BACKGROUND

The U.S. Forest Service (USFS) manages 154 national forests and 20 grasslands in 43 states and Puerto Rico. Among the agency's priorities are the preservation, improvement, and restoration of these lands to assure that current and future generations have access to the resources and opportunities they provide. In its mission to sustain the health, diversity, and productivity of our nation's forests and grasslands, the USFS continuously seeks ways to improve operations for characterizing, monitoring and forecasting the ever-changing conditions to our natural resources. Remote sensing and GIS technologies provide USFS natural resource managers a platform to monitor natural resources through which they can improve management decisions and deliver benefits to the public. The USFS-NASA Joint Applications Workshop will serve as a forum to discuss how NASA data products can serve the operational goals of the USFS by providing timely synthesized information to support management decisions and project prioritization.

To support sustainable natural resource management within the USFS, satellite data products must address key agency monitoring and assessment needs, including:

1. Soil moisture and hydrology –soil moisture dynamics, soil productivity and erosion, inventory and condition of wetland, riparian areas, and groundwater dependent ecosystems, aquatic habitat suitability, land cover and hydrological change and vulnerability;
2. Vegetation condition – forest and non-forest vegetation structure, composition, and function, forest health and productivity, seedling survival, biomass and carbon, invasive species, fuel loading and post-fire recovery, vegetation shifts due to climate change;
3. Emissions and flux – air and aerosols including GHG, carbon flux;
4. Detecting, assessing and monitoring ecosystem vulnerabilities due to changing environmental conditions (climate change and other abiotic stressors); and
5. Data and tools (knowledge synthesis) – development of integrated decision support tools (e.g., to prioritize restoration projects with positive carbon benefits), supported data formats, cloud computing (big data handling), integration (mission, tools), technology transfer.

NASA has a suite of missions that can provide information to support USFS operational needs, among these are

- Soil Moisture Active Passive (SMAP). The SMAP mission launched on January 31, 2015. Although SMAP's primary 3-year science mission ends in June 2018, SMAP has been approved for extended mission operations. The mission provides direct sensing of soil moisture globally in the top 5 cm of the soil column. In addition, SMAP provides model-derived root-zone soil moisture in the top 1 m of the soil column, as well as net ecosystem exchange of carbon dioxide with the atmosphere over global vegetated land areas (with an emphasis on boreal areas north of 45N latitude). SMAP derived soil moisture can provide critical information for wildfire, drought, and flood risk assessments and early warning, and ecological, weather, and hydrological forecasting.

- NASA-ISRO Synthetic Aperture Radar (NISAR). The NISAR mission, expected to launch in 2021, will provide a variety of information to contribute to sustainable development and management of ecosystem goods and services. NISAR will monitor global forest extent and quality by providing a time series of global radar imagery with a 6-day repeat cycle, which will provide regular observations of forests even in regions where cloud-cover has been a challenge for other remote sensing observations. NISAR data can be used to generate time series information on forest biomass, disturbance detection and inundation. NISAR data can also be used to classify disturbance and estimate vegetation/soil water content, which are key for monitoring fire hazards and wetland ecosystems.
- Ice, Cloud, and Land Elevation Satellite-2 (ICESat-2). The ICESat-2 mission launched on September 15, 2018. Its global geodetic measurements, including estimates of canopy height, canopy cover and terrain height, will help improve biomass estimations, forest structural mapping, and global digital terrain models. ICESat-2 provides densely spaced global vegetation canopy height information at higher spatial resolution than previously afforded by other space-borne sensors.
- NASA Carbon Monitoring System (CMS). The CMS initiative uses the full range of NASA satellite observations, modeling/analysis capabilities, and commercial off-the-self technologies to support national and international organizations in the development of carbon monitoring, reporting, and verification (MRV) systems of carbon stocks and fluxes.
- NASA Global Ecosystem Dynamics Investigation (GEDI). With an expected launch date of late 2018, GEDI is a full-waveform lidar instrument that will provide precise measurement of forest canopy height, canopy vertical structure, and surface elevation. GEDI will advance applications in a number of domains including forest management and carbon cycling, where its high resolution and very dense spatial sampling will enhance our knowledge of forest height and vertical structure, habitat quality and biodiversity, forest carbon sinks and source areas, among other areas.

