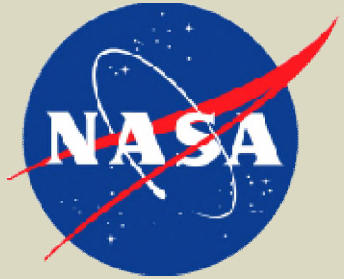
CEOS WORKING GROUP ON CALIBRATION & VALIDATION



CEOS WGCV Land Product Validation (LPV) Sub-Group: Current and Potential Roles in Future Decadal Survey Missions

Miguel O. Román[1] *for* Joanne Nightingale[1,2], Jaime Nickeson[1,2] & Gabriela Schaepman-Strub[3]

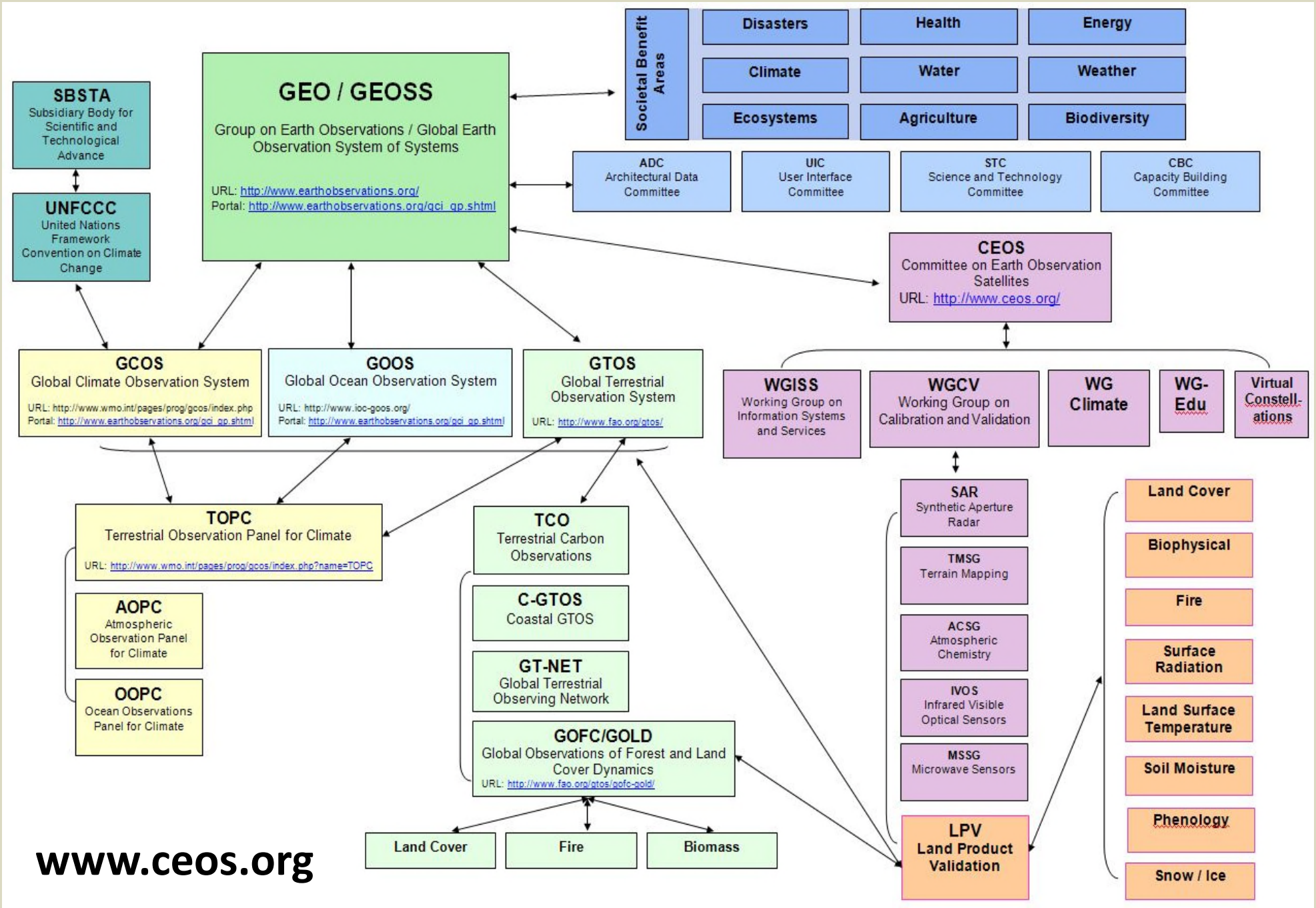
([1]NASA GSFC, [2]Sigma Space Corp, [3]University of Zurich)

