USFS – NASA Joint Applications Workshop: Satellite Data to Support Natural Resource Management

Workshop Agenda: April 30 – May 2, 2019

The Geospatial Technology and Applications Center (GTAC)

Wallace F. Bennett Federal Building

125 South State Street, Salt Lake City, Utah

Goals: To share and demonstrate the capabilities of NASA data products, as well as to develop connections and strengthen partnerships between NASA and USDA Forest Service.

Objectives: 1) To provide an overview of NASA missions and projects, data, and tools supporting natural resource management; 2) To share and prioritize USDA Forest Service operational needs with NASA; 3) To identify opportunities for collaboration; and 4) To expand USDA Forest Service awareness of NASA data sources and tools and mutually explore ways to advance information delivery.

Day 1, April 30th

8:00 a.m.   **Registration and Coffee 5th floor lobby area**

8:30 a.m.   **Session I: <u>Setting the Stage</u> Room 5007 (5th floor)**

Presenting: **Everett Hinkley**, National Remote Sensing Program Manager/ USDA Forest Service

- Welcome
- Introductions
- Objectives, Goals

8:50 a.m.   **Session II: <u>Overview of USDA Forest Service Management Goals and Information Needs</u> Room 5007 (5th floor)**

- Building a bridge between NASA technology and natural resource management decision makers

  Presenting: **Cynthia West**, Executive Director Office of Sustainability and Climate/ USDA Forest Service *(15 minutes)*
- USDA Forest Service information needs

- o Soil moisture and hydrology

  *Presenting: **Raha Hakimdavar**, USDA Forest Service (15 minutes)*

- o Vegetation structure and function

  *Presenting: **Carlos Ramirez**, Vegetation Mapping and Inventory Group Leader/ USDA Forest Service (15 minutes)*

- o Emissions and flux

  *Presenting: **Grant Domke**, CMS Principal Investigator/ USDA Forest Service (15 minutes)*

- o Early warning systems

  *Presenting: **Danny Lee,** Eastern Forest Environmental Threat Assessment Center (15 minutes)*

- o Data and tools (knowledge synthesis)

  *Presenting: **Kevin Megown,** Resource, Mapping, Inventory and Monitoring Program Lead, GTAC (15 minutes)*

10:20 a.m.   **Break**

10:35 a.m.   **Session III: <u>Overview of NASA's Missions/Projects and Product Functionalities</u>**

Room 5007 (5th floor)

- SMAP mission overview/ SMAP data products and applications overview
  *Presenting: **Dara Entekhabi,** SMAP Science Definition Team Lead/ Massachusetts Institute of Technology (30 minutes)*

- NISAR mission overview and products
  *Presenting: **Sassan Saatchi**, NASA Jet Propulsion Laboratory, California Institute of Technology (15 minutes)*

- NISAR Applications
  *Presenting: **E. Natasha Stavros,** NISAR Deputy Program Applications (DPA) Co-Lead/ NASA Jet Propulsion Laboratory, California Institute of Technology (15 minutes)*

- ICESat-2 mission overview

*Presenting: **Tom Neumann**, ICESat-2 Project Scientist/ NASA Goddard Space Flight Center (15 minutes)*

- ICESat-2 data products and applications overview

  *Presenting: **Amy Neuenschwander**, ICESat-2 Science Definition Team Member for Vegetation/ University of Texas at Austin (15 minutes)*

12:05 p.m.   **Lunch**

1:05 p.m.   **Session III: <u>Overview of NASA's Missions/Projects and Product Functionalities—Cont.</u> Room 5007 (5th floor)**

- GEDI mission overview

  *Presenting: **Ralph Dubayah**, GEDI Principal Investigator/ University of Maryland (15 minutes)*

- GEDI data products and applications overview

  *Presenting: **John Armston**, GEDI Co-Investigator/ University of Maryland (15 minutes)*

- CMS initiative overview

  *Presenting: **George Hurtt**, CMS Science Team Leader/ University of Maryland (15 minutes)*

- CMS data products and applications overview

  *Presenting: **Edil Sepulveda Carlo**, CMS Applications Coordinator/ NASA GSFC/SSAI (15 minutes)*

2:15 p.m.   **Break**

2:30 p.m.   **Break Out Exercises Round 1: Tools (Concurrent sessions, 1-hour X 2 rotations)**
                 <u>**Break out room 1:**</u> **Room 5007 (5th floor)**

- **The Application for Extracting and Exploring Analysis Ready Samples (AppEEARS)** provides trusted analysis ready geospatial data (including SMAP) from a variety of federal archives in an easy to use manner. It extracts and processes your desired data and provides interactive data visualizations—***Paul Moth***, National Snow and Ice Data Center (NSIDC) NASA Distributed Active Archive Center (DAAC)