This suite of NASA data and capabilities presents a strong opportunity for NASA to support USFS operational needs to sustain the health, diversity, and productivity of our nation's forests and grasslands. As such, the goals of the USFS-NASA Joint Applications Workshop are to share and demonstrate the capabilities of NASA data products, as well as to develop connections and strengthen partnerships between NASA and USFS.

Objectives and Expected Workshop Outcomes
The three-day USFS-NASA Joint Applications Workshop intends to bring together relevant NASA missions to support USFS's needs for sustainable natural resource management. Specific objectives for the workshop include: 1) to provide an overview of NASA missions and projects, data, and tools supporting natural resource management; 2) to share and prioritize USFS operational needs with NASA; 3) to identify opportunities for collaboration; and 4) to expand USFS awareness of NASA data sources and tools and mutually explore ways to advance information delivery.

To address these objectives, the workshop is organized into three main parts, which will provide an opportunity to:

1. review and discuss NASA missions, data, and tools supporting natural resources management;
2. prioritize USFS operational needs and identify opportunities for collaboration; and
3. conduct hands-on data tutorials to increase USFS understanding of NASA data sources and tools

This joint workshop between USFS and multi-NASA missions is expected to generate a better understanding of NASA data utility; better understanding of USFS operational needs; enhanced uses of NASA data products; and enhanced collaboration between NASA and USFS including laying the groundwork for a potential memorandum of understanding (MoU) between the two organizations for future development.

Workshop Planning Committee

As a stakeholder-led workshop, the USFS, the ICESat-2 Biomass Working Group, and stakeholders of the CMS initiative will advance the goals and design of the workshop in collaboration with the SMAP, ICESat-2, NISAR and CMS applications leads. The workshop planning committee consists of the following members:

Name	Organization
Everett Hinkley (National Remote Sensing Program Manager/Satellite Needs Working Group member)	USFS/Engineering, Technology, & Geospatial Services
Erik Johnson (Program Analyst)	USFS/Office of Sustainability & Climate
Carlos Ramirez (Program Manager – USDA Forest Service, Pacific Southwest Region, Remote Sensing Lab)	USFS/Pacific Southwest Region Remote Sensing Laboratory
Jess Clark (Remote Sensing Analyst and Assistant Program Leader at GTAC)	USFS/Geospatial Technology and Applications Center (GTAC)
Justin Epting (Remote Sensing and GIS Specialist and Assistant Program Leader at GTAC)	USFS/Geospatial Technology and Applications Center (GTAC)

Raha Hakimdavar (Hydrologist)	USFS/Watershed, Fish, Wildlife, Air, and Rare Plants
Stacie Bender (Geospatial Specialist and Assistant Program Leader at GTAC)	USFS/Geospatial Technology and Applications Center (GTAC)
ICESat-2 Biomass Working Group	
Birgit Peterson (Chair)	USGS
Nancy Glenn	Boise State University
Laura Duncanson	UMD/NASA Goddard
Temilola Fotayinbo	NASA Goddard
Amy Neuenschwander	University of Texas
Andreas Colliander (SMAP)	NASA JPL
Narendra Das (SMAP)	NASA JPL
Chalita Forgotson (SMAP Applications Lead)	SSAI/NASA Goddard
Sabrina Delgado Arias (ICESat-2 Applications Lead)	SSAI/NASA Goddard
Natasha Stavros (NISAR Applications Lead for Ecosystems)	NASA Jet Propulsion Laboratory
Edil Sepulveda Carlo (CMS Applications Lead)	SSAI/NASA Goddard