Global Agriculture Monitoring: a component of the GEOSS Agricultural Strategy

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Image: NASA, ASTER Science Team

Outline of the Talk

- The Context for the Meeting
- Recap from the Last Meeting
- Goals for this Workshop
  - Suggested Approach
  - The Workshop Report
- This Workshop Agenda

Context

- **Agriculture is an essential component of societal well-being**

- **Current Context for Global Agricultural Monitoring**
  - Changing global markets – shifting demographics, demand /supply
  - Climatic variability and change – extreme events (flooding, frost, agricultural droughts), changing cropping patterns, changing water supplies for irrigation
    - Adaptation of farming practices can be expected
  - Poverty, Conflict and Food Security – famine early warning
  - Changing agricultural distribution - new agricultural frontiers, abandonment, urban expansion into agricultural areas
  - Changing Land Use – mechanization, irrigation, farming practices
  - Demand Bio-fuels - changing crop types, food availability

- **Agriculture monitoring systems can lower barriers to**
  - obtaining timely information on agricultural production and markets
  - detecting trends in agriculture, providing input for ag. policy
  - enhancing the ability to manage food insecurity risk and reduce malnutrition

Programmatic Context: IGOL

- **IGOL - The Land Theme of the Integrated Global Observing Systems (IGOS) Partners**
  - Recognizes the need to enhance and better utilize the current observing systems
    - Satellite based
    - In-Situ Networks
  - Recognizes that gaps exist in the current observation systems
  - Recognizes the particular challenge of socio economic observations and data
- **First phase: Scoping and Requirements Report presented at the IGOS-P meeting in Paris (2007) (draft circulating)**
    - Agriculture is one of the broad domains
    - Agriculture component developed at the Rome Workshop 03/06
  - Establishing a relationship with GEOSS as a ‘land’ coordination mechanism

Programmatic Context: GEOSS

- **GEOSS (Global Earth Observing System of Systems)** :
  - Satellite and in-situ observations> international cooperation > focus on Societal Benefits

- The agricultural efficiency component of GEOSS is aimed at improving food security and increased availability and use of data

- A number of Agricultural Tasks have been defined e.g.
  - **AG-06-01: GEOSS Agriculture Strategic Plan**
  - **AG-07-02: Agricultural Risk Management**
  - **AG-07-03: Operational Agricultural Monitoring System**

  (see the following talk)

- **Initial articulation of agricultural requirements made at an IGOL Workshop on Agriculture Monitoring, FAO Rome, 2006**

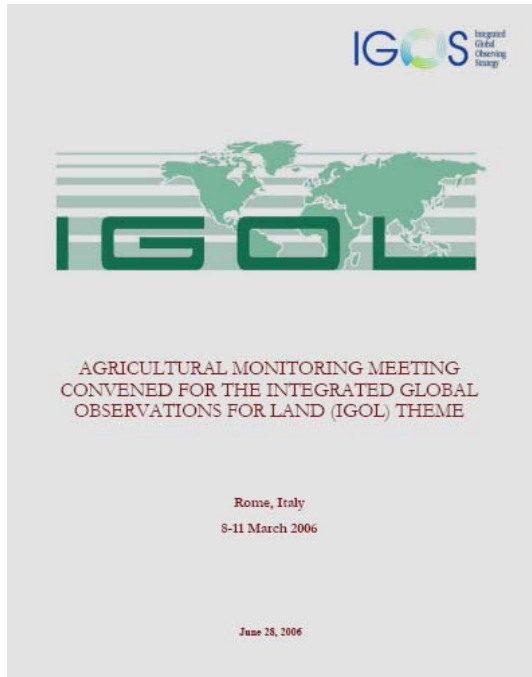
Types of Observation Coordination Activities that can be envisaged

