



# ***HyspIRI Products Symposium on Identifying Priority Products to Support HyspIRI's Science Questions***

***NASA/GSFC, May 16 and 17, 2012  
Building 34, Conference room W150***



# GSFC EO-1/HyspIRI Team

**Betsy Middleton, NASA**

**Bob Knox, NASA**

**Steve Ungar, UMBC**

**Petya Campbell, UMBC**

**Qingyuan Zhang, USRA**

**Fred Huemrich, UMBC**

**Ben Cheng, ERT**

**Larry Corp, Sigma Space**

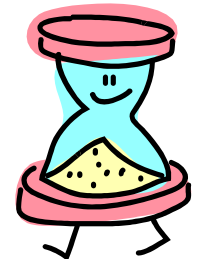
**Lisa Henderson, Sigma Space**

**David Landis, Sigma Space**

**Lawrence Ong, SSAI**

**Dan Mandl, NASA**

**Pat Cappelaere, Vightel Corp**



Wed/Thurs Lunches: Pay at Registration Desk

Wednesday Dinner: Sign up

# HyspIRI Products Symposium on Identifying Priority Products for SQs

**Focus:** To Identify Priority Products to Support HyspIRI Science Questions

**Objectives:**

- Identify science/application data products to be derived from HyspIRI measurements;
- Discuss issues underlying data product processing/integration/fusion;
- Prioritize the development of product prototypes.

Science Discipline Areas to be addressed:

- Ecosystem Function and Composition
- Disturbance and Human Impacts
- Volcano, Natural Hazards and Mineral/Resources

***Participants: 100+***

# Science Questions for the HysplRI Mission

(<http://hysplRI.jpl.nasa.gov>)

HysplRI has three top-level science questions [identified in the NRC Decadal Survey] related to:

## 1) Ecosystem function and composition

*What is the global distribution and status of terrestrial and coastal-aquatic ecosystems and how are they changing?*

## 2) Volcanoes and natural hazards

*How do volcanoes, fires and other natural hazards behave and do they provide precursor signals that can be used to predict future activity?*

## 3) Surface composition and the sustainable management of natural resources.

*What is the composition of the land surface and coastal shallow water regions and how can they be managed to support natural and human-induced change?*



# ***Topic 1. Ecosystem Function & Composition Questions***

## **VQ1. Ecosystems Pattern and Spatial Distribution and Components**

What is the global spatial pattern of ecosystem and diversity distributions and how do ecosystems differ in their composition or biodiversity?

## **VQ2. Ecosystem Function, Physiology and Seasonal Activity**

What are the seasonal expressions and cycles for terrestrial and aquatic ecosystems, functional groups, and diagnostic species? How are these being altered by changes in climate, land use, and disturbance?

## **VQ3. Biogeochemical Cycles**

How are the biogeochemical cycles that sustain life on Earth being altered/disrupted by natural and human-induced environmental change? How do these changes affect the composition and health of ecosystems and what are the feedbacks with other components of the Earth system?

## **VQ5. Ecosystems and Human Well-being**

How do changes in ecosystem composition and function affect human health, resource use, and resource management?

## **CQ1. Coastal, ocean, and inland aquatic environments**

How are local and landscape-scale changes in inland, coastal, and open ocean aquatic ecosystems related to changes in variability in regional and global climate?

## **CQ4. Ecosystem Function and Diversity**

How do species, functional type, and biodiversity composition within ecosystems influence the energy, water and biogeochemical cycles under varying climatic conditions?

## ***Topic 2. Disturbances & Human Impact Questions***

### **VQ4. Ecosystem Response to Disturbance**

How are disturbance regimes changing and how do these changes affect the ecosystem processes that support life on Earth?

### **TQ3. Water Use and Availability**

How is consumptive use of global freshwater supplies responding to changes in climate and demand, and what are the implications for sustainable management of water resources?

### **TQ5. Earth surface composition and Change**

What is the composition and temperature of the exposed surface of the Earth? How do these factors change over time and affect land use and habitability?

### **CQ2. Wildfires**

How are fires and vegetation composition coupled?

### **CQ6. Human Health and Urbanization**

How do patterns of human environmental and infectious diseases respond to leading environmental changes, particularly to urban growth and change and associated impacts of urbanization?

## ***Topic 3. Volcano, Natural Hazard & Mineral/Resource Questions***

### **TQ1. Volcanoes**

How can we help predict and mitigate earthquake and volcanic hazards through detection of transient thermal phenomena?

### **CQ3. Volcanoes**

Do volcanoes signal impending eruptions through changes in the temperature of the ground, rates of gas and aerosol emission, temperature and composition of crater lakes, or health and extent of vegetation cover?

### **TQ2. Wildfires**

What is the impact of global biomass burning on the terrestrial biosphere and atmosphere, and how is this impact changing over time?

### **CQ5. Land Surface Composition and Change**

What is the composition of exposed terrestrial surface of the Earth and how does it respond to anthropogenic and non anthropogenic drivers?

# Expected Outcomes of Symposium

**Goal:** To Identify and Evaluate Potential Products to Support HypsIRI Science Questions

**Objectives/Outcomes:**

- 1]** Identify science/application data products that could be derived from HypsIRI measurements.
- 2]** Prioritize the development of product prototypes.
- 3]** Address the geo-location challenges.
- 4]** Discover issues underlying data product processing and related to data integration/fusion.
- 5]** Develop a report on the community consensus for **1-4** above.

# 2011 NASA Senior Review

## Earth Observing-1 (EO-1)

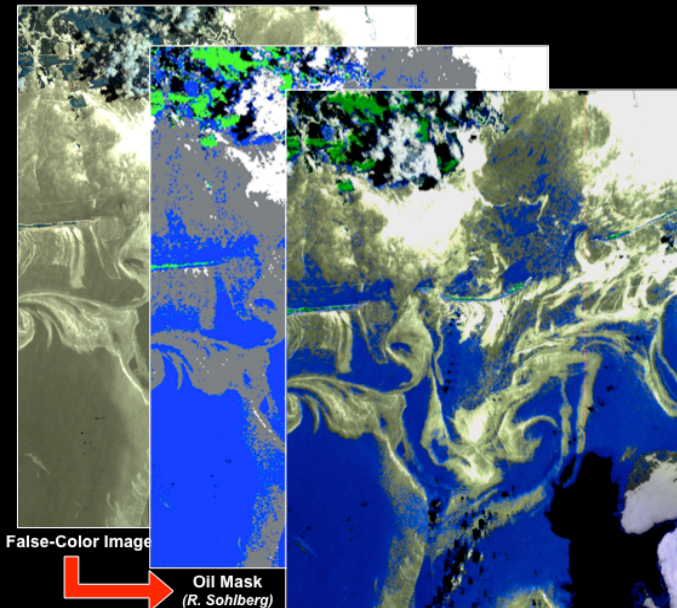
Mission Scientist, Dr. Elizabeth Middleton (NASA/GSFC Code 614.4)