~ With input from LPV Focus Group Leads

Outline

- Re-cap: Objectives and Goals
- LPV Structure Updates
- LPV activities relevant to HyspIRI
- Cal/Val Plans for VIIRS Land Science Products

Linkages between International Programs concerned with Terrestrial Earth Observation



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LPV Objective & Goals

To foster and coordinate **quantitative validation** of higher level global land products derived from remotely sensed data, in a traceable way, and to relay results so they are relevant to users.

- To increase the quality and efficiency of global satellite product validation by developing and promoting international standards and protocols for:
  - Field sampling
  - Scaling techniques
  - Accuracy reporting
  - Data / information exchange

- To provide feedback to international structures (GEOSS) for:
  - Requirements on product accuracy and quality assurance (QA4EO)
  - Terrestrial ECV measurement standards
  - Definitions for future missions

LPV Sub-group Structure

8 Land Product Focus Groups – 2 international co-leads

Chair: Joanne Nightingale 2010 - 2013

(NASA GSFC)

Vice-Chair: Gabriela Schaepman-Strub

(University of Zurich)

Support: Jaime Nickeson

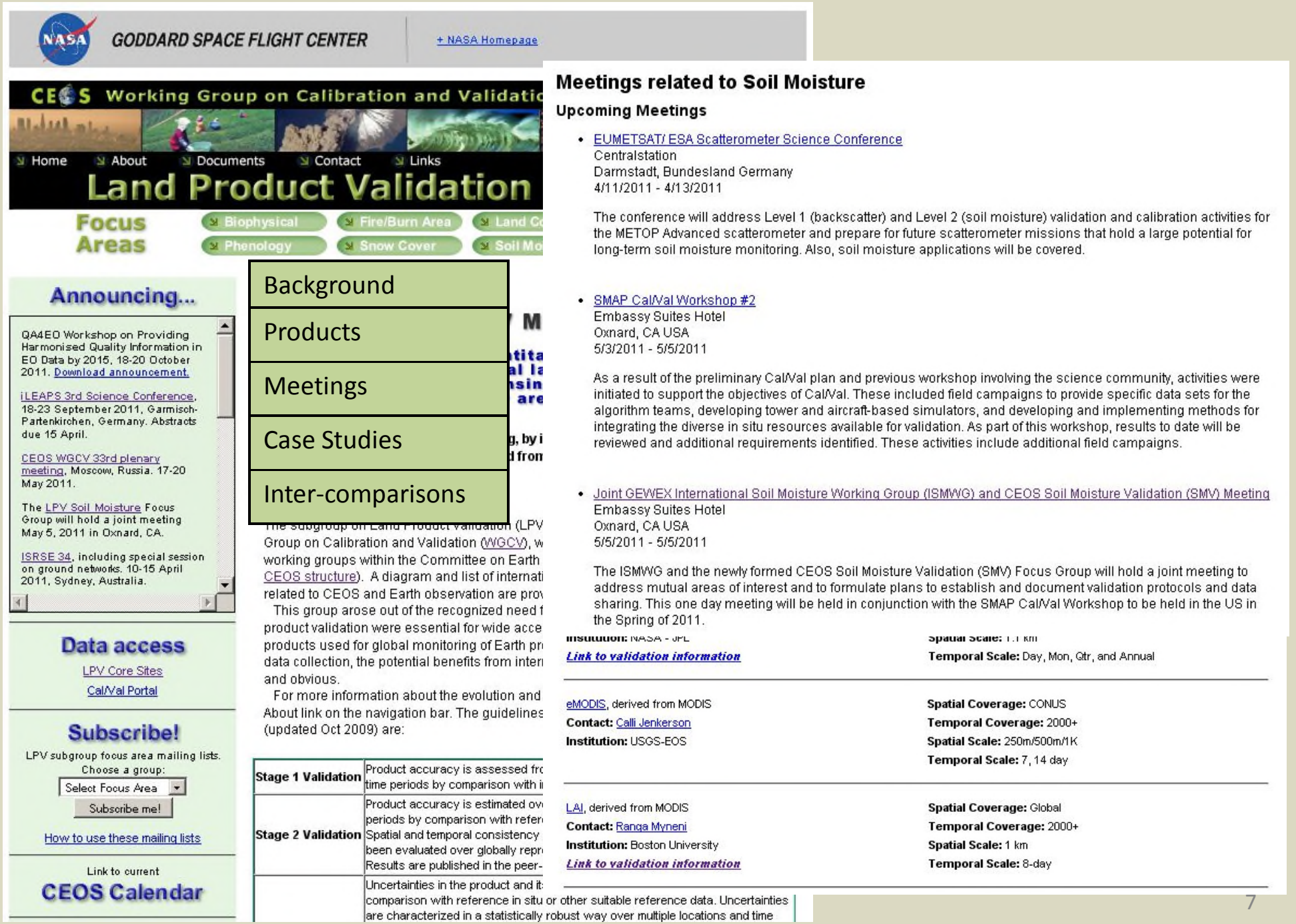
(NASA GSFC)