- Enhancing the Current Observation Systems
  - Data Collection Systems–sensors and ground networks
  - Observations and product enhancements
  - Data standardization, exchange, dissemination
- Developing New Observation Capabilities
  - Requirements leading to New Observations
  - Operational R&D > new products
  - Transition to operations
- Capacity Building to better utilize existing systems
  - Developed countries
  - *Developing countries*

March 06 IGOL Agriculture Workshop

Summary Findings

- Major enhancements required to the existing observation capabilities and new observations are needed to fill existing gaps
  - Emphasis needed on improving ‘operational’ capabilities
- To improve management of agricultural resources, strategic investments over the next 10 years in earth observations are required:
  - ***satellite observations***
  - ***in-situ measurements***
  - ***ground surveys***



Reviewed History of Agriculture Monitoring

Ground based and satellite systems -integrated

- Agricultural monitoring roots in field-based crop harvest estimation and yield models driven by meteorological data
- Early 1970's Ag. monitoring from space began with the Large Area Crop Inventory Experiment (LACIE) programme
- 1980's R&D based on the NOAA Advanced Very High Resolution Radiometer (AVHRR) added daily monitoring of vegetation condition using coarse resolution time series data to the suite of agricultural monitoring tools
- Recent improvements
  - Sensor technology (MODIS, VEGETATION, MERIS, ERS)
  - Improved weather information and predictions
  - Information Technology for data dissemination

Typology of Agricultural Monitoring Users

Typology illustrating how nations can benefit from enhanced observations of agricultural production

	Type 1	Type 2	Type 3
Reasons for enhanced observations	**Agricultural commodity** supply/demand assessments; practice verification; damage assessment; precision farming	**Regional food security** assessments; insurance/microfinance programs; irrigation monitoring	**Food insecurity** assessment; famine early warning
Development context	Developed countries & high income developing countries	Middle income developing countries	Least developed countries
Geographic region	North America, Europe, Australia, 'Northern' Asia, Near East	South America, East Asia, North Africa, Pacific, Central Asia	Sub-Saharan Africa, South Asia, Central America
Dominant climate type	Temperate, continental, Mediterranean, arid	Tropical, sub-tropical; arid, semiarid	Tropical, sub-tropical; arid, semiarid
Farming systems	Highly specialized, mechanized (incl. irrigation), high input & productivity, few holdings	Mixed technology, large acreage under irrigation	Low technology, rain-fed, largely subsistence, low productivity, many farm holdings
Institutional capacity	High capacity, high technology, large data sets (depth & breadth), reliability	Mixed capacity, large potential, rapid growth in data reliability & quantity	Very low capacity, low technology, low levels of reliability

Assessed Current Status

- Currently a number of operational agricultural monitoring systems exist at national, regional and global scales that utilize satellite observations, in-situ data and field survey
  - these operate independently w. some common data use
- 2 primary areas of focus:
  - food security in developing countries
  - global market of agricultural crops
- Increasing attention being given to impacts of climate change on agriculture and adaptation – sustainability context e.g. Nairobi Work Program

