Progress on GEOGLAM Implementation

First steps towards Implementation
2013-2014 Phase I and II

The Executive Committee is requested to:

- *Note GEOGLAM teams' compliance with the GEO Executive Committee 27th session guidance, outlining the first steps towards GEOGLAM implementation, with ongoing and planned activities, calendars and institutions in charge;*
- *Specifically take note of the "Logic model for GEOGLAM implementation and funding" section and provide guidance on the way forward;*
- *Support the implementation of the proposed governance model;*
- *Note this is a living document to be used as the basis for the development of a full GEOGLAM implementation document once the governance model is in place;*

Draft GEOGLAM Implementation Plan

TABLE OF CONTENTS FOR THE DRAFT GEOGLAM IMPLEMENTATION PLAN

1 FOREWORD

This document describes the first steps towards GEOGLAM implementation, outlining the highly complex operating environment in terms of the range of the institutions, programmes and projects currently involved, the R&D heritage from the GEO Agriculture Community of Practice, the most relevant achievements to date, the organization into three main components and three cross-cutting components, the phased approach for full implementation up to the operational level associated with a logic stepwise model, the governance model along with its draft terms of reference as well as specific activities for the near term (Phase I and II activities for the period 2012-2014) with a timeline for for guiding the implementation process, while allowing monitoring by its coordination group and relevant stakeholders.

This early Implementation Plan is a living document. It will serve as the basis for the full GEOGLAM Implementation Plan to be completed once GEOGLAM governance is in place, with a dedicated Program Coordination Office.

2 INTRODUCTION

GEOGLAM, the GEO Global Agricultural Monitoring initiative was initially launched by the Group of Twenty (G20) Agriculture Ministers in June 2011, in Paris. The initiative forms part of the G20 Action Plan on Food Price Volatility, which also includes the Agricultural Market Information System (AMIS, http://www.amis-outlook.org), another inter-institutional initiative hosted by the UN Food and Agriculture Organization (FAO). The G20 Ministerial Declaration states that GEOGLAM "will strengthen global agricultural monitoring by improving the use of remote sensing tools for crop production projections and weather forecasting". By providing coordinated Earth observations from satellites and integrating them with ground-based and other in-situ measurements, the initiative will contribute to generating reliable, accurate, timely and sustained crop monitoring information and yield forecasts.

The following paragraph is part of the G20 Head of States Declaration in Cannes, November, 2011.

> 44. We commit to improve market information and transparency in order to make international markets for agricultural commodities more effective. To that end, we launched:
>
> - The "Agricultural Market Information System" (AMIS) in Rome on September 15, 2011, to improve information on markets. It will enhance the quality, reliability, accuracy, timeliness and comparability of food market outlook information. As a first step, AMIS will focus its work on four major crops: wheat, maize, rice and soybeans. AMIS involves G20 countries and, at this stage, Egypt, Vietnam, Thailand, the Philippines, Nigeria, Ukraine and Kazakhstan. It will be managed by a secretariat located in FAO;
>
> - The "Global Agricultural Geo-monitoring Initiative" in Geneva on September 22-23, 2011. This initiative will coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data.

The Geo-Global Agricultural Monitoring Initiative (GEOGLAM), builds on GEO's Agricultural Community of Practice (AG COP) agenda and implementation actions in GEO's Agriculture's Societal Benefit Area. Established in 2007, this global network now has over 300 members, including such key organizations and programs as the FAO's Global Information and Early Warning System, the US Department of Agriculture's Foreign Agricultural Service, the USAID Famine Early Warning Systems Network, the Institute for Remote Sensing and Digital Earth of the China Academy of Sciences Crop Watch, the European Commission's JRC/MARS program, and Agri-Food Canada, to name just a few. The first coordinated effort of the AG CoP was JECAM, the Joint experiment of Crop Assessment and Monitoring (www.jecam.org). The overarching goal of JECAM is to reach a convergence of approaches, develop monitoring and reporting protocols and best practices for a variety of global agricultural systems. JECAM is enabling the global agricultural monitoring

community to compare results based on disparate sources of data, using various methods, over a variety of global cropping systems. The JECAM experiments will facilitate international standards for data products and reporting, eventually supporting the development of a global system of systems for agricultural crop assessment and monitoring. As such, JECAM is now fully integrated into GEOGLAM as its R&D component.