Focus Groups

* ECV

Focus Group	North America	Europe / Other	Listserv
Land Cover*	Mark Friedl (Boston University)	Martin Herold (Wageningen University, NL)	137
Fire* (Active/Burned Area)	Luigi Boschetti (University of Maryland)	Kevin Tansey (University of Leicester, UK)	73
Biophysical - LAI*	Richard Fernandes (NR Canada)	Stephen Plummer (Harwell, UK)	80
Biophysical - fAPAR*	Fred Huemmrich (NASA GSFC)	Nadine Gobron (JRC, IT)	80
Surface Radiation (Reflectance, BRDF, Albedo*)	Crystal Schaaf (Boston University)	Gabriela Schaepman (University of Zurich, SW)	41
Land Surface Temperature*	Simon Hook (NASA JPL)	Jose Sobrino (University of Valencia, SP)	65
Soil Moisture*	Tom Jackson (USDA)	Wolfgang Wagner (Vienna Uni of Technology, AT)	48
Land Surface Phenology	Jeff Morisette (USGS)	Jadu Dash (University of Southampton, UK)	76
Snow/Ice*	Dorothy Hall (NASA GSFC)	Jouni Pulliainen (Finish Instit of Meteorology, FI)	13+

LPV Webpage: http://lpvs.gsfc.nasa.gov/



LPV Activities relevant to HyspIRI

HysplRI Products

LPV Focus Group / Product	VSWIR L 2/ 3	VSWIR L4	VSWIR Global	TIR L4	SWIR / TIR
LAND COVER					
Fractional land cover / veg. cover					
Disturbance, PFT, hazard susceptibility					
SURFACE RADIATION					
Surface Reflectance					
Surface Albedo					
BIOPHYSICAL					
Gross / Net Primary Production					
fPAR					
LAI					
Water content, LUE, Pigments					
FIRE					
Detection of Fire events					
Fire fuel loads					
LAND SURFACE TEMPERATURE					
LST					
Emissivity					
Evapotranspiration					

Existing Val Methods

Research Required

Surface Radiation Focus Group

T8

ASSESSMENT OF THE STATUS OF THE DEVELOPMENT OF THE STANDARDS FOR THE TERRESTRIAL ESSENTIAL CLIMATE VARIABLES

GTOS

ESSENTIAL CLIMATE VARIABLES

GTOS 63

ALBEDO

Albedo and reflectance anisotropy

- **Official recognition of the need for long-term in-situ radiation measurements for spectral and broadband BRDF/albedo.**
- **Stresses importance of BSRN, Fluxnet, AERONET.**
- **Provides guidelines for data collection protocols and standardization across the flux networks.**

Schaaf et al., 2008

WMO UNESCO UNEP ICSU FAO

GCOS
GLOBAL CLIMATE OBSERVING SYSTEM

WMO UNESCO IOC UNEP ICSU

WORLD METEOROLOGICAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

IMPLEMENTATION PLAN FOR THE GLOBAL OBSERVING SYSTEM FOR CLIMATE IN SUPPORT OF THE UNFCCC

(2010 UPDATE)