Examples of Current Global > Regional Monitoring Systems

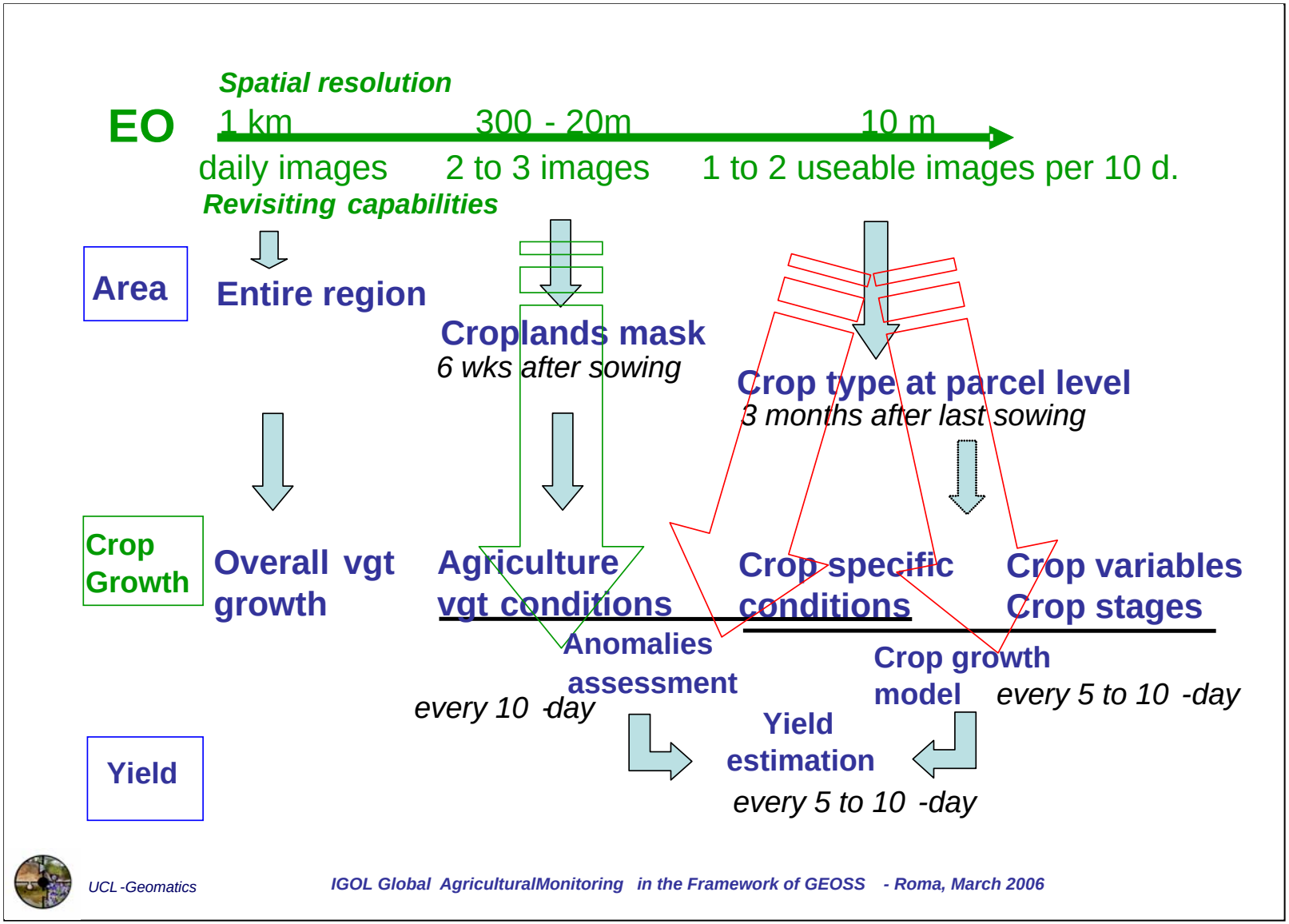
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
helping to build a world without hunger

National Agricultural Monitoring Systems

- Large number of countries have well established monitoring systems in place
  - Can be very effective at the national level
  - Large disparity exists between developed and developing country capabilities
- Often very different approaches and methods
  - Sampling strategies, data used
  - Rely primarily on field sampling
- No standardization of data collection (between nations)
- National reporting w. different levels of accuracy, availability/transparency and timeliness

  (Those who didn't attend the last meeting please provide a brief summary of your national programs)

Vision for EO contribution to crop growth monitoring



Goals for the satellite component of the agricultural observing system:

Within next 10 years space agencies should put in place and maintain an observing system for the operational provision of:

- a global crop area mask (300 - 10 m resolution) within six weeks of sowing
- an assessment of crop vegetation conditions (300m – 10m resolution) every 10 days
- identification of crop-type at the parcel level (10m resolution) one to three months after final sowing
- crop stage observations (10m) every five to ten days during critical periods