Mission Manager, Mr. Daniel Mandl (NASA/GSFC Code 581.0)

Toxic Red Flood in Hungary (2010), ALI True-Color



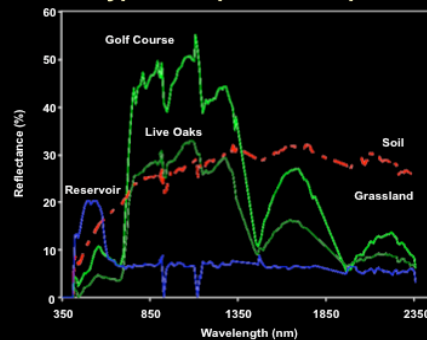
Gulf Oil Spill (2010), ALI Oil Product



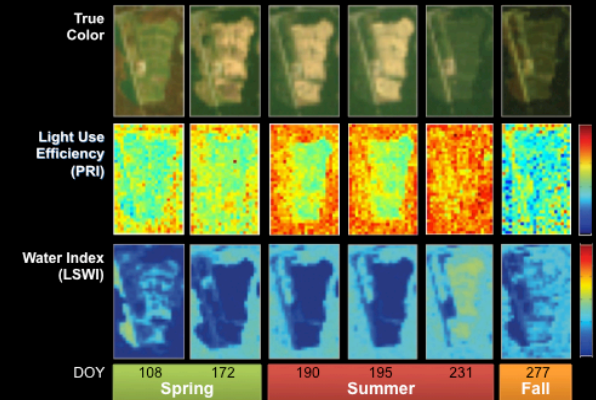
May 3, 2011



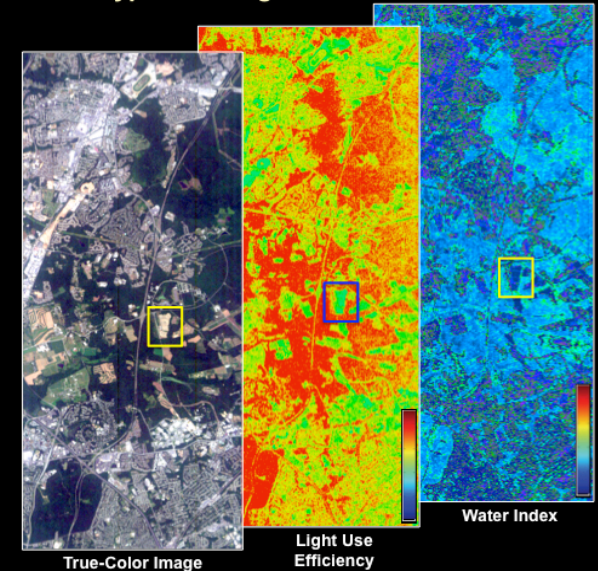
Hyperion Spectral Response



Hyperion Timeseries of Cornfield 2008



Hyperion Images of Cornfield Area





# Fire SensorWeb Experiments with U.S. Forest Service

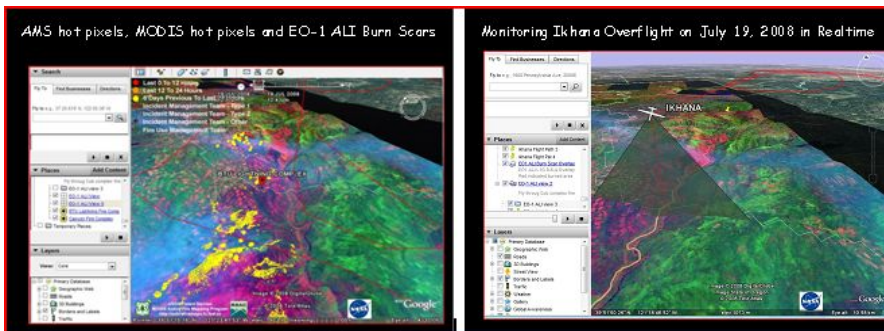
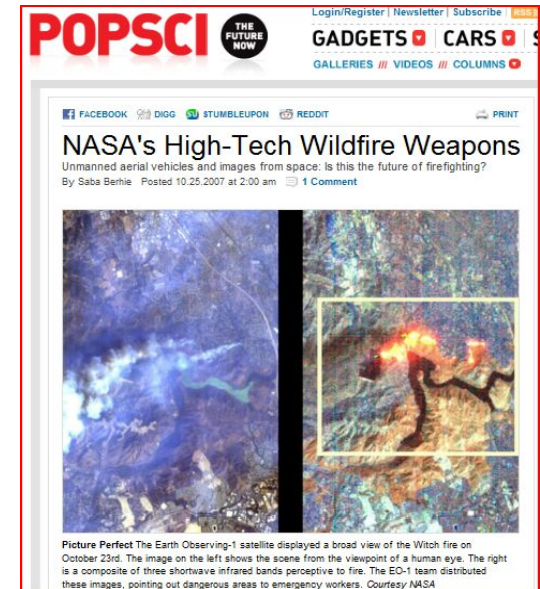
From 2003 to 2009, SensorWeb team conducted a variety of experiments to identify how best to inject SensorWeb technology into assisting Forest Service to manage large wildfires and assist decision makers. This involved interoperating satellite sensors and an Unmanned Aerial System sensors to produce useful data products to assist U.S Forest Service emergency managers.

