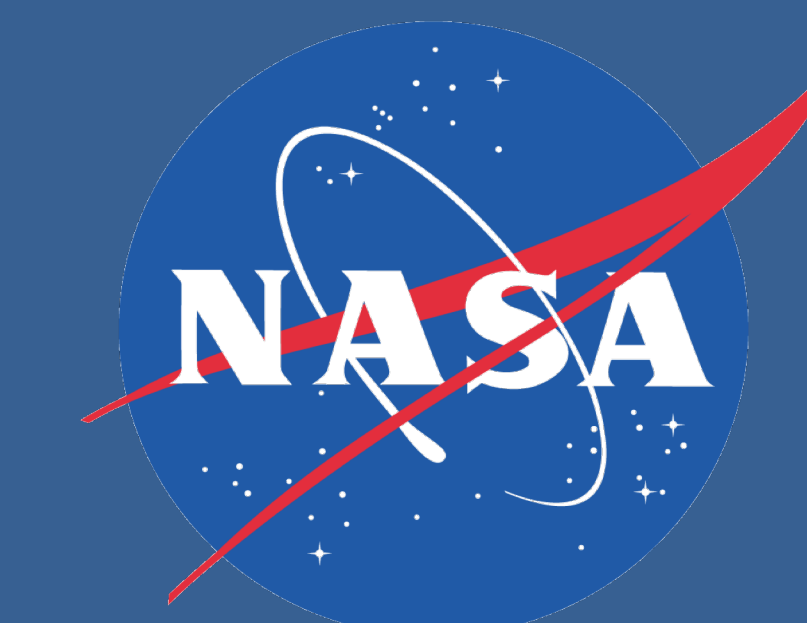


Identifying Data Needs and Gaps, and Ways to Improve Decision-Making of Stakeholders via the NASA Carbon Monitoring System Applications Project



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Abstract

The objective of the NASA Carbon Monitoring System (CMS) Initiative is to prototype the development of the capabilities necessary to support stakeholder needs for Monitoring, Reporting, and Verification (MRV) of carbon stocks and fluxes. The CMS Program was initiated by U.S. Congress in 2010 and up to today it continues to develop products that characterize and quantify carbon sources and sinks in the United States and the global tropics. Six years ago an applications effort was selected to engage potential end users and gather feedback about their data needs. The overarching objective of the CMS applications effort is to engage with the users of carbon data and other similar communities to ensure that the current and planned CMS science outcomes and data products are used in decision-making contexts. Applications have become an integral part in converting data developed by NASA into actionable knowledge that can be used to shape carbon policy. A CMS Applications Program Framework has been developed and validated in the last couple of years, providing a baseline and structure to the activities being undertaken by the Applications Team, and with the possibility of being replicated by future NASA mission applications efforts. One of the main activities from the applications efforts is the **coordination of applications workshops**, where scientists and stakeholders engage in discussions about the use, applications, challenges, needs, and lessons learned in the use of CMS data products, and how these products are impacting their organizations' goals and improving decision-making. This year, besides the **annual CMS Applications Workshop**, we also coordinated a **Joint USFS-NASA Applications Workshop**, with the participation of the CMS leadership, as well as several PI's and stakeholders. The workshop provided an opportunity to understand how CMS scientists and stakeholders are closely collaborating with USFS, as well as identify decision support needs that could be addressed by CMS data products. The presentation will highlight the pre and post-workshop efforts to identify the key scientists and stakeholders to participate in the two applications workshops we coordinated this year, as well as provide a summary of lessons learned in how CMS data products are being used by stakeholders, the remaining data needs and gaps, and ways in which CMS products can help improve decision-making processes.

CMS Applications Workshop Background

Goals of CMS Applications Workshop:

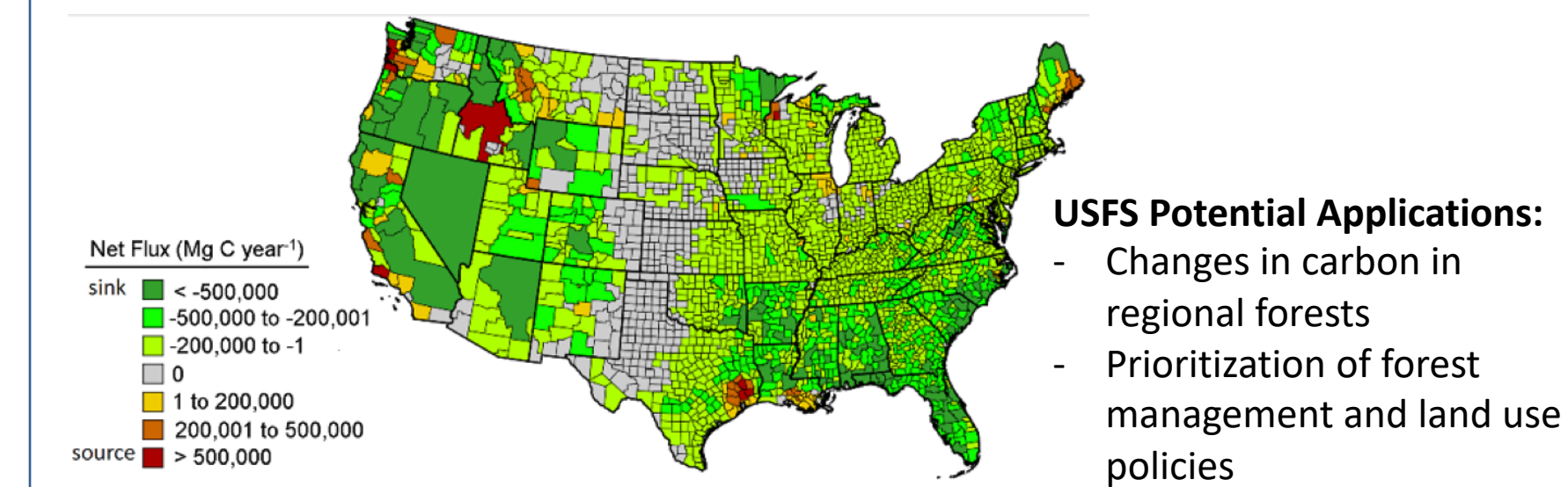
- 1- Understand stakeholders needs for carbon monitoring and Measurement, Reporting and Verification (MRV).
- 2- Identify the challenges/needs of communities that are interested in carbon MRV, biomass, Lidar applications and related activities.
- 3- Provide information on value of CMS products for MRV and related applications.
- 4- Link CMS community to active policy end users, decision makers and regulatory agencies to ensure maximum benefit of the projects to society.

Stakeholders Invited to CMS Applications Workshop



USFS-NASA Applications Workshop

Objective: Provide an overview of CMS data products that can support USDA Forest Service operational needs



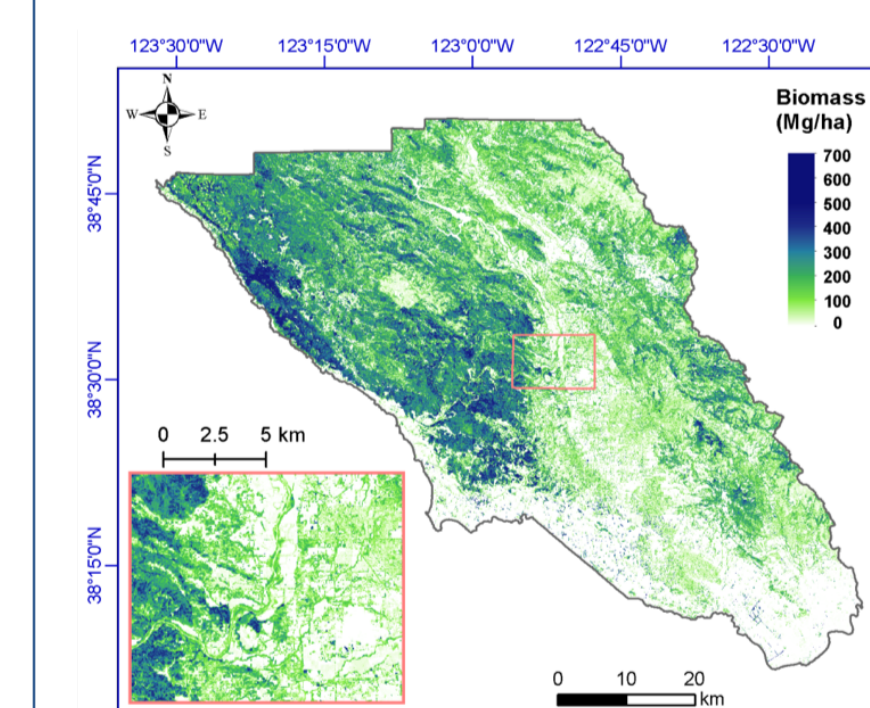
- USFS Potential Applications:**
- Changes in carbon in regional forests
 - Prioritization of forest management and land use policies

Average annual committed net carbon flux (Mg C/yr) at the combined country scale (from Hagen et al.)