6.1.3. Monitoring at Terrestrial Reference Sites

Many, if not most, of the terrestrial ECVs (such as FAPAR, LAI, biomass, and albedo) are too heterogeneous spatially to make global *in situ* measurements practical. They are typically measured at a limited number of research sites or retrieved from space measurements over large areas. There are three key requirements for *in situ* measurements at reference sites in the context of long-term global climate measurements: (a) To ensure that a representative set of biomes are properly and consistently documented over long periods of time (decades or more). This will allow the details of natural vegetation changes and carbon stocks, including fluxes, to be carefully monitored at key locations; (b) to measure key meteorological ECVs to support interpretation of changes recorded at such sites; and (c) to optimize the joint use of these terrestrial reference sites with:

- a set of sites delivering essential ground data for the validation of satellite-derived products that provide extensive geographical coverage for these variables (see Action T29 dealing specifically with calibration/validation of FAPAR and LAI).
- key ecosystem sites (see Action T4).

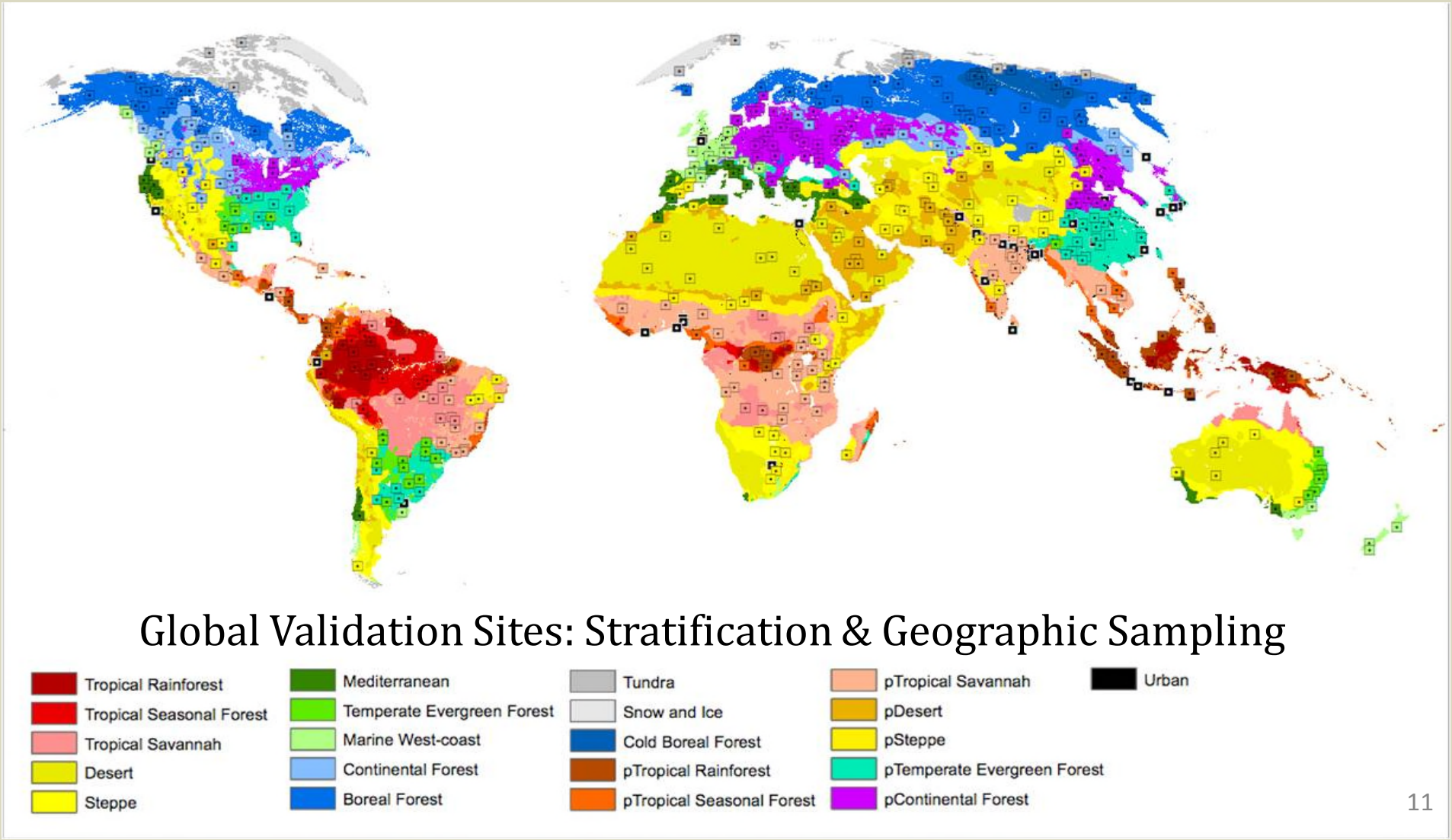
It may be efficient to establish these reference sites by building on existing networks, such as the Flux and Energy Exchange Network (FLUXNET) and the Long-Term Ecological Research Network (LTER), and to seek overlap between those networks.