**Detect:** National Fire Interagency Center (NIFC) large fire map and MODIS daily hot pixel maps acted as triggers  
**Respond:** Trigger EO-1 and Unmanned Aerial System (UAS) images automatically to take a detailed look  
**Product Generation:** Active fire maps, burn scar maps  
**Delivery:** Experimented with various web based delivery such as mash up displays and RSS feeds

*"An exciting aspect of the SensorWeb capability is the ability to automatically image, process and deliver higher resolution satellite imagery products online with little effort."*

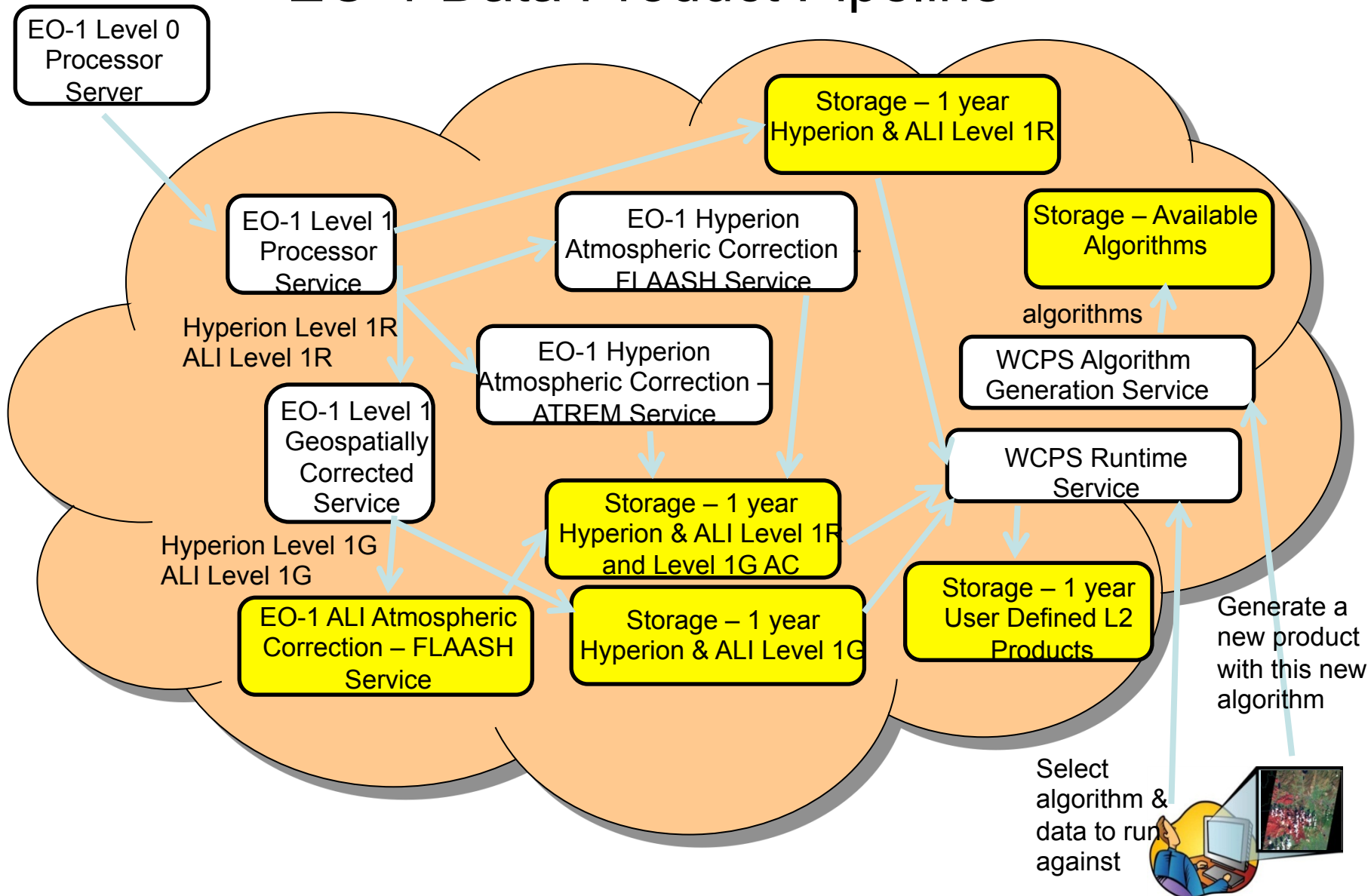
**Everett Hinkley**

**National Remote Sensing Program Manager**



# Transformation to On-Demand Product Cloud Part 1

## EO-1 Data Product Pipeline





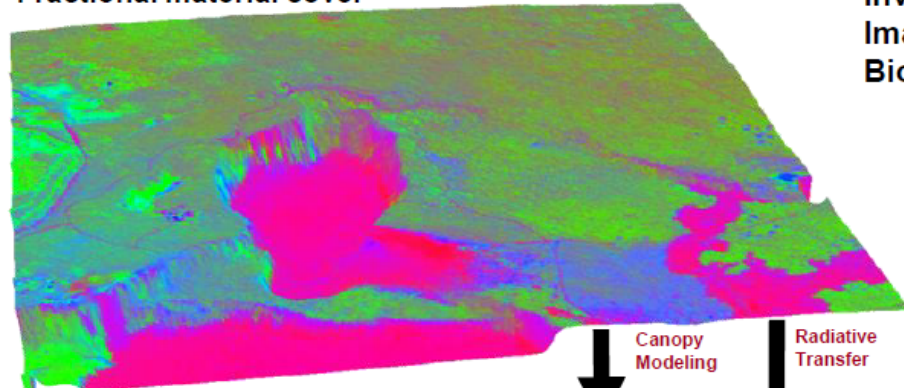


# Ecosystem Measurements for Climate Feedbacks

## Ecosystem Species-type, Chemistry & Condition



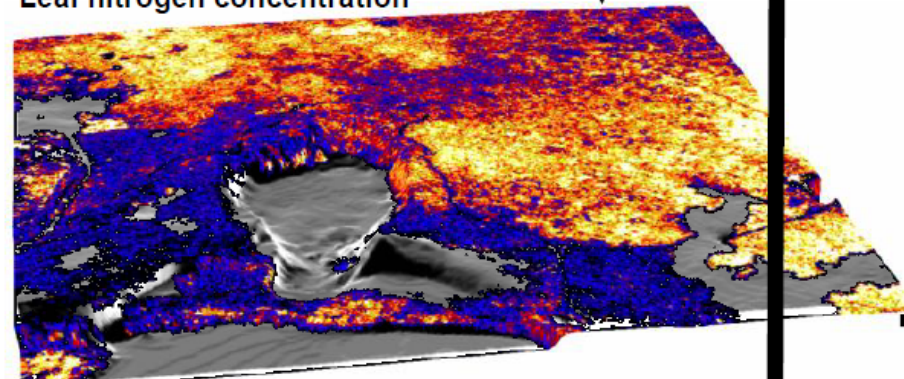
Fractional material cover



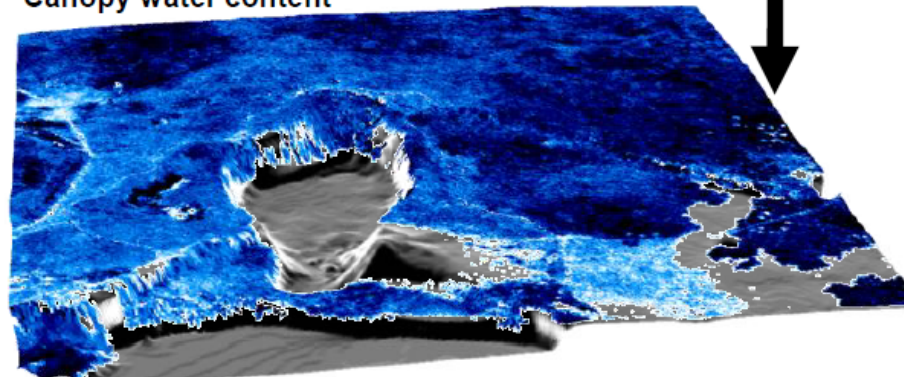
Canopy Modeling

Radiative Transfer

Leaf nitrogen concentration



Canopy water content

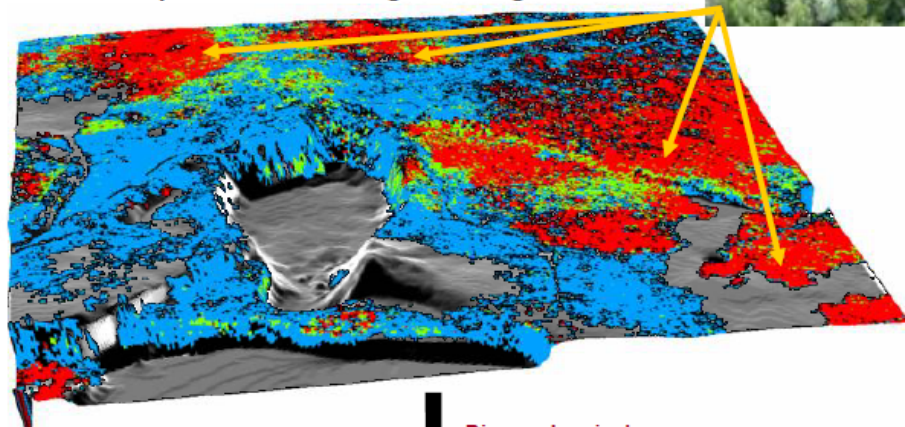


Invasive Species in the Hawaiian Rainforest from Airborne Imaging Spectrometer data: Patterns of Invasion and Biogeochemical Consequences