USFS Potential Applications:

- Perform regional to national scale UNFCCC National Inventory Reporting
- Assess disturbance threats to US forests and impacts on the carbon balance of forested landscapes
- Assess the potential climate benefits of afforestation/reforestation

Major Forest Disturbances Since the mid-1980s Mapped at 30-m Resolution. Williams et al. (2016) *Glob. Planet. Change*

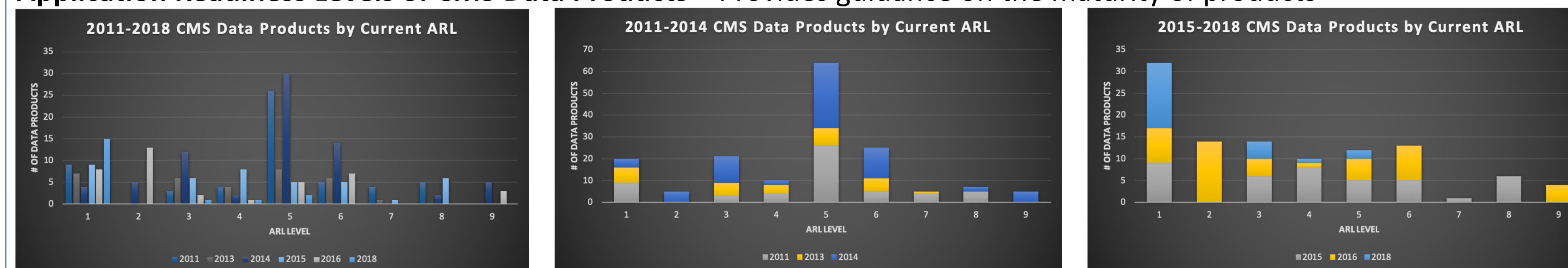


- USFS Potential Applications:**
- Habitat mapping and modeling
 - Forest inventories
 - As an input to wildfire modeling/fuel modeling
 - Disease hazard/risk

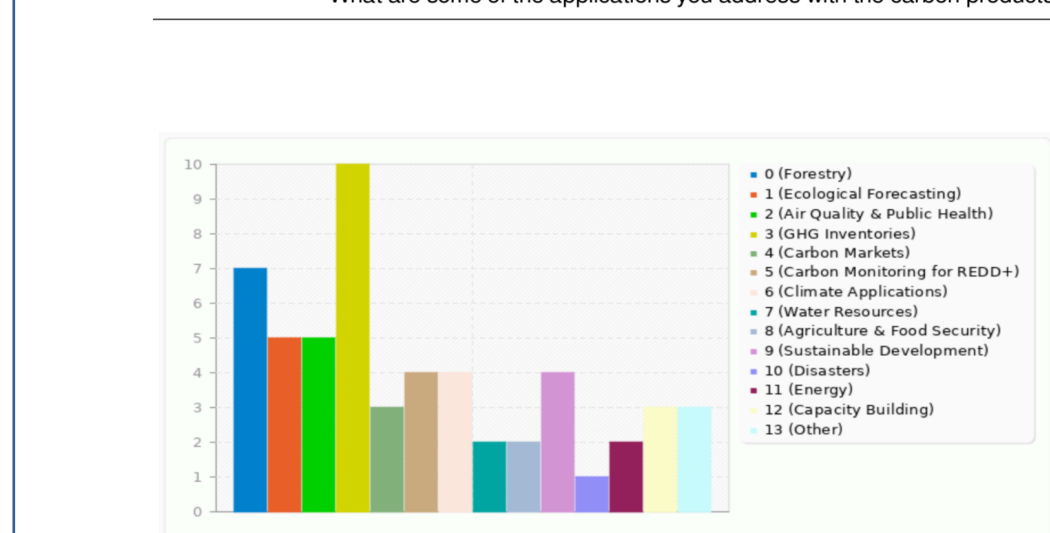
Estimated aboveground biomass (Mg/ha) for Sonoma County at 30-m spatial resolution using the random forest method. From Dubayah et al. (2017), available at ORNL DAAC.

