

Thriving on Our Changing Planet

A Decadal Strategy for Earth Observations from Space*

Surface Biology and Geology Designated Observables

Quick Summary: Recommendations

1 VISION & STRATEGY
"Thriving on our Changing Planet"

2 SCIENCE & APPLICATIONS
Address 35 key science/applications questions, from among hundreds suggested. Those with objectives prioritized as most important fell into six categories:

- Coupling of the Water and Energy Cycles
- Ecosystem Change
- Extending & Improving Weather and Air Quality Forecasts
- Sea Level Rise
- Reducing Climate Uncertainty & Informing Societal Response
- Surface Dynamics, Geological Hazards and Disasters

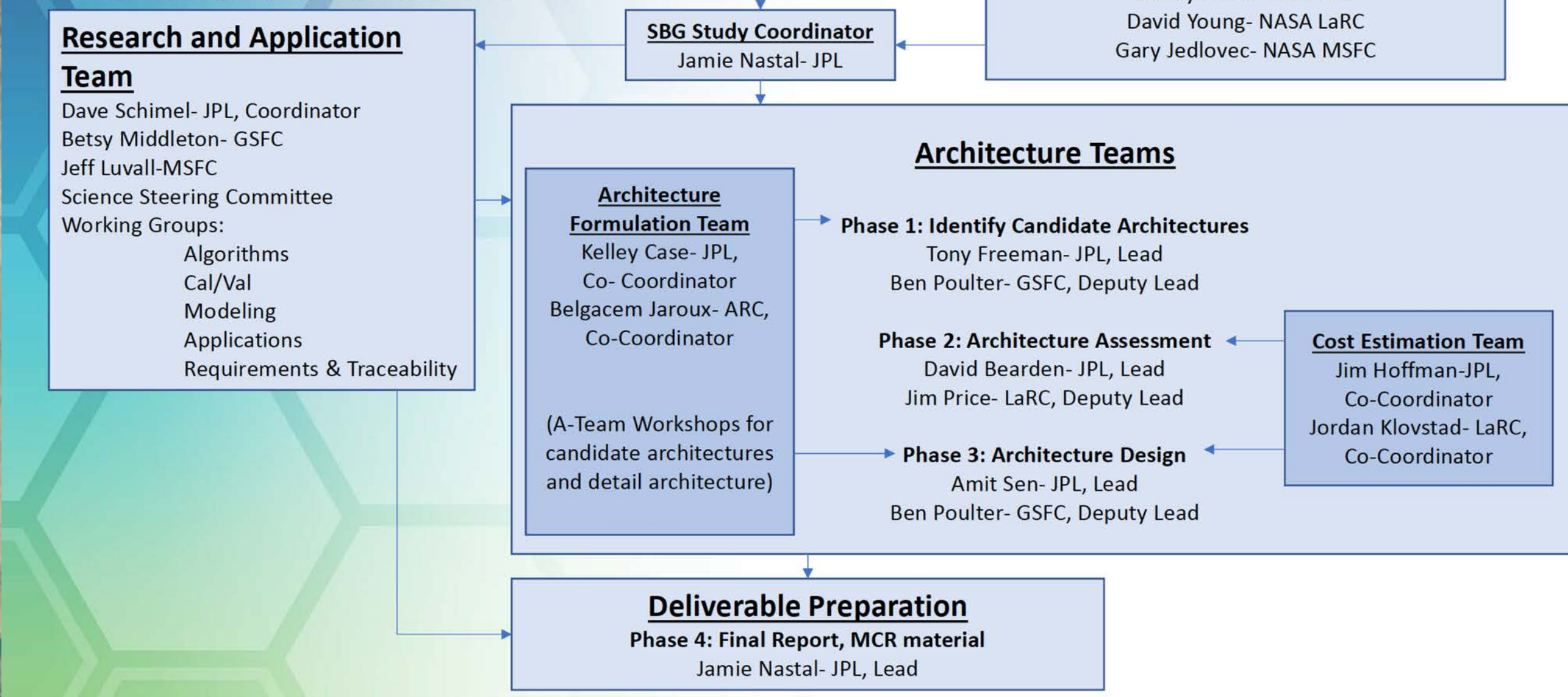
3 OBSERVATIONS
Augment the Program of Record with eight priority observables:

- Five that are specified to be implemented:
 - Aerosols
 - Clouds, Convection, & Precipitation
 - Mass Change
 - Surface Biology & Geology
 - Surface Deformation & Change
- Three others to be selected competitively from among seven candidates
- Structure new NASA mission program elements to accomplish this
- Methods for new NASA capabilities to be leveraged by NOAA and USGS