Action T3[93] *[IP-04 T3, T29]*[94]

Action: Development of a subset of current LTER and FLUXNET sites into a global terrestrial reference network for monitoring sites with sustained funding perspective, and collocated measurements of meteorological ECVs; seek linkage with Actions T4 and T29 as appropriate.
Who: Parties' national services and research agencies, FLUXNET organizations, the US National Ecological Observatory Network (NEON) and the European Integrated Carbon Observation System (ICOS), in association with CEOS WGCV, CGMS-GSICS, and GTOS (Terrestrial Carbon Observations Panel (TCO) and TOPC).
Time-frame: Implementation started by 2011, completed by 2014.
Performance Indicator: Plan for the development and application of standardised protocols for the measurements of fluxes and state variables.
Annual Cost Implications: 30-100M US$ (40% in non-Annex-I Parties).

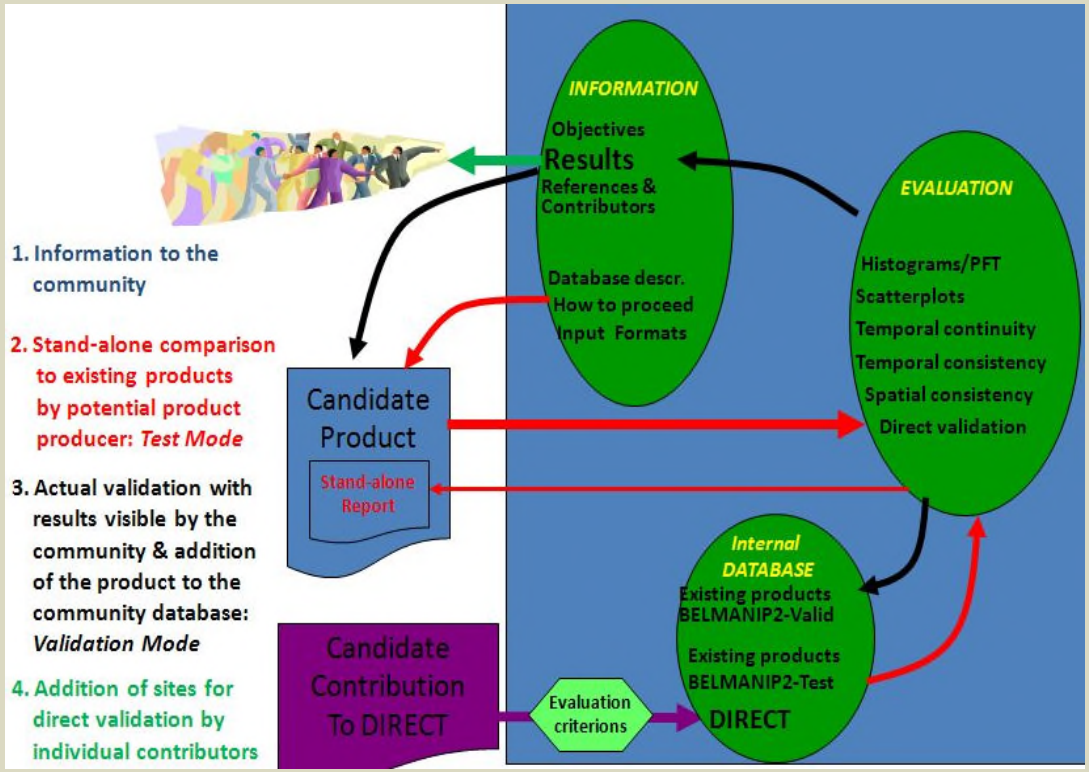
Land Cover Focus Group

- Implementation of a global sample design and database for land cover validation independent of specific products
- Design provides a global stratified sample of LC validation sites based on climate/vegetation biomes & population data, sample sites are 5km x 5km
- “Ground truth” derived from very high resolution imagery with the assistance of local experts