The main objective of GEOGLAM is to reinforce the international community's capacity to produce and disseminate relevant, timely and accurate forecasts of agricultural production at national, regional and global scales by using Earth Observation data. This will be achieved by:

- enhancing national agricultural reporting systems, including through a geo-spatial education curriculum to enable training of participants worldwide;
- establishing a sustained international network of agricultural monitoring and research organisations and practitioners; and
- harmonizing the operational global agricultural monitoring systems based on both satellite and in situ observations, including through improved coordination of satellite observations.

3 THE CASE FOR GEOGLAM: WHY SHOULD GEO MEMBERS ENDORSE AND SUPPORT THE GEOGLAM INITITATIVE

Because GEO must – GEO was created around thematic areas which match the Millennium Development Goals. Advanced agriculture information through the use of timely Earth Observation inputs, is a key GEO target and there is no defence for food shortages, famine and malnutrition to be newspaper headlines, when one knows months in advance what would happen;

Because GEO can – it is the vision of GEO to increase EO to inform decision making and with the use of remote sensing and crop models and it is now possible to use remote sensing parameters linked to plant phenology to monitor crop condition and ascertain crop production outcomes months ahead of harvest;

Because it makes sense – better knowledge will inform better action and will result in better outcomes;

Because the benefits are clear and the costs are minor – practical knowledge on how to better manage a global food system worth trillions of dollars that impacts billions of people will cost millions of dollars – the math is simple;

Because the cost of inaction is too high – political instability, conflict, depravation, malnutrition, lost productivity through the impacts of poor nutrition, the persistence of the poverty traps – the list is well known, but solutions are available.

4 GEOGLAM OPERATING ENVIRONMENT

GEOGLAM has a policy mandate coming from the G20 Action Plan to reduce Food Price Volatility launched in 2011. GEO, as an intergovernmental organizations created to enhance the use of earth Observations to inform decisions and policies, was given the task by the G20 governments. Despite the fact that G20 is concerned with the four main commodities, GEO has also the strategic mandate to enhance the capacities of countries that are food insecure to assess their crop conditions. In order to take the task on board, GEO based its capacity on the existing Agricultural Community of Practice which was established in 2007 as a result of two meetings hosted at FAO, which was in charge of developing the GEO Task in Agriculture, aimed at achieving the established strategic targets for Agriculture by 2015. GEOGLAM is where policy and science meet to enhance current operational systems for agricultural monitoring; one can also say that GEOGLAM is where top-down and bottom-up actions meet.

The GEO Community of Practice, the partners in GEOGLAM, has now more than 300 members and keeps growing. Among its members are UN agencies, recognized programmes (international, national or regional), academic departments, research centres, institutions that have R&D and operational mandates in agriculture, space agencies, regional organizations and the members of the private sector. The list include, to name a few: USDA (FAS GLAM), FAO (GIEWS, Global Strategy, FIVIMS), WMO (Agricultural Meteorological Program and WAMIS), WFP, EC/JRC (MARS unit), USAID (FEWSNET),GMFCS(now Copernicus), CSIRO and ABARES (Australia), VITO (Belgium), IIASA, ISRO, NASA, ESA, INPE, JAXA, SANSA, CONAB (Brazil), CGIAR, INTA (Argentina), IRSTEA and CIRAD (France), Agri-food (CANADA), University of Maryland (USA), Université catholique de Louvain (Belgium), SADC, RADI (China CropWatch), CILSS, AMESD and Asia Rice.

Given its stakeholder interests, mandates and capacities, GEOGLAM was designed around three main pillars and three cross-cutting elements, making up to six components or building blocks. The components are the basis for identification of deliverables and activities, implementation plan and management through their teams and leads; they are described in the next section. The three pillars are: 1) Enhancement of Global and Regional systems; 2) National capacity development and 3) Countries-at-Risk. Cross-cutting components are: 4) EO data coordination; 5) R&D coordination and, 6) Information systems (for disseminating data, products and information).