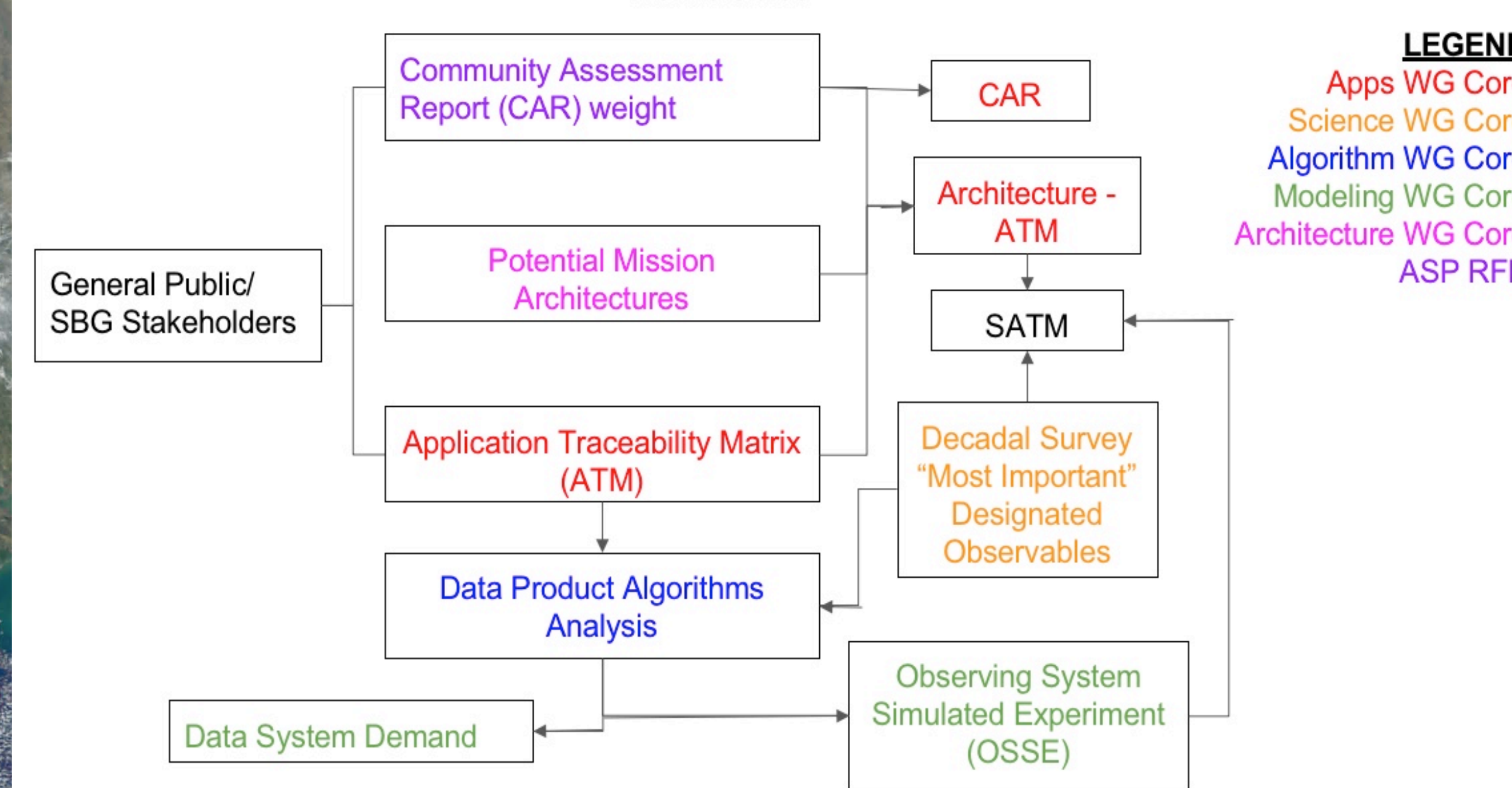
4 PROGRAMMATICS

- CROSS-AGENCY
- NASA
 - Flight
 - Technology
 - Applications
- NOAA
- USGS

SBG Organization, Roles & Work Flow Are Well-Defined



SBG Designated Observable Working Group Structure and Deliverables



DS Question	Focused Science Topic	Application Focus Group	Application Concept	Decision Approach	L2+ VSWR (one row) and TIR (another row)	Spatial	Temporal	Latency	Other Design Considerations	End Users	Ancillary
H-2. How do anthropogenic changes in climate, land use, water use, and water storage, interact and modify the water and energy cycles locally, regionally and globally and what are the short- and long-term consequences?	Land Surface Fluxes, Ecosystem traits and biodiversity - terrestrial	Disasters	Fuel Mapping for wildfire danger management. Post fire severity assessment and recovery	Use veg composition, structure, health, chemical properties to inform mitigation actions like thinning based either directly on the maps or integration into fire simulation models. Use vegetation traits to monitor and predict live fuel moisture, an important component of wildfire danger in some ecosystems, over time. Could inform how areas are classified as "burn/no burn" and public.	L4-Plant functional type L4-Dead/Dormant Vegetation Maps L3-Green Vegetation and Non-photosynthetic vegetation L3-4-Fuel classification L3-Live Fuel Moisture L3-Vegetation Traits L2-Surface Reflectance L3-Evapotranspiration	30m x 30m	annual -w/ky	NA	sun-synchronous	USFS GTAC and regional offices National Parks Service Bureau of Land Management USGS EROS - LANDFIRE	lidar for structure, field data to parameterize
E-1. What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space?	Ecosystem traits and biodiversity - terrestrial	Forest Management	Given accelerating change, restoration and/or management of dynamic habitat conditions to enhance resilience, limit biodiversity loss, and recover endangered species (terrestrial)	Use of terrestrial veg composition, structure, health to target areas for habitat restoration (like native species replantings or removal of invasives). ET can be used to monitor improvement of water consumptive use due to	L2-Land surface temperature L4-Evaporative Stress Index L3-Evapotranspiration L2-Land surface temperature	30m x 30m	annual	NA	sun-synchronous	USFS GTAC and regional offices National Parks Service Bureau of Land Management USGS EROS - LANDFIRE US FWS, State level FWS, New Mexico Office of the State Engineer	lidar for structure, field data to parameterize ECOSTRESS ancillary
E-1. What are the structure, function, and biodiversity of Earth's ecosystems, and how and why are they changing in time and space?	Ecosystem traits and biodiversity - terrestrial	Carbon-Forest Management	Monitor carbon accounting for carbon markets	Use veg composition, structure, and health to target areas for reforestation and afforestation	L4-Plant functional type L3-Dead/Dormant Vegetation L3-Green vs Non-Green/Non-Photosynthetic Veg L3-4-Vegetation Classification L2-Surface Reflectance	30m x 30m	Annual	NA	sun-synchronous	SERVIR Conservation International Gates Foundation WWF WRI World Bank REDD+ CNC	lidar for structure, field data to parameterize