Biophysical Focus Group

- OLIVE (**O**n**L**ine **I**nteractive **V**alidation **E**xercise) (Baret *et al*.)
- Web-interface tool for independent validation of biophysical land products (LAI, fAPAR and Albedo)
- Will provide existing in situ data and high resolution scaled reference maps for validation, new validation datasets may be submitted
  - Technical specifications document undergone review by ESA and key LPV members
  - Operational mid-2011
  - User workshop scheduled for early 2012



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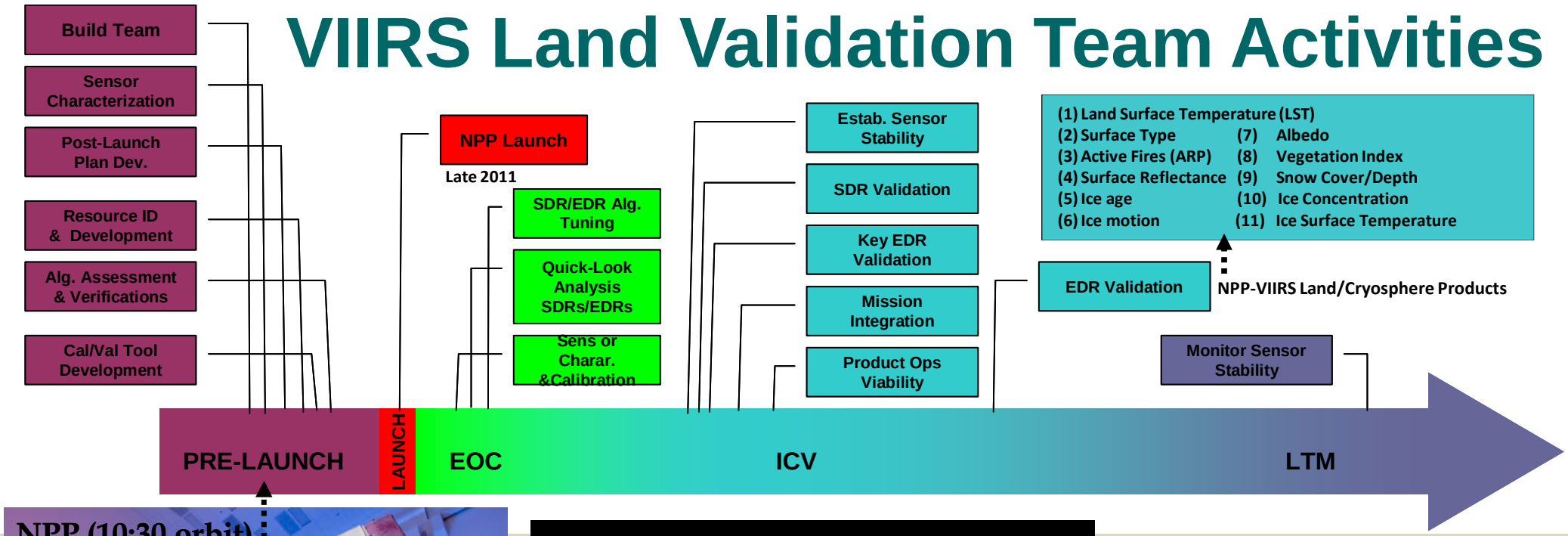
LPV and Data Quality

