GEO Workshop on
Best practices of crop area estimation/forecasting with earth observation and future needs

5-6 June 2008 EC JRC, Ispra

FIRST DRAFT FOR COMMENT

Executive Summary

Agricultural monitoring systems provide information on agricultural production and on risks to food security to a range of decision and policy makers around the world. An essential component of such monitoring systems is timely estimation/forecasting of crop area which is pertinent for both crop production forecasting and for tracking changes in cropped land distribution. At present, timely crop area estimation is one of the weakest elements within agricultural monitoring systems, despite the wide range of methods that have been developed for the purpose. To address this shortcoming, the European Commission- Joint Research Center (EC JRC) hosted a workshop specifically on the theme of crop area estimation, which was the third in a series of GEO (Group on Earth Observations) Agricultural Monitoring Workshops.

Forty one participants representing twenty seven national and international organizations came together for this thematic workshop from June 5th to 6th in Ispra (Italy) to:

i) assess the current state of the art in crop area estimation,

ii) develop a guidelines report on best practices for crop area estimation/forecasting with earth observations,

iii) design a series of regional pilot experiments on cropland area estimation to compare methods and accuracies,

iv) to review and refine, based on workshop discussions and findings, priority tasks for the GEO Agricultural Monitoring Community of Practice (GEO AG-07-03 CoP) and develop the associated 2009-2011 task sheet.

The workshop consisted of summary presentations on: current operational methods for crop area estimation, data needs, statistical approaches, and accuracy assessment, and of a series of discussions and break-out sessions. The presentations can be found at *http://agrifish.jrc.it/ftp/Public/Javier/GEOSS/*
The breakout sessions were organized around a) developing the crop area best practices document, b) developing the proposed regional experiments, c)

developing the next steps for the GEO AG-07-03 Task and the updated work plan.

a) Best Practices Document

This breakout group went through the strawman outline for the document and made a number of revisions. This group recommended that the area estimation guidelines be stratified according to the following:

- availability of ground data
- complexity of landscape (complex vs. simple)
- estimate type (single crop vs. crop groups)
- target accuracy (high vs. moderate)
- estimate timing (pre-harvest vs. post-harvest)

It was agreed that in the absence of ground data, high (60-10m) and very high (1m-3m) resolution imagery can be substituted, though accuracy of estimates will be limited by commission-omission errors that cannot be measured. When sufficient ground data are available, high/very high resolution imagery can be used to design a sampling plan (random, systematic, stratified). Regression, calibration and ratio estimators can be used for all cases where moderate or high accuracy estimates are feasible. It was recommended that when possible, high, moderate and coarse resolution imagery should be combined to facilitate and in some cases enable the estimation process. This group decided not to address the topic of crop area forecasting (estimation 4-5 months prior to harvest) within the best practices document as the methods are considered to be, still in research phase and have yet to be transitioned to the operational domain. Further discussions on this topic are needed with GEO Task AG-07-02.

b) The Community of Practice Regional Experiments

This breakout group was charged with providing a common template for the proposed regional experiments. The purpose of the experiments is to: encourage method inter-comparison and development accuracy assessment of best practices, allowing cross-fertilization of approaches between different groups. The experiments were divided into two primary groups: crop-type area estimates and crop-group area indicators. The experiments will be carried out in several countries including: Ethiopia, South Africa, China, India, Brazil, Argentina, Nigeria, and Afghanistan. Participation will be open and coordination will be managed by the hosting group.

The following objectives were identified for these experiments:

- develop a common framework for reporting methods and results
- encompass a range of agricultural settings
- cover the 3 types of crop area products (crop type, crop group, cropland)
- secure the availability of the appropriate EO data for the cropping system
- in the longer term- possible cross-check and harmonization of methods

The group recognized that the common reporting framework should address:

- description of the statistical theoretical background
- accuracy assessment to be based on field observations
- timing of information delivery
- portability of approach to other areas
- cost analysis
- operational robustness
- fitness of products for decision making processes
- pre-processing standards
- technical capacity requirements
- added value of EO to existing systems
- quality control procedures

To carry out these experiments the group would use the appropriate data for crop monitoring. The group recommended acquiring several AWiFS images for the majority of sites where they are currently not being acquired, and SAR time series images for 3 of the sites. It was also recommended to produce a global map of agricultural landscape structure that could be used to relate the best practices guidelines to the regional cropping system context.

c) The next steps for the AG-07-03 Task and observation requirements

This breakout group went through the sub-tasks identified in the 07-08 GEO work plan provided updates and identified some new tasks for the 09-10 timeframe. The primary focus of the discussions was on the near term (18-24 months) activities for the Community of Practice, acknowledging that the long term goal of this task is to develop a global distributed system for monitoring agriculture.