CMS Applications Survey Results

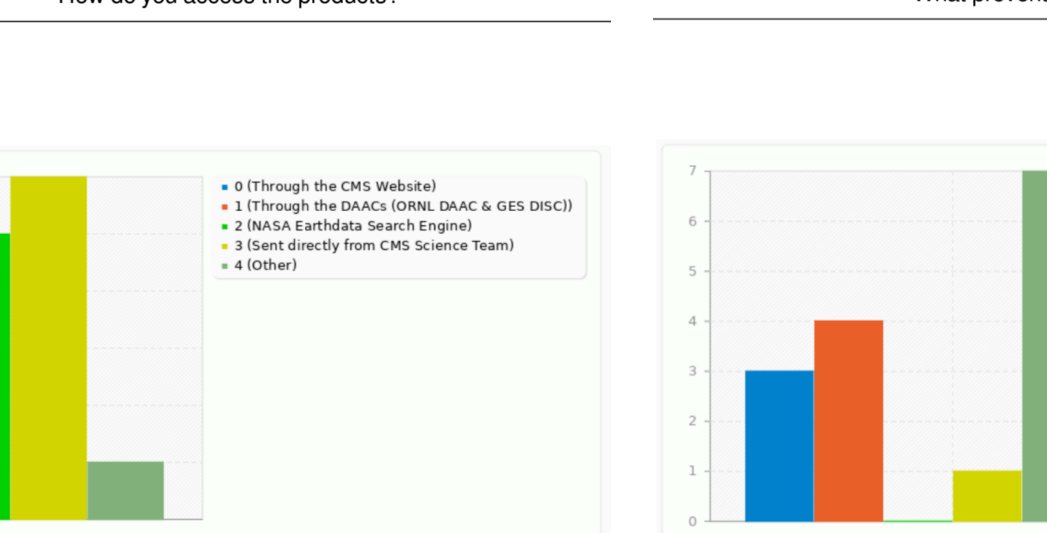
Application Readiness Levels of CMS Data Products – Provides guidance on the maturity of products



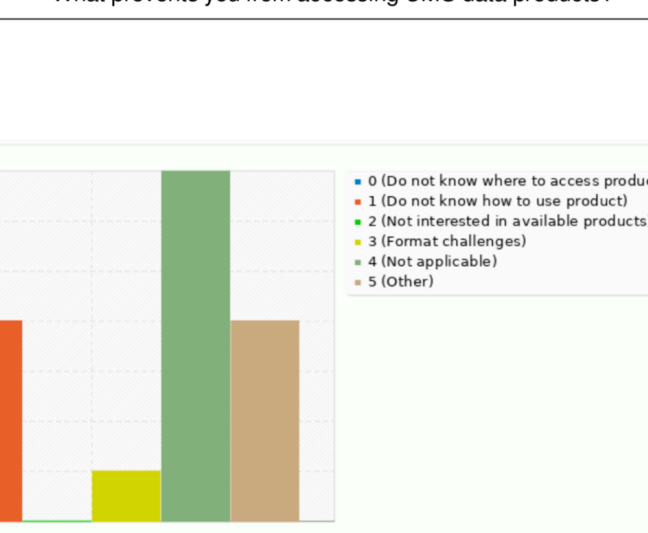
What are some of the applications you address with the carbon products?



How do you access the products?



What prevents you from accessing CMS data products?