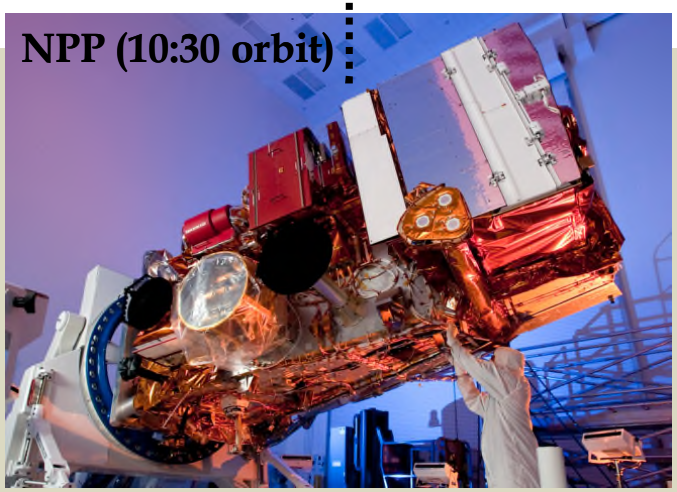
- LPV starting involvement with WGCV –WGISS and ESIP Federation Information Quality Cluster (GSFC)
- IQ cluster
  - Quality of remote sensing data, terminology, standardization, IQ framework, IQ4EO white paper preparation
- Standards for “ALL remote sensing products”:
  - Metadata
  - QA flags
- Assessment of “fitness for purpose” and ways of defining this within product meta-data

- LST community via **HysplRI** product planning and Barrax field campaign work are willing to be the first “test case”

Cal/Val Plans for VIIRS Land Science Products

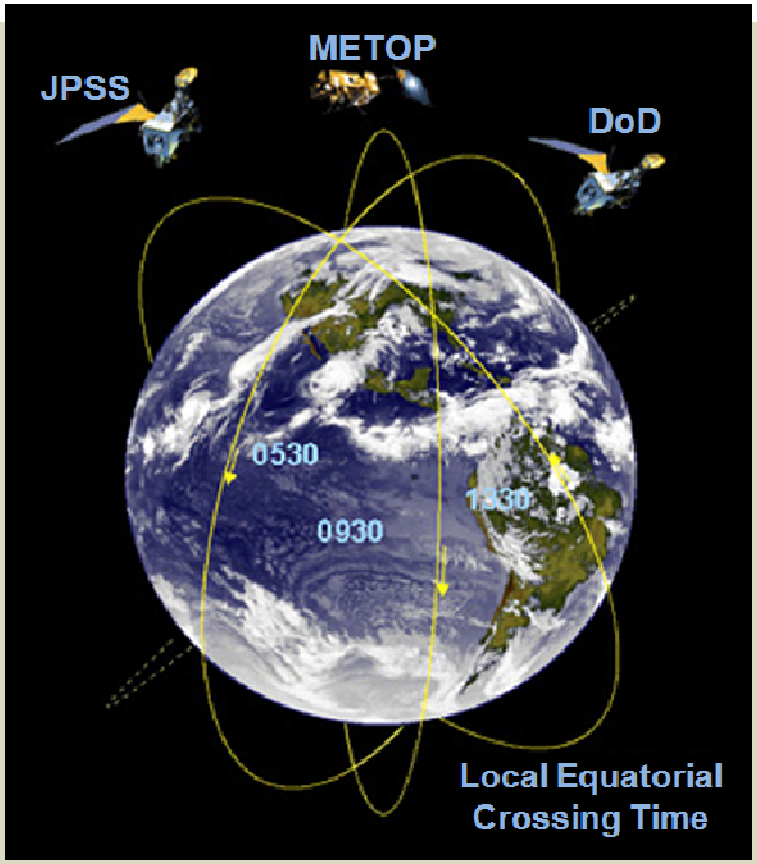
VIIRS Land Validation Team Activities





JPSS-DPA Objectives:

- To validate the VIIRS Land EDRs, IPs, and ARPs to meet **operational performance requirements**.

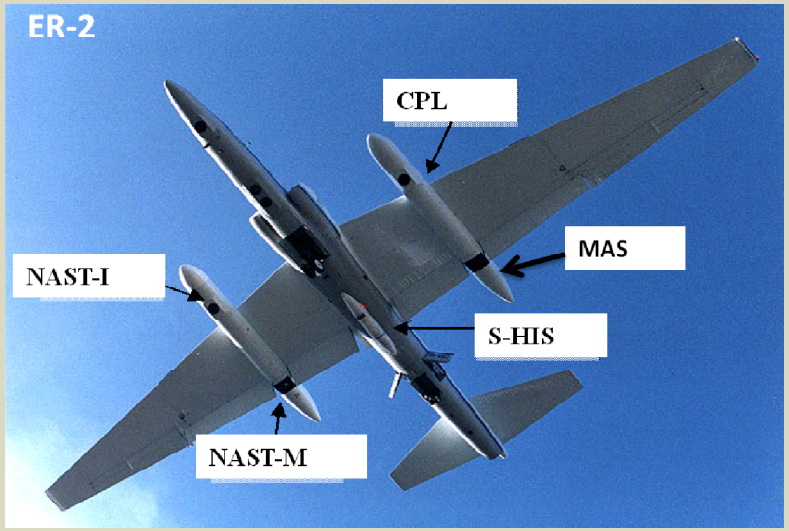


NASA's Role:

- To continue the scientific data record started in the EOS era.
- To coordinate algorithm development, QA, and validation activities for "Science-quality" products.
- Reprocessing will also be required to produce consistent, integrated, EOS/NPP/JPSS long term data records.

Aircraft Campaigns in Support of VIIRS Cal/Val Efforts

From Sensor Data Records…



- Airborne simulators support prototyping and testing of Level 1 VIIRS Sensor Data Records (SDRs).

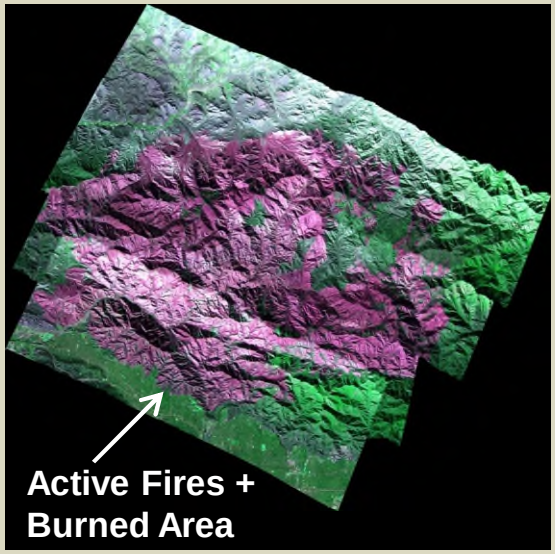
- Provide verification of sensor calibration and stability during ICV and LTM.

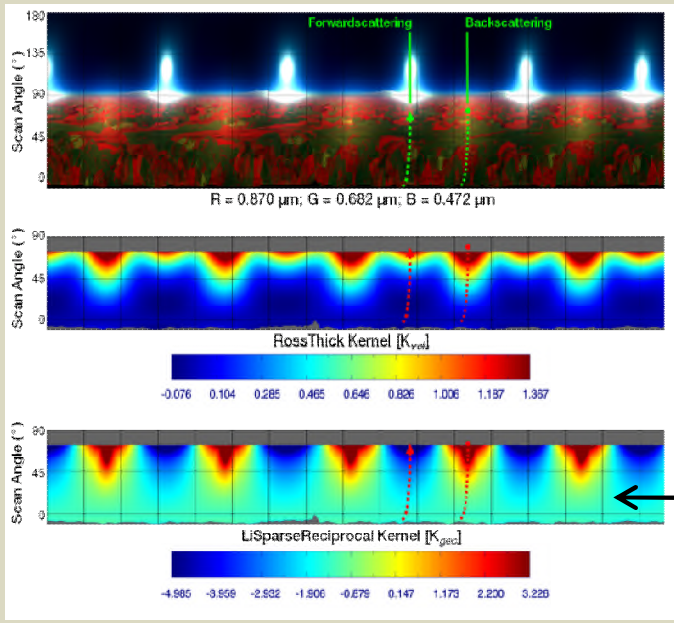
… to Global Land Products

(AMS/Ikhana)

IFOV:	2.5 mrad
FOV:	85.9˚
GIFOV:	50 m

Simulated Bands:
- ETM+ B1-B4
- MODIS B27
- VIIRS M15-M16





(CAR/P3-B)

Simulated Bands:
- ETM+ B1-B4
- MODIS B1,B2,B3,B5
- VIIRS I2, M3, M5, M7-8

IFOV:	17.5 mrad
FOV:	190.0˚
GIFOV:	4.0-500 m

Surface Reflectance, VI, BRDF, and Albedo ***(see poster display)***

- Development and testing of standard products (L2+); Provides critical in-situ data for multi-sensor validation and intercomparison studies .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WGCV
Land Product Validation Subgroup