Myrica infestations

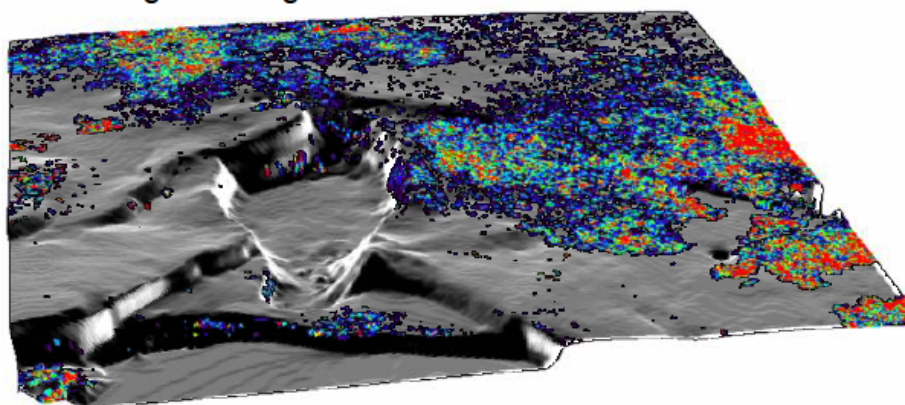


Invasive species and nitrogen-fixing PFT



Biogeochemical Analysis

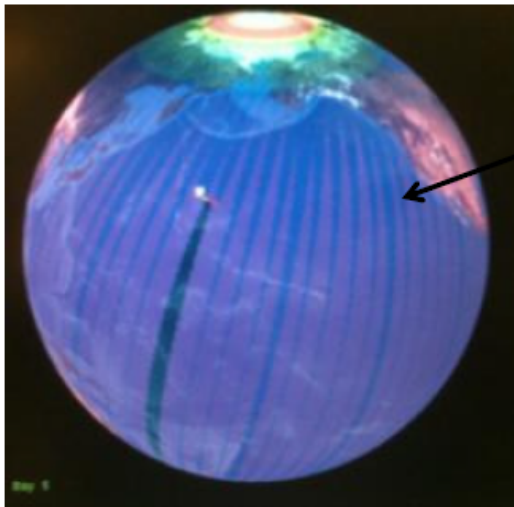
Soil nitrogen trace gas emissions



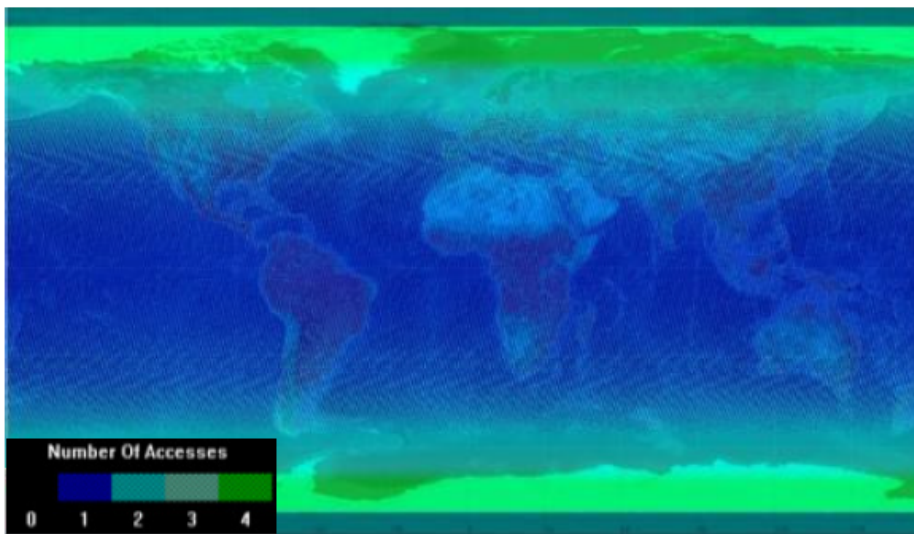
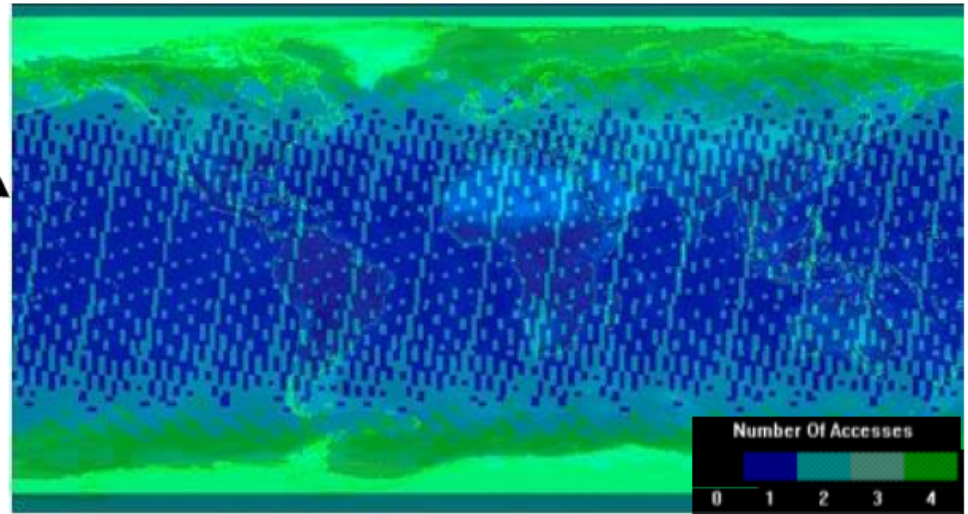
Asner and Vitousek, *Proceeding of the National Academy of Sciences*  
Hall and Asner, *Global Change Biology*



# HyspIRI Global Coverage

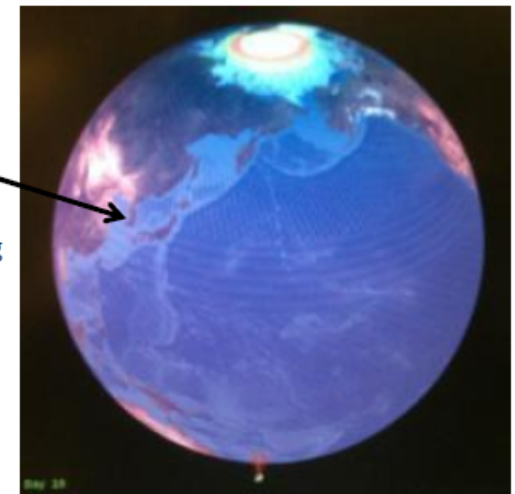


TIR Coverage  
after 5 days



VSWIR  
Coverage after  
19 days

Due to the min 20 deg  
Sun elevation angle  
constraint on the  
VSWIR acquisition,  
the latitudes covered  
change with the  
seasons





# ***HyspIRI Science Symposium on Ecosystem Data Products***

***NASA/GSFC, May 4 and 5, 2010  
Building 33, Room H114***



# **Mature & Ready: *Proposed HypsIRI Terrestrial Ecology Products***

(\* = Climate Variable; \*\* = Essential Climate Variables defined by CEOS/GEO)  
(Green text items show significant enhancement over existing multi-spectral observations)

## **VSWIR Imaging Spectrometer ALONE**

### ***Level 4 Biophysical & Physiological Products***

- 1 **Directional Canopy Albedo [\*\*]**
- 2 Fractional Cover: Snow, Water and Ice [\*\*]
- 3 Leaf Area Index, LAI [\*\*]
- 4 Canopy fAPAR (PAR absorbed by vegetation) [\*\*]
- 5 Canopy fAPARchl (PAR absorbed by chlorophyll-containing canopy only) [\*]
- 6 **Total Canopy Chlorophyll Content [\*]**
- 7 **Fractional Cover: Green Vegetation, Non-Photosynthetic Vegetation, impervious surfaces, soil [\*]**
- 8 **Fractional Cover for Vegetation Classes: Coniferous, Deciduous, and Mixed Forests; Grasslands; Wetlands; Crops [\*]**