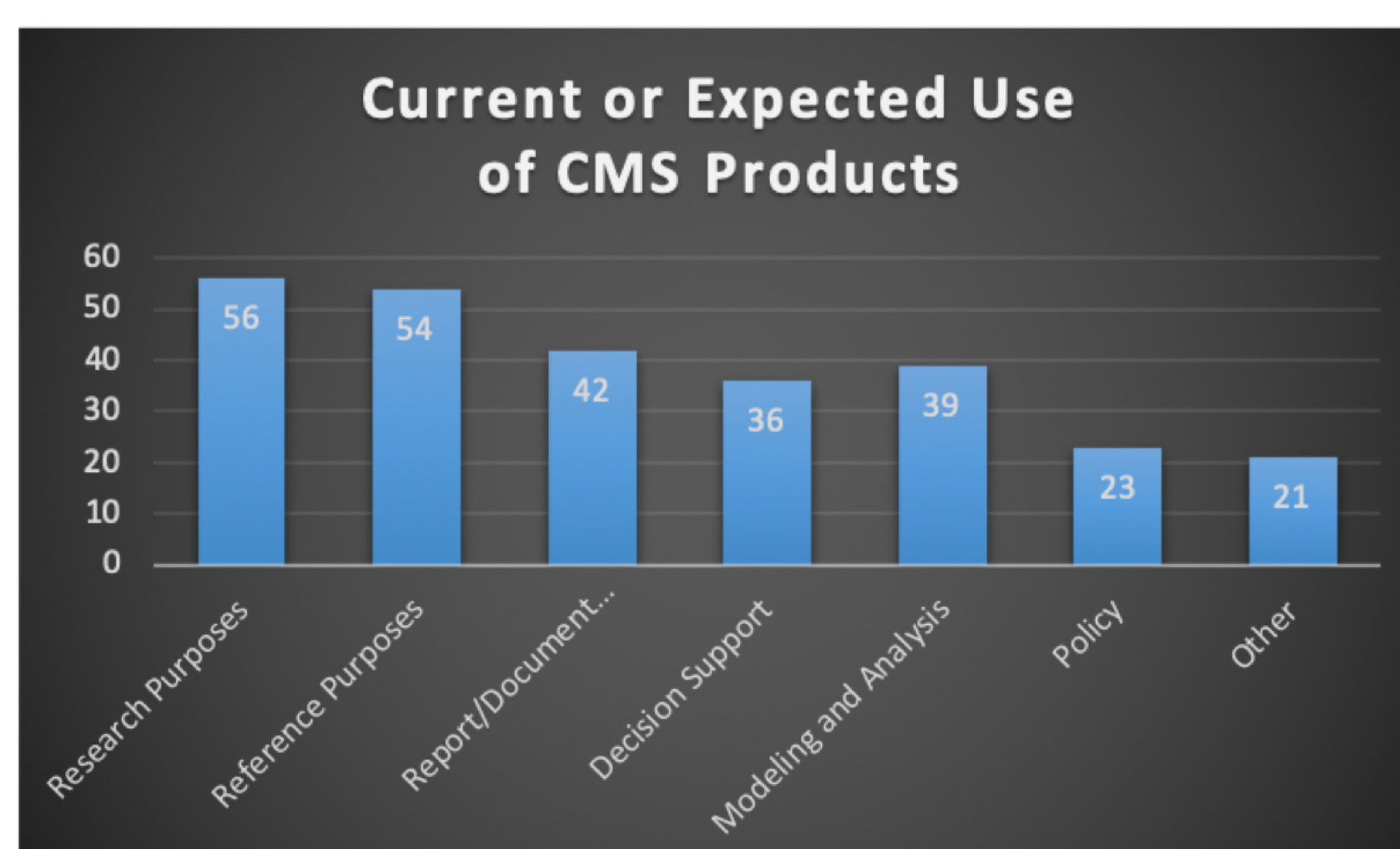


Results of CMS Data Access and Uses Survey for Stakeholders

The results of the survey were used by ORNL DAAC & GES DISC to organize a Data Access Tutorial for CMS Stakeholders during the 2019 CMS Applications Workshop