- **ORNL DAAC's Soil Moisture Visualizer (SMV)** brings together multiple sources (i.e. in-situ, airborne, and satellite) of soil moisture data available for North America into a single platform for visualization and download. The SMV harmonizes surface and root zone soil moisture data that are in diverse native data formats and encompass a range of spatial footprints, soil depths, and measurement frequencies. The SMV consists of a Web-based application for visualization and spatial subsetting of the soil moisture data and accompanying REST-based services for accessing the data. This tutorial will focus on the visualization and download capabilities through its Web-based user interface—*Yaxing Wei*, Oak Ridge National Laboratory (ORNL) NASA Distributed Active Archive Center (DAAC)

Break out room 2: Room 6001 (6th floor)

- **OpenAltimetry** allows users to visualize ICESat-2 ground tracks, plot photon height on the fly, and access subsetted data in both native HDF5 format and CSV—*Amy FitzGerrell*, National Snow and Ice Data Center (NSIDC) NASA Distributed Active Archive Center (DAAC)

- **HyP3** is an automated data processing pipeline that generates analysis-ready products from Synthetic Aperture Radar (SAR) data, including Radiometric Terrain Corrected (RTC) images and Interferograms (InSAR). RTC products are suitable for monitoring changes through time, including vegetation cover, soil moisture, and surface water extent. InSAR can be used to detect and quantify surface deformation caused by geological processes or human activity— *Heidi Kristenson*, Alaska Satellite Facility NASA Distributed Active Archive Center (DAAC)

4:45 p.m. **Evening Social and Informal Poster Session (Adjourns 6:30 p.m.) Room 2402 and mezzanine area (2nd floor)**

Day 2, May 1st

8:00 a.m. **Day 1 Recapitulate Room 5007 (5th floor)**

8:15 a.m. **Session IV: <u>Applications of NASA Data for Natural Resource Management</u>**

- SMAP soil moisture for drought monitoring and early warning
  Presenting: Dara Entekhabi, SMAP Science Definition Team Lead/
  Massachusetts Institute of Technology *(15 minutes)*

- SMAP soil moisture across different vegetation types and SMAPVEX 19

  *Presenting: **Andreas Colliander**, SMAP Science Team Member/ NASA Jet Propulsion Laboratory (15 minutes)*

- SMAP soil moisture for USDA Forest Service Rangeland Monitoring System

  *Presenting: **Matt Reeves**, USDA Forest Service (15 minutes)*

- Operational wildland fuels assessments/mapping

  *Presenting: **Birgit Peterson**, USGS EROS (15 minutes)*

- Growth, removals, and management intensity

  *Presenting: **Randolph Wynne**, Virginia Tech (15 minutes)*

- The operational use of remote sensing data products in the USDA Forest Service's Forest Inventory and Analysis (FIA) program

  *Presenting: **Andrew Lister**, USDA Forest Service Northern Research Station (15 minutes)*

- Overview of a joint USFS-NASA partnership to estimate forest carbon stocks in interior Alaska by integrating field, airborne and satellite data

  *Presenting: **Hans-Erik Andersen**, CMS Co-Investigator/ USDA Forest Service PNW Research Station (15 minutes)*

- OBI-WAN: Piloting a GEDI-based Forest Carbon Monitoring, Reporting, and Verification tool

  *Presenting: **Sean Healey**, CMS Principal Investigator & GEDI Science Definition Team/ USDA Forest Service (15 minutes)*

- NASA Disasters Mapping Portal

  *Presenting: **Jeremy Kirkendall**, NASA HQ Applied Science's Program (15 minutes)*

10:30 a.m. **Break**

10:45 a.m. **Session V: <u>Breakout Panels to Discuss USDA Forest Service Information Needs, Gaps, and Plans to Close the Gaps</u>**

Each breakout panel will include a sticky note exercise where participants will be encouraged to answer the following questions:

1. What Forest Service information needs do NASA's existing products address?
2. What are the remaining data/knowledge gaps?
3. What are the biggest technical challenges around this topic that data and tools could fill?
4. What level of error/uncertainty is acceptable?
5. What scale and resolution are needed?
6. How can we best fill the gaps?
7. What recent discoveries have you made on the topic that could help fill data and knowledge gaps?
8. How would you prioritize what needs to be done next?