Some Challenges and Gaps for Enhanced Global Agricultural Monitoring System

- A strategy needed to implement observation enhancements and secure the long term goals

Some Priority Issues

- Long-term continuity of high resolution global datasets (w. increased temporal resolution)
- Data sharing and pricing policies
- Distributed data components w. interoperability
- Coordination of *in-situ* data collection and improved data access
- Capacity building of user community
  - particularly developing countries

Last Workshop Recommendation Topics

(see handout)

1. Long-term continuity of ***global high resolution (50-10m) data*** is critical for successful agricultural production monitoring.
2. The urgent need for enhanced observations for agricultural production monitoring and the resulting benefits to food security and societal well-being should be recognized and *a* ***strategy put in place to mobilize the international community*** to implement these enhancements and provide the necessary observations.
3. Data providers should support ***development and adoption of data and pricing policies that minimize delays in data access, foster wide spatial and temporal data availability of data,*** *promote data sharing* and collaboration, and enable integration of earth observations and *in situ* data.
4. Timely, accurate and comprehensive ***in situ data*** are important for agricultural production monitoring and efforts should be made to ***enhance the quality and availability of these data*****.**
5. Developing countries are often those in greatest need of improved baseline data sets and timely agricultural monitoring. ***Enhancing the capacity of developing country data users and collectors*** has met challenges in the past, but should remain a priority.

The Goals of this Workshop

- **Further develop the monitoring component of the 10 year agricultural strategy for GEOSS**
  - Revisit the components identified at the last workshop
  - State clearly what we need to have happen
- **Outline initial concrete steps for implementing the strategy**
  - Refine the GEOSS Ag Monitoring Task
  - Select a small number of necessary significant improvements
  - Define what needs to be done in some detail
  - Identify potential actors
- **Establish a GEOS Agriculture Monitoring Community of Practice**
  - A flexible group that can develop a community consensus, can advise GEOSS on agricultural issues, can advocate for the strategy implementation, can help implement the identified tasks
- **Develop a report for the GEOSS Plenary in November**
  - Advocacy for what needs to be done

NB. GEOSS is not a funding agency but

- *it can put pressure on participating agencies*
- *it can provide a point of leverage for national/international funding for contributory projects*

Purpose of the Workshop Report

- Identify the Broad (Long Term) Goals for an Agricultural Monitoring System of Systems
  - by desired functions?

- Define a small number of priority Near-Term GEOSS Tasks : Projects/Initiatives (w. annual review) – see later
  - That would really make a difference
    - That is feasible to do
    - That is appropriate for GEOSS (International cooperation)

The Agenda

- **Day 1. 9- 5.30**
  - **1. Introductory Session**
  - **2. Building on Existing Activities**
  - **3. Tour de Table – Update on Developments in Regional to Global Agricultural Monitoring Programs since the last meeting** (5-10 minute updates)
  - **4. Tour de Table - Update on example National Agricultural Monitoring Activities since the last meeting** (5- 10 minute updates) -More comprehensive write ups will be provided in the meeting report
  - **5. Tour de Table - Updates on International and National Satellite Systems and Initiatives** (5-10 minute updates) - More comprehensive write ups will be provided in the meeting report
  - **6. Breakout Groups - Defining the Components of the GEOSS Ag Strategy (Part 1)**
    - **Group 1. Focus on Food Security and Early Warning**
    - **Group 2. Focus on Agricultural Monitoring**
  - ***Workshop Reception 5.45 -7.00***
- **Day 2. 9- 5.30**
  - **6. Breakout Groups - Defining the Components of the GEOSS Ag Strategy (Part 2)**
  - **7. Report Back**
  - **8. Data Issues Session**
  - **9. Breakout Groups – Developing the GEOSS Agricultural Monitoring Tasks**
    - **Group 1. Agricultural Area Estimation**
    - **Group 2. Cropping Systems database for Agricultural Monitoring**
    - **Group 3. In-Situ Vegetation Measurements and integration with EO**
    - **Group 4. Rainfall/Meteo Data Enhancement**
- **Day 3. 9- 3:00**
  - **10. Report Back Sessions from Groups 1-4**
  - **11. Round Table Topics**
    - Linking to GEO Opportunities for Capacity Building
    - Developing Country Priorities for Agricultural Monitoring
    - Establishing a GEOSS Agricultural Monitoring Community of Practice
  - **12. Summarizing what GEOSS can do for Agricultural Monitoring**
  - **13. Developing the Meeting Report and Formulating the Recommendations**
  - Close of Workshop 3pm