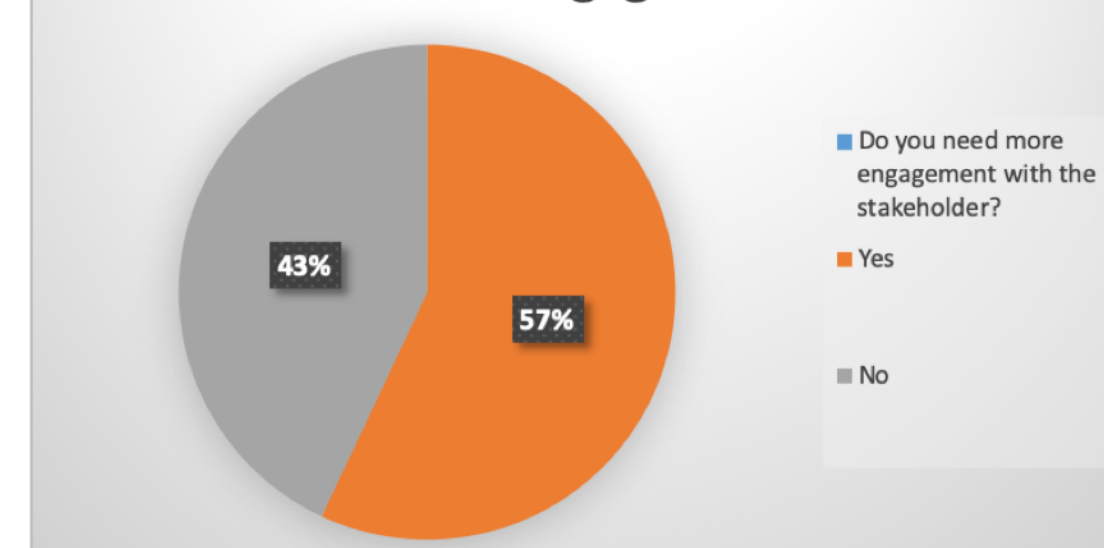
Introduction

CMS Stakeholder Survey for Science Team



- 25 CMS Principal Investigators (PIs) responded
- 86 CMS Stakeholders were identified
- Main stakeholders: USFS, EPA, NOAA, and CA ARB

Stakeholder Engagement Need



Workshop Results - Lessons Learned & Data Needs of CMS Stakeholder Community

Organization	Applications	Successes	Data Needs
Stakeholders Using CMS Data Products at the U.S. Local Scale			
Sonoma County Agricultural Preservation and Open Space District	Land conservation planning & prioritization; Disasters & extreme events; Ecosystems & watershed health; Community resilience	Capacity building and partnership opportunities; Unintended outcomes - uses beyond carbon; Enhanced accuracy and spatial scale of multi-benefit analysis	Land use/emissions scenarios at local (county) scale; Update frequency for change detection (3-5 years), Enhanced economic analysis
Illinois Farm Bureau	Agriculture applications; Crop yield information; Sustainability and conservation practices	The best science being put to use by and for farmers; Field scale for their own decision-making	Nutrient Loss Reduction Strategy is a priority; Soil health focus on cover crops
Stakeholders Using CMS Data Products at U.S. Regional or National Scale			
USDA Forest Service	Wildlife hazard; Water quality; Ecological forecasting; Air quality; Timber treatment assessments; Landscape prioritization	CMS products allow USFS to understand biomass impacts of common treatments; Lidar-based AGB map preferred for project level analysis; Help Five-Year-Action-Plan	Wall-to-wall annual products in standard GIS raster formats; Products that can help USFS refine coarse-level mapping; Rangeland products; Fuels
U.S. EPA	National Greenhouse Gas Inventory	Worked together to develop a gridded CH ₄ Inventory using national and regional high resolution datasets; has been widely used	Discrepancy between top-down and bottom-up studies; Emission factor data to update the GHG inventory
Stakeholders Using CMS Data Products at the International or Global Scale			
Watson Institute for International & Public Affairs, Brown Univ.	Oil & Gas flaring; GHG Emissions; Climate mitigation strategies	CMS products integrated successfully into the Oil Climate Index; CMS data can help attribute methane to oil & gas sources	Timely satellite reports and updates; Finer-tuned methane estimates beyond NA; Methane measurements over water
SilvaCarbon	Forest and landscape change; Forest inventory; GHG inventory for land sector; REDD+	Use of CMS data products; plans to use OBI-WAN Forest Carbon Reporting as a source of emissions factors for REDD+	Wall to wall products that integrate radar and optical data in the tropics; Emission factors derived from EO

Outcomes & Future Work

- Workshop Summary for The Earth Observer Newsletter and CMS Quarterly Newsletter
- CMS Applications Workshop Report/Proceedings
- CMS Stakeholder Fact Sheets with information about stakeholder organization, uses and applications, impact, and data needs
- Workshop Agenda, Slides, Recording, and Report to be Published in CMS Website
- Creation of CMS Stakeholder Working Group & Possible MoU with Stakeholder Organizations
- CMS Policy Speaker Series in 2020 at NASA GSFC
- CMS Thematic Workshops: Carbon Removal Workshop in Spring 2020
- Stakeholder Workshops for CMS Projects {e.g. Hurtt Stakeholder Workshop in MD on March 2020}
- 2nd Joint Workshop: NASA-USFS Applications Workshop – April 2020
- More Data Tutorials for CMS Stakeholders in 2020 on How to use CMS datasets and scenario-based exercises for a wider stakeholder community, and with the help of the DAACs and ARSET

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For more information please visit: carbon.nasa.gov/applications