## **Multi-Spectral TIR Imagery ALONE**

### ***Level 2 & 3 Products [Day or Night swath & gridded data]*** (Terrain corrected; Day/Night Seasonal Composites)

- 1 Soil Moisture [\*\*]
- 2 Fire Severity & Direction & Fire Radiative Power [\*\*]
- 3 Distribution and variation in land surface temperature [\*]
- 4 Water Stress Indicators [\*]
- 5 Emissivity-Based Land Surface Classification (e.g., pervious vs. impervious) [\*]
- 6 Cloud Mask [\*]

## **VSWIR + TIR Combined**

### ***Level 4 Combined Products***

- |   |   |
|---|---|
| 1 <b>Biomass for Grasslands [**]</b>      | 4 <b>Functional Types/Species Composition [*]</b>                     |
| 2 <b>Diversity, Coastal Habitats [**]</b> | 5 <b>Ecological Disturbance Area (logging, natural disasters) [*]</b> |
| 3 <b>ET by Land Cover Type [*]</b>        | 6 <b>Drought Index (PET/AET) by Land Cover Type [*]</b>               |

# ***Proposed Terrestrial Ecology Products from HypsIRI***

**Potential Products Needing Further Validation (\* = Climate Variable; \*\* = ECV defined by CEOS)**  
(Green text items show significant enhancement over existing multi-spectral observations)

## **VSWIR Imaging Spectrometer ALONE**

### ***Level 4 Biophysical & Physiological Products***

- 1 **Photosynthetic Parameters (LUE, Jmax, Vcmax) [\*]**
- 2 **Environmental Stress Measurements (response variables) [\*]**
- 3 **Canopy N content (mass/area) [\*]**
- 4 **Canopy Water Content [\*]**
- 5 **Vegetation Pigment Content (Chl a, Chl b, Carotenoids, Anthocyanins)**
- 6 **Canopy Lignin and Cellulose**

## **Multi-Spectral TIR Imagery ALONE**

### ***L3 Products [Day or Night swath & gridded data]***

- 1 **Burn Area (experimental as TIR only)**
- 2 **Burn Severity (experimental as TIR only)**