Request

- Please provide all presentations to Reuben / Inbal
  - these will be posted on the web site
- Please write up a short summary of your update presentation (provide any additional material as you wish)
  - these will be used to develop the report

Refining the GEOSS Ag Monitoring Task AG07-03

Chris Justice (UMD)

As Currently Defined

AG-07-03: Operational Agricultural Monitoring System

- The purpose of this Task is to support the development of an Operational Agricultural Monitoring System comprising:
  - A global soil and terrain database at the scale of 1:1,000,000
  - A global farming system database regularly updated with satellite and in-situ observations
  - An operational linkage of Earth observation data to geospatially referenced production and use statistics.

Modified Approach

- Define the Overall Task i.e. an Ag Monitoring System of Systems – setting requirements
  - defining the components and required functionality
  - defining the outputs ?

    (First Breakout Groups)
- Concrete Sub Tasks (near term activities)
  - Outlining the tasks and their implementation
  - *to be determined at this workshop*

    (Second Breakout Groups)

System Functional Components

- mapping and monitoring of changes in agricultural type and distribution
- global monitoring of agricultural production, facilitating reduction of risk and increased productivity at a range of scales;
- accurate and timely national agricultural statistical reporting;
- accurate forecasting of shortfalls in crop production and food supply;
- effective early warning of famine, enabling a timely mobilization of an international response in food aid;
- reliable and broadly accepted 5, 10, and 20 year projections of food demand and supply as a function of changing demographics, markets, agricultural practices and climate.