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Session title: Opportunities and Challenges around Forest Soil Moisture Information

Room 5007 (5th floor)

10:45 a.m.   Opening presentation—**Dara Entekhabi,** SMAP Science Definition Team Lead/ Massachusetts Institute of Technology *(10 minutes)*

10:55 a.m.   Ann Arbor Forest Soil Moisture Workshop Report-out**—Liza Jenkins**, Michigan Tech Research Institute *(10 minutes)*

11:05 a.m.   Forest Soil Moisture, Forest Health, and Wildfire **—Jeff Bruggink**, USDA Forest Service Regional Soils and BAER Program Manager *(10 minutes)*

11:15 a.m.   Forest Soil Moisture Mapping/ Data Applications in the Forest Service**— Cynthia West,** Executive Director Office of Sustainability and Climate/ USDA Forest Service *(10 minutes)*

11:25 a.m.   Sticky Note Exercise

12:00 p.m.   Lunch

1:15 p.m.   Facilitated discussion: Technical challenges to obtaining forest soil moisture information

- What are gaps?
- How to fill the gaps?

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Session title: Status of Emissions and Flux Estimation and Report in the USDA Forest Service

Room 6001 (6th floor)

10:45 a.m.   Setting the stage: Estimating emissions and fluxes across scales—**Grant Domke,** USDA Forest Service *(10 minutes)*

10:55 a.m.   Stakeholder flash session: Each presenter (3) will have 10 minutes to address the general questions followed by 15 minutes of discussion.

1. Domestic and international perspective—***Andy Lister***, USDA Forest Service
2. NFS Climate— ***Participant***
3. Rangeland carbon, fire emissions—***Participant***

11:40 a.m.   Sticky Note Exercise

12:00 p.m.   **Lunch**

1:15 p.m.   Applications flash session: Each presenter (5) will have 9 minutes to describe the use of NASA data and data products to address emissions and flux needs.

1. GHG estimation, disturbance, and attribution—***Chris Williams***, Clark University
2. Alaska carbon stocks—***Hans-Erik Andersen***, USDA Forest Service
3. U.S. GHG; CARDAMOM—***Sassan Saatchi***, NASA JPL
4. CMS – Northeast, modeling—***George Hurtt***, University of Maryland
5. NFS assessments, GEDI—***Sean Healey***, USDA Forest Service

2:00 p.m.   Facilitated discussion: Technical challenges to emissions and flux estimation and reporting

- What are gaps?
- How to fill the gaps?

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Session title: Opportunities and Challenges — Vegetation structure and function

Room 2402 (2nd floor)

10:45 a.m.   Introductory remarks, plan for session, ground rules —***Nancy Glenn***, Boise State University *(10 minutes)*

10:55 a.m.   Current USFS management needs in vegetation structure and function —***Sanford Moss***, USDA Forest Service *(10 minutes)*

11:05 a.m.   Future USFS management needs in vegetation structure and function – ***Andy Hudak***, USDA Forest Service *(10 minutes)*

11:15 a.m.   Synthesis of previous day observations/opportunities—**Birgit Peterson**, U.S.
                Geological Survey (USGS) Earth Resources Observation and Science (EROS)
                Center *(10 minutes)*

11:25 a.m.   Focus Groups: This interactive facilitated session will respond to the four USFS
                management issues using the above guiding questions. The outcome of this
                session is a group synthesis resulting in a 2-page visual fact sheet and/or
                whitepaper. The four USFS management issues include:

                1. Silviculture: National Environmental Policy Act (NEPA) and management
                   planning including harvest areas
                2. Fire and fuels: Modeling fire behavior and effects, fuel treatments
                3. Range management: Change over time including biomass, pinyon/juniper
                   encroachment
                4. Wildlife habitat: Habitat modeling with vegetation lifeform (forest/woodland,
                   shrubland, herbaceous) and multi-layer cover

12:00 p.m.   **Lunch**

1:15 p.m.   Continued Focus Groups

                Did any enlightening information come to you during lunch conversations? Other
                thoughts? Wrap-up

1:30 p.m.   Report out by each group

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2:45 p.m.   **Break**

3:00 p.m.   **Break Out Exercises Round 2: Data Access and Download (Adjourns 5:00 p.m.)**

                Break out room 1— 5007 (5ᵗʰ floor): Web interface data access

                - **NASA Earthdata Search** allows users to search, visualize, and access data across
                  thousands of Earth Science data sets. Additional customization services are available for
                  select data sets, including subsetting, reformatting, and reprojection—**Paul Moth**,
                  National Snow and Ice Data Center (NSIDC) NASA Distributed Active Archive
                  Center (DAAC)

                - **NASA Worldview** allows users to interactively browse global satellite imagery within
                  hours of it being acquired. Users can save, share, and download the underlying data—**Paul**

Moth, National Snow and Ice Data Center (NSIDC) NASA Distributed Active Archive Center (DAAC)

- **VERTEX** is the Alaska Satellite Facility's data portal. It is a user-friendly web interface for Synthetic Aperture Radar (SAR) data discovery and download—*Heidi Kristenson*, Alaska Satellite Facility NASA Distributed Active Archive Center (DAAC)