Four new AG-07-03 sub-tasks were recommended:

- Develop a common centralized PAY (production, area, yield) database that will allow for comparison of similar products, and will provide information on who is doing what and where. It was envisioned that the agencies currently generating statistics for multiple countries (USDA/FAS, EC-JRC/ China) would be the first to populate the database with their national level estimates, and individual country's estimates would be added as available, following a broader program of outreach once the database is up and running.
- Compile a rapid assessment database of experts with a remote sensing emphasis. This will provide information on the members of the agricultural monitoring community of practice and their area of expertise, which can be particularly valuable when rapid assessment is needed during a regional agricultural crisis.

- Hold a workshop aimed at reviewing methods for integration of in-situ and EO estimates of rainfall for Africa (to be held at JRC, Fall of 2008) and make recommendations on where new meteorological stations should be put in place in Africa. The workshop will compare different methods used for rainfall estimation and review current and projected satellite data availability and possible gaps.

In addition, it was recognized that the AG-07-03 CoP should be expanded to include additional participants from major agricultural producing regions of the world, including Southeast Asia, Russia, and Australia. In the discussion, issues of current data policy-systems were emphasized as they significantly inhibit the use and sharing of earth observation data, which all agricultural monitoring systems rely on. Data policies were discussed in terms of: sharing of pre-processed data and data products and sharing of raw data.

Workshop Recommendations

During the discussions and breakout sessions, the following recommendations and tasks were identified as priorities (Task # and lead organization are given in brackets):

- Implement data sharing policies that allow for affordable, timely global agricultural monitoring. To advance this recommendation it was agreed to proceed with a Global Agricultural Data and Product Workshop to define a set of operational products for agriculture monitoring, and to address EO and in-situ data availability, timeliness, quality, dissemination and continuity issues. Representatives from the Chinese Academy of Sciences offered to help organize workshop on this topic in China in 2009 - (Sub Task AG-07-03.5 - China CAS).

- Produce of a global map of field size distribution and cropping system complexity in order to guide both EO data acquisition and crop area estimation methods (*New* Sub Task AG-07-03.10 - UMD)

- Design pilot studies for integrating EO data within national statistical reporting systems that will lead to documentation of community guidelines and protocols (Sub Task AG-07-03.3). The first step is to identify a prioritized list of countries in need of improved agricultural monitoring systems and crop statistics as a way to target the pilot studies (FAO and GEO AG-07-03 Task Sec., ISRO India).

- Proceed with a series of international regional crop area experiments aimed at method inter-comparison in Ethiopia, Argentina, Brazil, Canada and China (Sub Task AG-07-03.2 – Various COP members).

- Proceed with the production of global maps of croplands at c. 250m and 20-60m (Sub Task AG-07-03.4 – US SDSU, UCL (c. 250m,) – input data set for the 20-60m product being developed under GEO Task DA-07-02)

- Identify funding opportunities for a series of capacity building workshops on EO, agricultural monitoring and famine early warning (Sub Task AG-07-03.6 – in conjunction with AG-06-07 – AG-07-03 Task Sec. ISRO India)

- Develop a common Production, Area, and Yield (PAY) database for displaying crop statistics from the various international efforts (*New* Sub Task AG-07-03.8 – India AG-07-03 Task Sec. ISRO, US USDA FAS, EC MARS, China CAS)

- Hold a workshop aimed at reviewing methods for integration of in-situ and EO estimates of rainfall in Africa (New Sub Task AG-07-03.9 - EC MARS, Fall 2008)

Attendees at the Best Practices for Crop Area Estimation Workshop, Ispra, Italy June 2008