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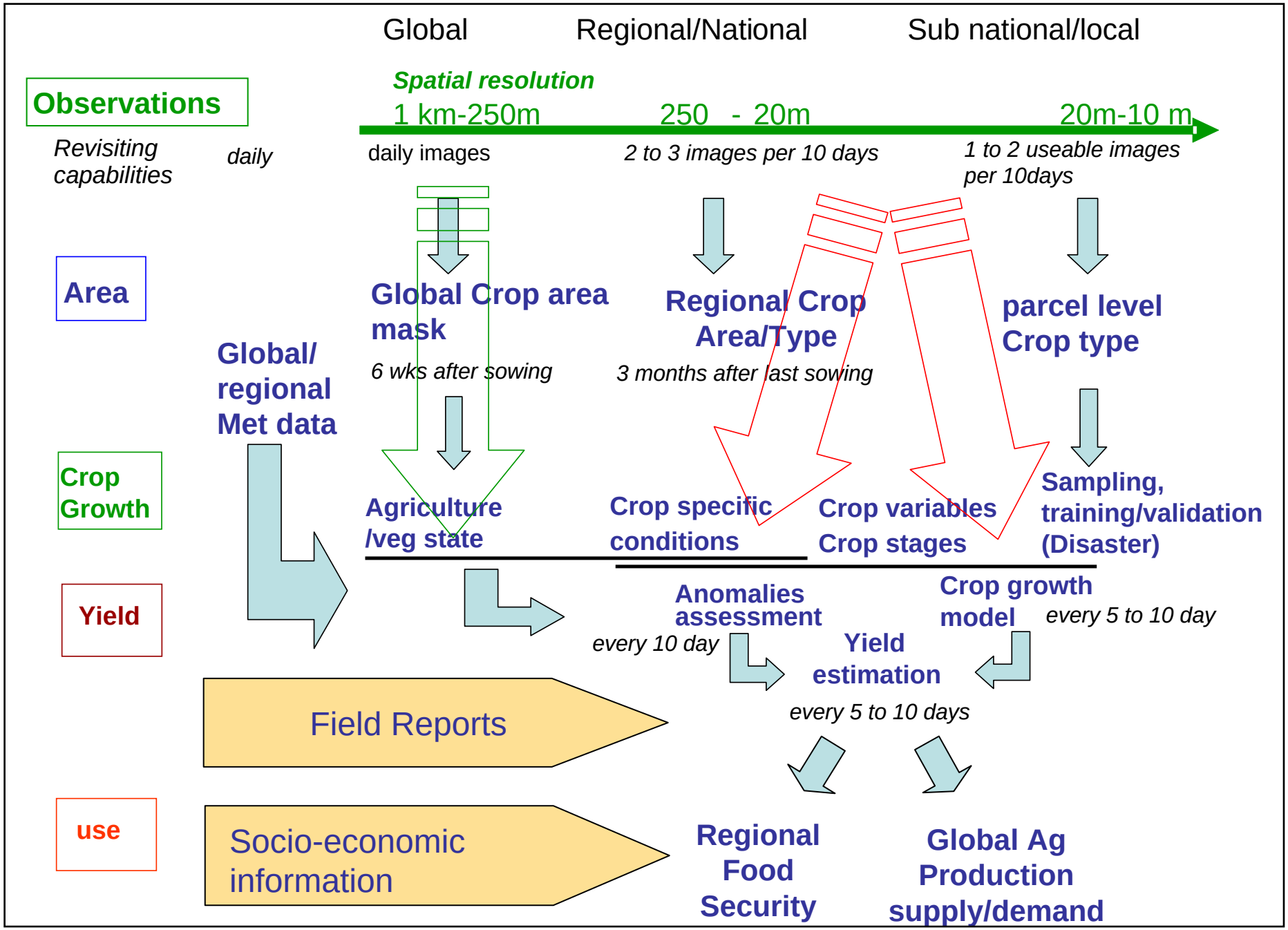
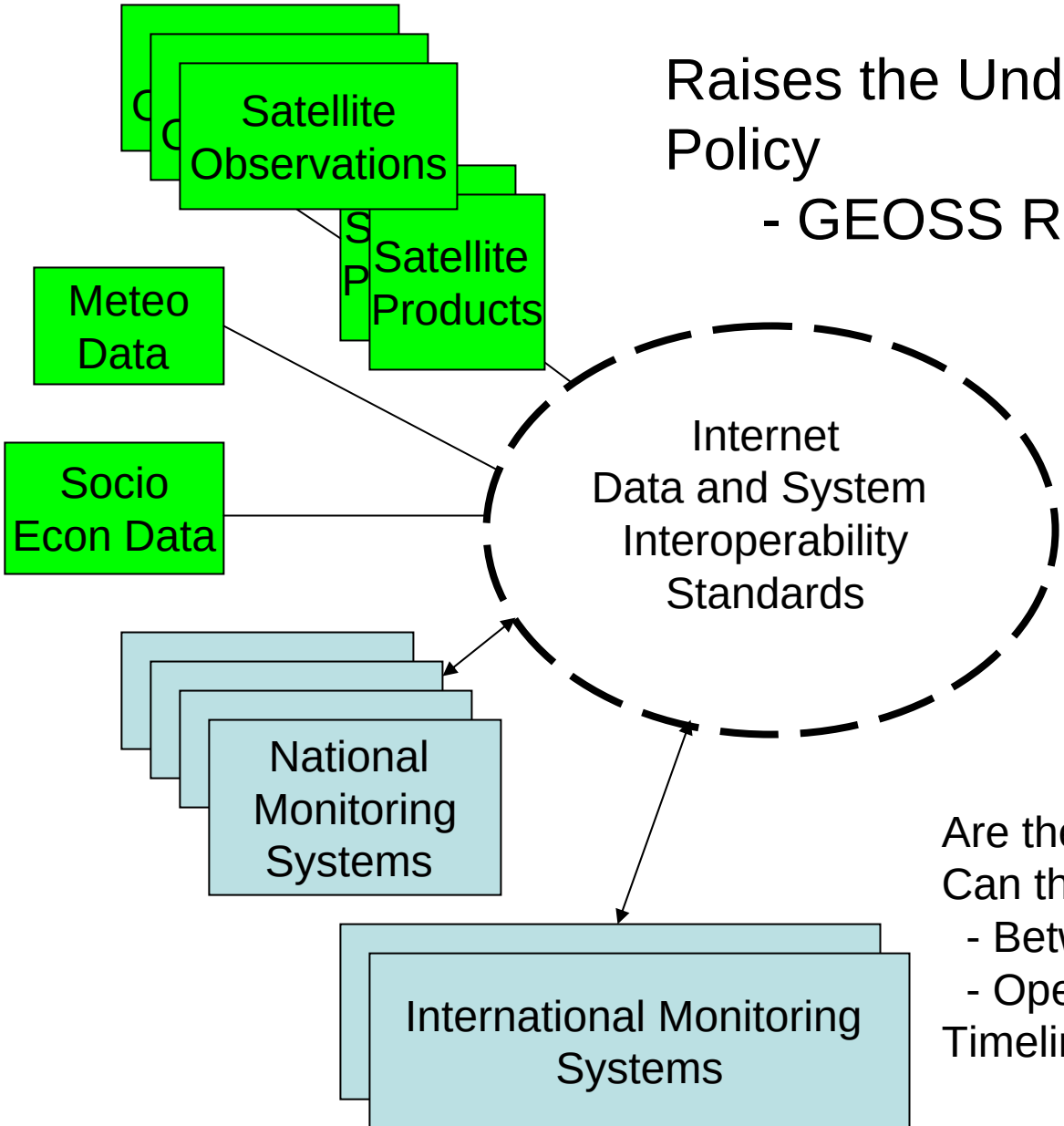