Break out room 2—6001 (6ᵗʰ floor): Programmatic data access

- **Programmatic access to data and customization services.** The subsetting, reformatting, and reprojection services provided through NASA Earthdata Search can also be accessed programmatically. We will demonstrate this functionality through a python Jupyter Notebook, which can be applied to existing analysis routines—*Amy FitzGerrell*, National Snow and Ice Data Center (NSIDC) NASA Distributed Active Archive Center (DAAC)

- **Access data through ORNL DAAC Web services for forest disturbance analysis.** ORNL DAAC offers various tools and Web services which allow programmatic access of the data (https://daac.ornl.gov/tools/), including the OGC Web services (https://webmap.ornl.gov/ogc), MODIS Subset Service (https://modis.ornl.gov), and the Daymet Single Pixel Service (https://daymet.ornl.gov/single-pixel/). In this tutorial, we will leverage Jupyter Notebook and use different Web services to access and combine datasets near Deep Creek Ridge in Central Idaho, where there was a significant tree mortality due to bark beetles during 2009-2011 period, to analyze the forest disturbance caused by bark beetles—*Yaxing Wei*, Oak Ridge National Laboratory (ORNL) NASA Distributed Active Archive Center (DAAC)

Day 3, May 2ⁿᵈ

8:00 a.m.   **Break Out Exercises Round 3: Scenario-Based Data Processing and Analysis**

Break out room 1— 5007 (5ᵗʰ floor): What is the trend in soil moisture? How does this compare to regional trends?

- **Analysis in ArcGIS.** Using ArcGIS and SMAP data to display and analyze time series and regional trends in soil moisture data—*Paul Moth*, National Snow and Ice Data Center (NSIDC) NASA Distributed Active Archive Center (DAAC)

- **Analysis in Python**. This hands-on tutorial will leverage a Jupyter notebook, accessible and executable on-the-fly for session participants, to demonstrate how to dynamically retrieve and analyze different soil moisture data products (e.g. satellite, airborne, and in-situ observations) at selected USFS national forests study sites from ORNL DAAC's Soil Moisture Visualizer (SMV) and answer questions like "What is the trend in soil moisture at a study site and how does it compare with the trend at the level of USFS administrative regions?". This interactive tutorial will also bring in USFS productivity data at those study sites to provide insights on impact of soil moisture on forest productivity—*Yaxing Wei*, Oak Ridge National Laboratory (ORNL) NASA Distributed Active Archive Center (DAAC)

- **Synthetic Aperture Radar (SAR) Applications.** (1) Demonstration of a SAR time series animation visualizing changes in soil moisture at a USFS study site; and (2) Tutorial using an ArcGIS-based workflow to map flood events using SAR imagery—*Heidi Kristenson*, Alaska Satellite Facility NASA Distributed Active Archive Center (DAAC)

- **Cloud Analysis using PODPAC.** This live demonstration will use the open-source Python library, PODPAC, to: (1) develop an analysis in a Jupyter Notebook; and (2) execute it on the Amazon Web Service (AWS) Cloud. This analysis will combine NASA SMAP data, along with non-NASA data. It will show a workflow that can be run on serverless AWS Lambda functions, enabling highly distributed, on-demand processing with minimal maintenance—*Marc Shapiro*, Creare LLC

Break out room 2—6001 (6th floor): Leveraging sampling observations for regional vegetation structure assessments: approaches and limitations. This session will include a case study from the Kaibab Plateau, an ICESat-2 data demonstration, perspectives from ICESat-2 Early Adopters; and participant discussion—*Birgit Peterson*, U.S. Geological Survey (USGS) Earth Resources Observation and Science (EROS) Center

11:50 a.m. **Data Tutorials Feedback (https://www.surveymonkey.com/r/5ZLK3ZN)**

12:00 p.m. **Lunch**

1:00 p.m. **Session VI: Breakout Report Out and Synthesis Room 5007 (5th floor)**

- Each break out lead and/or their designee(s) will answer questions and report findings from their sessions including identified information gaps and collaboration opportunities

2:30 p.m.   **Session VII: <u>Group Discussion to Prioritize the Identified Remaining Gaps and Plan(s) to Close the Gaps</u>** Room 5007 (5th floor) – facilitated by *Erik Johnson*, Data Manager, Office of Sustainability and Climate/ USDA Forest Service and *Chalita Forgotson*, NASA SMAP Applications Coordinator/ NASA GSFC/SSAI

- Prioritize the identified remaining gaps
- Prioritize the identified plan(s) to close the gaps

3:30 p.m.   **Break**

3:45 p.m.   **Summation of Workshop (Adjourns 5:00 p.m.)** Room 5007 (5th floor)

Presenting: Everett Hinkley, National Remote Sensing Program Manager/ USDA Forest Service

- Discussion
- Next steps