## **VSWIR + TIR Combined**

### ***L4 Products – Regional***

- 1 **Surface Energy Flux [\*\*]**
- 2 **Combusted Biomass [\*\*]**
- 3 **Sensible Heat due to Urban Heat Islands (Anthropogenic Heat) [\*]**
- 4 **LST: Day/Night Differences for Ecosystems & Urban Areas [\*]**
- 5 **LST Urban/Suburban [\*]**
- 6 **LST by Functional Groups and Ecosystem Types [\*]**
- 7 **Surface Topographic Temperature Mapping [\*]**

### ***L4 Products – Global***

- 1 **LST & Emissions by Fractional Land Cover (Vegetation, Soil, Water, Snow, Ice, etc.) [\*\*]**
- 2 **Ecosystem/Crop Phenology with Fusion Approaches [\*]**





# ***HyspIRI Science Symposium on Ecosystem & Environmental Global/Regional Data Products***

***NASA/GSFC, May 17 and 18, 2011  
GSFC Visitor Center***



Higher Level Products for HypsIRI – Discussion Summary

#	Product	Level (L2/3/4)	Maturity	MODIS	Landsat	Models	Notes
<b>Reflectance &amp; TIR Products</b>							
A.	<b><u>Global Products for Data Continuity</u></b>						
1	Convolved Reflectance to other sensors (long term data recors; narrowband/broadband)	3	yes	yes	progress	yes	R(%), LEDAPS, WELD algorithms
2	Symulated LST for other sensors (e.g. MODIS, LDCM/TIRS)	2	yes	yes	yes	yes	LST (T C°)
3	Fractional land cover type (FLC) [continuous fields, % of land cover: soil, water, vegetation, ice&snow]	3	yes	yes	yes	yes	for long term records continue MODIS product, test f(PV, NPV) for vegetation cover
4	Thermal Anomalies	4	yes		yes/limited	yes	
<b>B. <u>Terrestrial (veg. &amp; soil)</u></b>							
I.	<b><u>Spectral End-member Abundance</u></b> - mineral maps, veg type maps	3	in progress	no	no	no	Local Spectral libraries (cal/val) needed
II.	<b><u>Vegetation Spectral Bio-indicators (VIs)</u></b> - water, cellulose, chlorophyll, general stress - nitrogen - hot spots - LST per VFC and LC	3/4 3 4 4 4	in progress in progress in progress in progress in progress	EVI, NDVI yes/limited no yes/limited yes/limited	TM 5/4, 4/3 etc. no no yes in progress	progress no yes no no	   Local Spectral libraries and chemistry (cal/val)
III.	<b><u>Canopy function Yield (CO2 sequestration, GPP, NEP)</u></b> - LUE, WUE - ET	 4 4	 in progress in progress	   	 no no	 yes yes	
IV.	<b><u>Classifications</u></b>						
1	<b>Fractional vegetation cover (FVC)</b> <i>[photosynthetic vegetation [PV] or non-photosynthetic vegetation [NPV], Soil]</i>	3	yes	no	limited		AutoMCU or equivalent (SWIR and red-edge with tied spectra)
2	<b>Fractional cover by plant functional type (PFTs)</b>	4	in progress	see below	no	yes	Required by DVGM (dynamic global vegetation models) end ESM (Earth system models); At launch 2-6 types/km <sup>2</sup> , goal 6-10 resolved
V.	<b><u>Terrestrial Products Supporting Long Term Data Records</u></b>						For HypsIRI products context, and for long term records continuity
1	<b>MODIS Vegetation Continuous Fields (VCF - cotext &amp;</b> - life form (proportion of woody vegetation, herbaceous - leaf type (proportion of woody vegetation that is needle - leaf longevity (proportion of woody vegetation that is	4 4 4 4	yes yes yes yes	yes		 yes no no	
2	<b>Ecological disturbance (NPV increase)</b>  - Land cover conversions - Severe wind, drought, insect, etc. - Fires (VISWIR detection, severity)	4  4 4	yes, global on progress  yes, global in progress in progress in progress	Fire product  yes yes	LEDAPS  yes/limited yes/limited yes/limited	  yes yes	Based on PV, spectral change diagnosing disturbance type; decline/recovery; for land history Terrestrial ECVs: LC, permafrost, glaciers/ice, LAI, fire False alarm a possibility
VI.	<b><u>Biodiversity</u></b> - Optical types diversity - Plant functional diversity - Biodiversity indicators	 4 4 4	 initialized initialized in progress	 no no no	 no no no	 yes yes yes	see publication on the topic by Usting and Gammon see publication on the topic by Asner, Wright, et al. Spectral corelation with bio-diversity



Higher Level Products for HypsIRI – Discussion Summary (continued)

#	Product	Level (L2/3/4)	Maturity	MODIS	Landsat	Models	Notes
C.	<u><b>Aquatic [shallow water, rivers, lakes]</b></u>						
1	Remote Sensing Reflectance (Rrs)	2 or 3	yes, operational	yes	no		Remote Sensing Reflectance = water-leaving radiance (Lw) / downwelling irradiance (Ed); (Rrs, units sr-1, 400–800 nm) ; This is the result
2	Sea Surface Temperature	2-Jan	yes, operational	yes	no		Routine product from many satellites.
3	Seafloor Spectral Reflectance (units %, 400–??? nm)	3	in progress	no	no		Combined results from aquatic retrieval
4	Water Depth	3	in progress	no	no		There are several candidate algorithms in
5	Water Optical Properties	3	in progress	yes	no		-"-
6	Retrieval Quality Flags	3	in progress	na	no		-"-
7	Fractional Cover	3	in progress	na	no		Derived from Rrs, mixture decomposition methods need scaling to HypsIRI data
8	Pigments (e.g. chlorophyll)	3	mature, work in progress to separate aquatic sources	yes	no		Derived from Rrs, work in progress to separate contributions of planktonic, submerged and emerged aquatic sources
9	Light-Use Efficiencies (for (1) Productivity and (2) Calcif	3	in progress	yes	no		There are few investigations for shallow
	- Productivity (Gross/Net)	4	in progress	yes	no		Investigations for fresh water bodies, needs synthesis of fresh, coastal and deep ocean
	- Calcification	4	not initialized	na	no		There are no existing algorithms, and there have been (virtually) no investigations
10	Water content Dissolved Organic Mater (DOM)	4	in progress	yes	no		Investigations for fresh water bodies, needs synthesis of fresh, coastal and ocean methods
11	Degree Heating Weeks	3	mature	yes	no		Routine product from many satellites.
D.	<u><b>Snow/Ice [high latitudes, high</b></u>						<b>Input to be obtained from:</b>
	Snow cover, Ice caps, Glaciers	3/4	no experts present				<b>Dorothy Hall, Jeff Dozier, Thomas Painter</b>
<b>Top of Atmosphere and Localized Products, and By-products of Level 2 Processing</b>							
1	TOA Optical and TIR Radiance (bands)	1B	yes	yes/limited	yes/limited		
2	Volcanoes eruption, size, prognosis	4	yes	yes/limited	yes/limited	yes	
3	Clouds (masks)	3	yes	yes	yes/limited		
4	Incident PAR (direct, diffuse PAR)	3				yes	
5	Water vapor product	3	yes			yes	
6	Aerosol optical depth product	3	yes	no	no	no	
7	Albedo	4	in progress	yes	no		