Global
Regional/National
Sub national/local
Observations
Spatial resolution
1 km-250m
250 - 20m
20m-10 m
Revisiting capabilities
daily
daily images
2 to 3 images per 10 days
1 to 2 useable images per 10days
Area
Global Crop area mask
6 wks after sowing
Regional Crop Area/Type
3 months after last sowing
parcel level Crop type
Global/ regional Met data
Crop Growth
Agriculture /veg state
Crop specific conditions
Crop variables Crop stages
Sampling, training/validation (Disaster)
Yield
Anomalies assessment
every 10 day
Crop growth model
every 5 to 10 day
Yield estimation
every 5 to 10 days
Field Reports
use
Socio-economic information
Regional Food Security
Global Ag Production supply/demand

Ag Monitoring System of Systems



Raises the Underlying Issue of Data Policy

- GEOSS Rules of Play

Issues

Are there a core set of products?
Can the data be shared?
- Between the Community of Practice
- Openly with all

Timeliness of Availability

Example of Possible Tasks

(all require international cooperation)

- Improved coverage of weather station data
- 5 year mapping of global agricultural land use type and extent at 50-20m (2005, 2010)
- Free and open sharing of moderate resolution data products - 1km-250m through NPOESS
- Improved access to National Ag. Statistics
- Others?

Charge to the First Breakout Groups

Developing the 10 year GEOSS Ag Monitoring Strategy
1. Agricultural Monitoring
2. Food Security Famine Early Warning

- Assess/Refine The Observations Vision Diagram (V2)
  - what needs improving
  - what is missing
- Outline the Long Term Strategy
  - Necessary Components
  - What needs to happen
- Highlight a few priority components
  - Describe how they might be implemented

(These are suggestions - Chairs to organize sessions to be most productive)