H-1. How is the water cycle changing? Are changes in evapotranspiration and precipitation accelerating, with greater rates of evapotranspiration and thereby precipitation, and how are these changes expressed in the space-time distribution of rainfall, snowfall, evapotranspiration, and the frequency and magnitude of extremes such as droughts and floods?	Snow Monitoring	Water Management	Improving estimates of streamflow volumes and timing for water resources management, flood control, ecosystem flows, and hydropower	Apply snow properties products in streamflow estimates provided by operational agencies to inform water allocation, flood control, hydropower, and water use.	L4 - Snow Water Equivalent L4 - Snow Density L3 - Albedo L3 - Snow Grain Size L3 - Fractional Cover: Snow - Vegetation - Bare Rock - Soil - Water L3 - Snow Radiative Forcing L2 - Surface Reflectance	90m X 90m	90-365 days	90-365 days		Western States Water Council State Water Agencies (in areas where snow is major water supply) NOAA (responsible for hydroforecasts)	Lidar snow depth
H-2. How do anthropogenic changes in climate, land use, water use, and water storage, interact and modify the water and energy cycles locally, regionally and globally and what are the short- and long-term consequences?	Land Surface Fluxes	Water management	Improving estimates of evapotranspiration from wetlands and riparian ecosystems to monitor water demands for wetland and riparian ecosystems, improve accurate accounting of consumptive use by in water limited regions, and identify habitat loss and degradation	Apply improved ET products in estimates of water demand to improve water accounting and ensure adequate instream flows for wetland and riparian ecosystems.	L3 - Green Vegetation and Non-photosynthetic vegetation L3 - NDVI L2 - Surface Reflectance (L2) NDVI (L2)			8-16 days		Federal, state and local water management agencies, NGOs	
S-1. How can large-scale geological hazards be accurately forecast in a socially relevant	Landslides	Disasters	High spatial-resolution time series of distribution of vegetation and rock/soil composition		L3 - GV: Substrate: Rock L4 - Surface Reflectance L3 - Light Absorbing Impurities L3 - Snow Grain Size L3 - Fractional Snow Cover Area L3 - Snow Cover Area L3 - Albedo L2 - Surface Reflectance	30-45 m	weekly				
H-2. How do anthropogenic changes in climate, land use, water use, and water storage, interact and modify the water and energy cycles locally, regionally and globally and what are the short- and long-term consequences?	Snow Monitoring	Water Management	Land surface radiative forcing to constrain weather forecasting and climate model inputs	Apply snow properties products in streamflow estimates provided by operational agencies to inform water allocation and water use.	L2 - Surface Temperature L2 - Surface Emissivity	60-100 m x 60-100 m	3 - 16 days	TIR should be contemporaneous with VSWIR but possibly multiple revisits per sensing day	Within 24 hours of acquisition	Synergy with other US and international VSWIR/TIR multispectral instrument needs to be considered here	Lidar snow depth
H-1. How is the water cycle changing? Are changes in evapotranspiration and precipitation accelerating, with greater rates of evapotranspiration and thereby precipitation, and how are these changes expressed in the space-time distribution of rainfall, snowfall, evapotranspiration, and the frequency and magnitude of extremes such as droughts and floods?	Snow Monitoring	Water Management	Land surface radiative forcing to constrain weather forecasting and climate model inputs	Apply snow properties products in streamflow estimates provided by operational agencies to inform hydropower	L4 - Light Absorbing Impurities L3 - Snow Grain Size L3 - Fractional Snow Cover Area L3 - Snow Cover Area L2 - Surface Reflectance	10-30 m x 10-30 m	3 - 16 days	TIR should be contemporaneous with VSWIR but possibly multiple revisits per sensing day	Within 24 hours of acquisition	Synergy with other US and international VSWIR/TIR multispectral instrument needs to be consider here	Lidar snow depth