# DAY 1 (May 16): Morning Agenda

**8:00-8:30am: Registration, Coffee, Posters Up (W150)**

**8:30-9:30am (W150) HypsIRI Mission Update**

Status of HypsIRI Mission *[Woody Turner, NASA/HQ, 10 min]*

HypsIRI Plans & Perspectives *[Jack Kaye, NASA/HQ, 10 min]*

Summary of HypsIRI Mission & Instruments *[Rob Green & Simon Hook, NASA/JPL, 30 min]*

Review of Symposia 1 & 2, HypsIRI Science Questions and Symposium 3 Objectives  
*[Betsy Middleton, NASA/GSFC, 15 min]*

**9:50-10:20am (W150) Topic 1. Ecosystem Function & Composition Questions (VQ1-3, 5; CQ1, 4)**

Examples of existing higher level products: *[Fred Huemmrich, UMBC, 15 min]*

Desired New HypsIRI Products *[Petya Campbell, UMBC, 15 min]*

**10:20-10:30am: Coffee Break & Posters**

**10:30am-11:45am (W150) Contributed Talks [20 min each]**

1] Daily ET Products at Landsat/HypsIRI Scale from MODIS- & Landsat/HypsIRI-like Data  
*[Carmelo Cammalleri, USDA]*

2] Evapotranspiration Using Remote Sensing & Weather Data in Mesoscale/local Scale Physically Based Models *[Susan Ustin, UCD]*

3] Tower Flux Estimates at Validation Sites with EO-1 Hyperion *[Fred Huemmrich & Petya Campbell, UMBC]*

4] 3 years, 150 AVIRIS images: Practical considerations for analyses of large hyperspectral data sets for ecosystem studies *[Aditya Singh & Phil Townsend, UW]*

**11:45am-1:00pm: Lunch**

# DAY 1 (May 16): Afternoon Agenda

**1:00-2:05pm Discussion of Topic 1 - Higher Level Ecosystem Products: Prioritize desired products; Discuss methods, tools and resources required** *[Susan Ustin, UCD & Fred Huemmrich, UMBC]*

Discussions by Breakout Groups *[2-3 Groups, 45 min, W120A, W120B, W150]*

Summary of Discussions *[Everyone, 20 min, W150]*

**2:10-2:30pm (W150) Contributed Talk**

5] Extracting Temperature and Emissivity from High Spatial Resolution Multispectral Thermal Infrared Data  
*[Simon Hook & Glynn Hulley, JPL]*

**2:30-3:00pm (W150) Topic 2. Disturbances & Human Impact Questions (VQ4, TQ3, 5; CQ2, CQ6)**

Examples of existing higher level products: *[Dale Quattrochi & Jeff Luvall, NASA/MSFC, 15 min]*

**3:00pm-3:25pm: Coffee Break & Posters**

**3:25-4:25pm (W150) Contributed Talks [20 min each]**

6] Synergies between VSWIR and TIR data for the urban environment: An evaluation of the potential for the Hyperspectral Infrared Imager (HypSIIRI) Decadal Survey mission

*[Dar Roberts, UCSB, Dale Quattrochi, NASA/MSFC; Glynn Hulley, Simon Hook & Rob Green, JPL]*

7] Estimating Agricultural Crop Residue: Opportunities for HypSIIRI *[Melba Crawford, Purdue]*

8] Values and Advantages of HypSIIRI for Remote Sensing of Aquatic Environments *[ZhongPing Lee, UMASS]*

**4:25-5:30pm Discussion of Topic 2 - Disturbances & Human Impact: Prioritize desired products; Discuss methods, tools and resources required** *[Dale Quattrochi, NASA/MSFC & Melba Crawford, Purdue]*

Discussions by Breakout Groups *[2-3 Groups, 45 min, W120A, W120B, W150]*

Summary of Discussions *[Everyone, 20 min, W150]*

**5:30-6:00pm (W150) General Discussion** *[Leaders: Woody Turner, NASA/HQ & Petya Campbell, UMBC]*

**6:00pm** Adjourn for Dinner

**6:30pm Happy Hour & Dinner** *[at Ruby Tuesday]*

# DAY 2 (May 17): Morning Agenda

## **8:00-8:30am: Coffee & Posters**

**8:30-9:30am** (W150) IPM & Cloud Data Distribution, Low Latency Tools & Products; ESTO activities

*[Demo & Examples: Dan Mandl, NASA GSFC, & Robert Sohlberg, UMBC, 75 min]*

## **9:30-10:30am (W150) Topic 3. Volcano, Natural Hazard & Mineral/Resource Questions (TQ1-2, 4; CQ3, 5)**

Examples of Higher level Products Possible from Existing Assets: Landsat, MODIS, ASTER, MASTER, AVIRIS,

Hyperion, ALI *[John “Lyle” Mars, USGS, HypsIRI staff-15 min]*

Identify desired new HypsIRI products *[Rob Wright, UH, 15 min]*

## **10:30-10:45am Contributed Talk**

9] Atmospheric Correction Tools/Application for HypsIRI: Onboard & on the Cloud

*[Tim Perkins, Spectral Sciences, Inc.]*

## **10:45-11:00am: Coffee Break & Posters**

## **11:00-11:45am (W150) Contributed Talks from SSG [15 min each]**

10] ASTER Standard TIR Data Products *[Mike Abrams, NASA/JPL]*

11] Results of increased spatial and spectral observations of volcanic activity: Implications for HypsIRI TIR data