Component 1 builds on:

a) The USDA's Foreign Agriculture Service Global Agricultural Monitoring in partnership with Department of Geography University of Maryland and NASA (http://www.pecad.fas.usda.gov/glam.htm);

b) The Institute of Remote Sensing and Digital Earth (RADI), China CropWatch System (CCWS) developed by the former Institute of Remote Sensing Application (IRSA), now merged into the Institute of Remote Sensing and Digital Earth (RADI) of the Chinese Academy of Sciences (CAS) in 1998, covering China and 46 major grain-growing countries of the world (http://www.cropwatch.com.cn/en/);

c) The Asia Rice Crop Estimation and Monitoring (http://asia-rice.org/), a new Asian partnership for GEOGLAM that includes a broad range of stakeholders such as national governments and their agencies responsible for their various rice crop monitoring and food security systems and capabilities; Regional intergovernmental coordination bodies with ambitions in this domain, including ASEAN and APEC; Remote sensing organizations and their coordination groups that can support supply of the necessary space data – these including the space agencies of Japan, China, India, Indonesia, Korea, Thailand, Vietnam and others; as well as the regional space agency forum APRSAF and the international Committee on Earth Observation Satellites (CEOS) and its Space Data Coordination Group (SDCG); FAO and their regional activity groups; and key donor organizations, global (World Bank), regional (ADB), and national (e.g. JICA and AusAid);

d) The European Union Joint Research Centre Monitoring Agriculture Resources (MARS unit), that releases timely crop Monitoring Information for Europe, including forecasts, early assessments and the scientific underpinning for efficient monitoring and control systems. MARS serves the Agriculture and Food policies of the European Union, their impact on rural economies and on the environment, encompassing the global issues of food security and climate change.

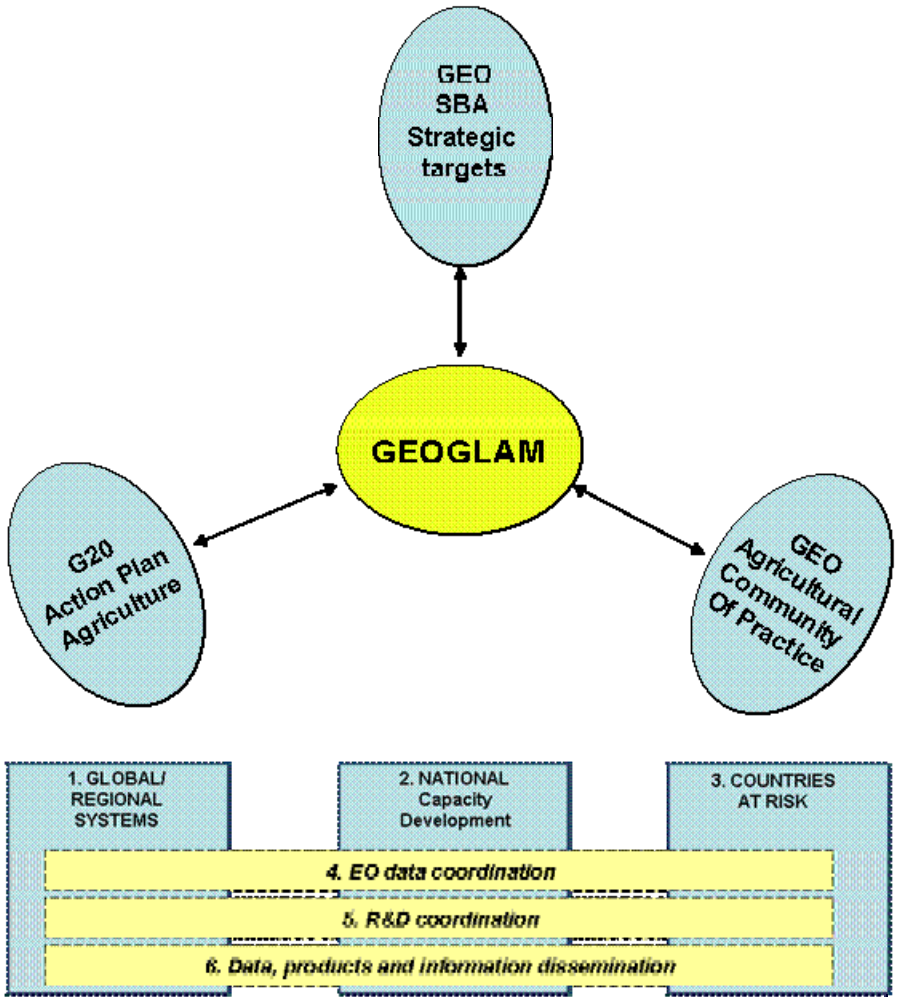

Figure 1 - The operating environment and components of GEOGLAM

Component 2 builds on:

a) The Food and Agriculture Organization of the United Nations (FAO) on-going efforts in supporting capacity development among the concerned agencies of member countries, with emphasis on the use of Earth Observation to increase accuracy and reduce costs for their crop statistics system, through, for example through the Global Strategy program (http://www.fao.org/economic/globalstrategy/en/). The Natural Resources Division leads the effort inside the agency with a large network of partners engaged in those efforts. Both food insecure and producers/exporters are targets for FAO capacity development.