HyspIRI Science and Applications

Key Science and Science Applications

Climate: Ecosystem biochemistry, condition & feedback; spectral albedo; carbon/dust on snow/ice; biomass burning; evapotranspiration.

Ecosystems: Global plant functional-type, physiological condition, and biochemistry including agricultural lands.

Fires: Fuel status, fire occurrence, severity, emissions, and patterns of recovery globally.

Coral reef and coastal habitats: Global composition and status.

Volcanoes: Eruptions, emissions, regional and global impact.

Natural and resources: Global distributions of surface mineral resources and improved understanding of geology and related hazards.

Societal Factors: Urban environment, habitability and resources.

Mission Urgency
The HyspIRI science and application objectives are important today and uniquely addressed by the combined imaging spectroscopy, thermal infrared measurements, and IPM direct broadcast.

Ecosystems
Spruce/Fir
White Pine
Hemlock
Beech
Sugar Maple
Red Maple
Other Mixed HW

Fires
Evapotranspiration
Habitats

Measurement

Imaging Spectrometer (VSWIR)
- 380 to 2510 nm in 10nm bands
- 30 m spatial sampling
- 16 days revisit
- Global land and shallow water

Thermal Infrared (TIR):
- 8 bands between 4-12 µm
- 50 m spatial sampling
- 5 days revisit
- Global land and shallow water

IPM-Direct Broadcast

Workshop Objectives
Interact with broad science and applications research community
Review science inputs to the Decadal Survey
Review HyspIRI Mission Concept efforts in 2017
Discuss ECOSTRESS TIR mission headed to the ISS
Present new relevant Science and Applications Research
Review results from the U.S. HyspIRI preparatory airborne campaigns
Review AVIRIS-NG VSWIR Asian Environments campaign in India
Support current Decadal Survey process
Information and Registration at: <http://hyspiri.jpl.nasa.gov>

SBG Applications Working Group (AWG)

The Applications Working Group will recruit, coordinate and integrate input on applications needs, data product requirements and training/education and other needs:

- The AWG will identify key applications requirements, latency, revisit, specific products.
- The AWG will cultivate stakeholders and end users via joint activities, workshops, thematic working groups, and design and dissemination of tailored SBG data products.
- Characterize the SBG Communities of Practice and Potential and produce a SBG Community Assessment Report.

Participation Sign Up List: <http://tinyurl.com/SBGApplicationsWG>

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