*[Michael Ramsey, Univ. Pittsburgh]*

12] Quantifying global volcanic unrest with HypsIRI: near-real-time algorithms and products *[Rob Wright, UH]*

## **11:45am-12:50pm Lunch & Demo**

Atmospheric Correction Tools and Application Needs, Using EO-1 Hyperion Images

*[Pat Cappelaere, NASA GSFC & Steve Adler-Golden, Spectral Sciences,, Inc.]*

# DAY 2 (May 17): Afternoon Agenda

**12:50-2:05pm** Discussion of Topic 3 - Volcanoes, Natural Hazards & Mineral/Resources: Prioritize desired products; Discuss methods, tools and resources required

**[Mike Abrams, NASA/JPL & Rob Wright, UH]**

Discussions by Breakout Groups [2-3 Groups, 45 min, W120A, W120B, W150]

Summary of Discussions [Everyone, 20 min, W150]

**2:10-2:40pm (W150)** Contributed Talk from SSG, Introduction to Geolocation Challenges

13] Geo-location knowledge requirements for HypSIIRI products & science questions

**[Steve Ungar & Pat Cappelaere, NASA/GSFC, 30 min]**

**2:40-3:10pm: Coffee Break, Posters & AC Demo**

**3:10-4:10pm (W120A, W120B, W150)** Interactive Discussion on Geolocation Challenges (60 min)

**W120A Group 1:** Geolocation Challenges & Topic 1 (Ecosystems)

**[Leaders: Susan Ustin, UCD & Fred Huemmerich, UMBC]**

**W120B Group 2:** Geolocation Challenges & Topics 2 (Disturbance/Human Impacts) and 3 (Volcanoes & Disasters) **[Leaders: Dale Quattrochi, NASA/MFSC & Rob Wright, UH]**

**4:15-4:30pm (W150)** Open Discussion on General Needs & Issues for Higher Level HypSIIRI Products

**[Leader: Betsy Middleton, NASA GSFC & Yen-Ben Cheng, ERT]**

**4:30-5:30pm (W150)** Reports to Full Meeting from Each Discussion

**[Discussion Leaders: Betsy Middleton, NASA GSFC & Woody Turner, NASA/HQ]**

Generate list of Recommendations from Discussions (by Topic 1-3)

Summary of Meeting

**5:30pm Adjourn**

# NASA Decadal Survey HypsIRI

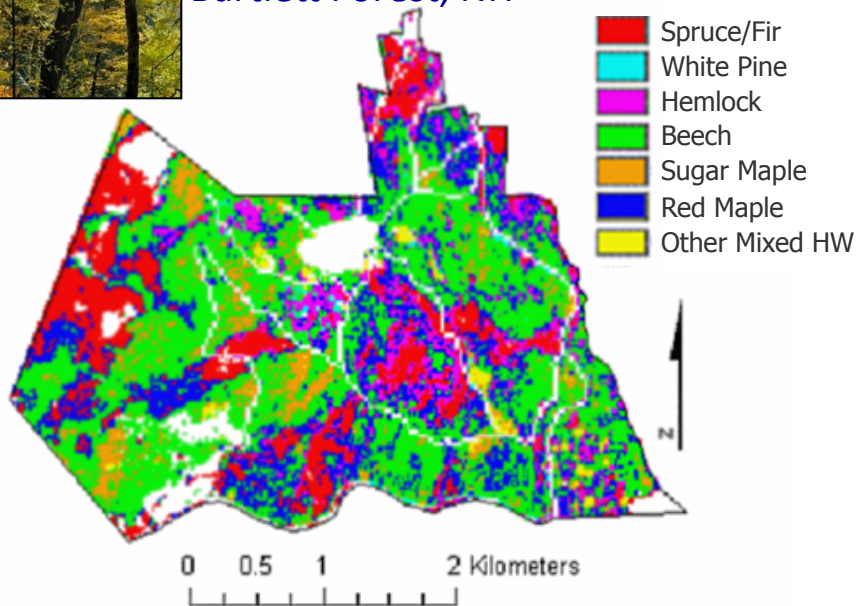




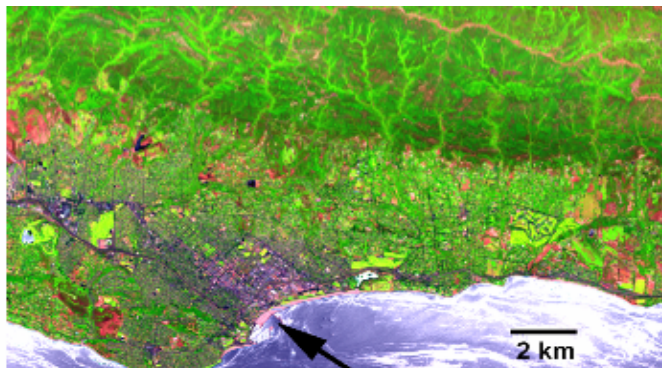
# Determine the global distribution, composition, and condition of ecosystems, including agricultural lands



Tree species mapping,  
Bartlett Forest, NH



HyspIRI Airborne Simulator Data Set



## Societal Issue:

- Forests, farmlands and a variety of other ecosystems are critical to life on the Earth. Many ecosystems are changing in ways that are poorly understood.

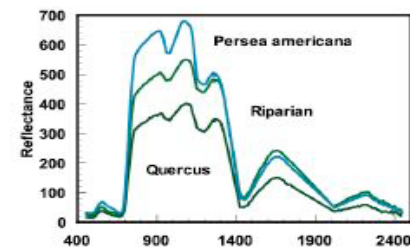
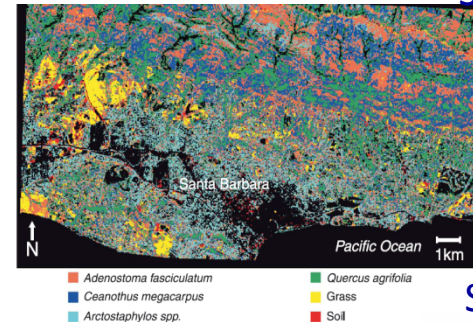
## Scientific Issue:

- Understanding the distribution, diversity and status of ecosystems is necessary for understanding how they function and for predicting future changes.

## Approach (Why we need HyspIRI):

- HyspIRI will provide an important new capability to detect & monitor ecosystem composition and condition globally, with spectroscopic and thermal measurements.

## Species Type Determination



## Species Fractional Cover

