New Paintings Outside the Lines: Beyond the Visible
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USFS Watershed Condition Scoping Workshop
Fort Collins, CO 6-7 September, 2017
Data Sources in Today's Talk

**Satellite:**
- RADARSAT (Gravimetric)
- TanDEM-X/PolInSAR (Dual DEM; Polarized Lidar SAR)

**Suborbital:**
- Hyper spectral (AVIRIS-NG)
- LiDAR/Imaging Spectrometry
- G-LiHT: Goddard's LiDAR, Hyperspectral & Thermal Imager
- UAVSAR/LVIS
Earth Science Missions

ISS Instruments
CATS, LIS, SACE II
TSIS-1, OCO-3, ECOSTRESS, GEDI
CLARREO-PF

JPSS-2 Instruments
RBI, OMPS-Limb

Formulation
Implementation
Primary Ops
Extended Ops
Radarsat-2 shows 3-13” subsidence 2014-2015
Pre-HySpRI Airborne Campaign

AVIRIS Data obtained: Spring, summer, fall 2013-2015; Summer 2016-2017
Pre-HyspIRI Airborne Campaign

Aviris.jpl.nasa.gov
AVIRIS-NG Species Level Discrimination

- Annual grass
- Barren
- Bigcone pine
- Brome
- Coastal sage
- Mixed chaparral
- Montane chaparral
- Oak
- Ponderosa pine
- Water
2008 Sayre Fire in LA:
Cheatgrass moving up drainages; scattered oaks at risk
California ASO

Airborne Snow Observatory
Snow Water Equivalent
Tuolumne Basin
Jun 05, 2014

Snow Water Equivalent
Tuolumne Basin
Jun 08, 2015

Snow Water Equivalent
Tuolumne Basin
Jun 07, 2016

Three Years California ASO
Total Basin Snow Water Equivalent

ASO – Tuolumne River Basin
5 year SWE volume
High resolution photo of peat collapse resulting from Sea Level Rise and Salt intrusion in the Florida Everglades taken by NASA G-Light instrument in 2017
3-D model of coastal topography and canopy height derived from High-resolution Stereo imagery
Spatio-temporal dynamics across ENP can be monitored through long-term (and continuous) satellite imagery.

More information on Mangrove Science: https://mangrovescience.org/
Combining the forest function and structure can provide better details to the changing coastline.

**Changes in NDVI**
- Complete Loss
- Degrading/Loss
- Regeneration

**Changes in Structure**
- Loss > 4 m
- Gain > 4 m
- No Change

*NASA Carbon Monitoring Systems*
UAVSAR Pongara Wetlands Canopy Height Fusion Product

PolInSAR & Lidar Fusion Canopy Height Product

\[ y = 1.07x + 0.19 \]
\[ r^2 : 0.7 \]

Bias: 2.34 m
Y-X Std Dev: 6.4 m
X Std Dev: 11.4 m
RMSE: 6.81 m
N: 3410238

* M. Simard & M. Denbina
Mangrove Height Maps for Gabon, Tanzania and Mozambique at 12 m resolution from TanDEM-X
Focus Areas in Applied Sciences:

- Biodiversity/Ecological Forecasting
- Water Quality
- Food Security
- Natural Hazards (Tsunami/Hurricane, Earthquakes,..)
NASA Enabling Tools

Regional Climate Modeling: https://rcmes.jpl.nasa.gov/


MERRA-2 Reanalysis: https://gmao.gsfc.nasa.gov/reanalysis

NASA Earth Exchange: https://nex.nasa.gov/nex/
GCAM Land use: 450 ppm atmospheric CO$_2$

450 ppm Stabilization Scenario When ALL Carbon is Valued

450 ppm Stabilization Scenario When Terrestrial Carbon is NOT Valued

From Wise et al., 2009 Science
SUMMARY

New integrative capabilities to capture status/changes in landscape structure and function

Opportunity for new paradigms and process understanding for ecosystem and global modeling frameworks

EVI opportunities, Decadal Survey
SUMMARY

Ongoing and Future:
ECOSTRESS - measure plant temp for water stress
GEDI - Global Ecosystem Dynamics Investigation: high resolution laser observations of 3D structure of the Earth
NISAR - NASA-ISRO SAR: ecosystem disturbances, ice-sheet collapse, and natural hazards such as earthquakes, tsunamis, volcanoes and landslides.
PACE - Plankton, Aerosol, Cloud ocean Ecosystem: ocean/atmosphere, chlorophyll dynamics, HABs
SWOT - Surface Water Ocean Topography: water storage changes in wetlands, lakes, and reservoirs
EVI opportunities, Decadal Survey