhanced fire and smoke monitoring
- **Training Summary:** Attendees learned how to apply NASA Earth observations to air quality forecasting; smoke, fire, and PM2.5 monitoring; image interpretation; and image processing. The training provided practitioners in wildland fire, smoke management, public health, and air quality management with tools to incorporate satellite remote sensing into their decision-making process.
- **Overview Statistics:** 26 participants, 18 organizations, 5 countries,
- **Audience:** National and international entities involved in air

https://arset.gsfc.nasa.gov/wildfires/workshops/smoke-symposium-2016

Attendees included: USDA Forest Service, National Park Service

GWIS Goals in GEO WP 2017-2019

- *Provide harmonized fire information (e.g. fire danger)*
- *Promote networking of fire information providers through annual workshops;*
- *Establish operational links with other wildfire communities;*
- *Integrate / harmonize regional wildfire information data sources;*
- *Develop, implement and promote interoperability and communication*
- *Coordinate / promote capacity building and training activities*

Advancing NASA's Wildland Fire Applications Capabilities

- **Wildland Fire application science answering questions and supporting decisions** transforming EO data and research results into environmental intelligence.
- **Coordination and collaboration** informing brokers, managers, and responders with critical products and services .
- **Creation and leverage of partnerships** strengthening and enabling effective response throughout the wildfire lifecycle.