b) National on-going efforts by many nations to leverage on the increasing offer of 'public good' space-based Remote Sensing data to add timeliness and transparency to their systems and reducing costs from traditional systems. Argentina, Australia, Brazil, Mexico, South Africa, Ukraine, Russia, Kazakhstan, India are examples of countries where capacity can be further enhanced for operational uptake of EO to support their own strategies and contribute to the G20 goals of bringing stability in global food prices.

c) On-going and developing bilateral cooperation between GEOGLAM members, Agriculture and Development Agencies to enhance agricultural monitoring capabilities through the enhanced use of EO. For example, the cooperation between CropWatch, RADI/China with many organizations in Thailand for enhancing capacity on rice monitoring and yield forecasting and cooperation between USDA and Pakistan to build capacity at Crop Reporting Services in Pakistan.

Component 3 builds on:

a) The EU JRC MARS unit with its long tradition of investing (and supporting the development of) in crop monitoring in many African countries, as well in the Black Sea Region;

b) The Food and Agriculture Organization Global Information and Early Warning Systems (GIEWS) http://www.fao.org/giews/english/index.htm. The GIEWS has developed tools for visualizing remote sensing imagery and methods for crop and food security missions, emphasizing early warning in African countries, as well as Latin America and South east Asia;

c) The Famine Early Warning Systems Network (FEWS NET), which is a USAID-funded activity that collaborates with international, regional and national partners to provide timely and rigorous early warning and vulnerability information on emerging and evolving food security issues. NASA, NOAA, USGS, WMO WIGOS and USDA/FAS are members of the FEWS NET network of partners.

This component requires a specific strategy that differs from the G20 and Global Systems that are focused on look into four main commodities, as it addresses different crops and agricultural systems found throughout Africa, Caribbean area, Central and South East Asia.

Component 4 is the coordination effort to increase the use of Earth observations to improve operational agricultural monitoring. For this GEO relies on its space-based arm which is the Committee on Earth Observation Satellites (CEOS), a group of the world's civil remote-sensing space agencies. A joint co-community effort is in place to develop requirements, the data and implementation plan for coordinated, sustained satellite acquisition and processing for agricultural regions of the World. Partnering with the WMO Agricultural Meteorology Program, GEOGLAM will also produce meteorological syntheses based on in-situ and short-term and mid-term forecasts and increase the availability of gridded datasets into the WMO Information System (discoverable in GEO CGI), which is key for the initiative as whole, and specially for the At Risk Countries early warning information chain.

Component 5 is concerned with the implementation of the Joint Experiments (JECAM) (see http://www.jecam.org/) as the primary R&D component of GEOGLAM where data and methods are shared and compared and best practices are developed. As such JECAM has provided the test bed for the CEOS data acquisition effort in supporting crop monitoring from satellites.

Component 6 accounts for the information system where datasets can be discovered and the GEOGLAM information to its stakeholders will be available. The system will be designed during Phase 1/2. GEOGLAM will utilize the GEO Infrastructure Tasks and teams for developing and enhancing its information systems. As a first step a GEOGLAM website is under development and will be online by December 2013.

GEOGLAM is a very complex initiative, with institutions involved all over the World dealing with widely different agriculture structures from producers/exporters to food insecure countries and activities. The component's structure is designed to facilitate implementation, management and coordination. But one must keep in mind that GEOGLAM is not made up of pieces that are disconnected. The cross-cutting components really encompass the main pillars of GEOGLAM and the enhancement of national capacity takes into consideration the multiple needs of different stakeholders, countries and regions. This very complex nature is reflected in the work plan of GEOGLAM and will impact its implementation.

5 GEOGLAM GOVERNANCE

GEOGLAM comes from the strong network of institutions gathered in the GEO Agricultural of Practice, setup in 2007 to advance the GEO Agriculture strategic target by implementing a specific task as part of the GEO work plan. As such there is a significant range of both institutional culture and capacity level. To be able to implement its goals GEOGLAM requires a governance arrangement that is simple enough but goes beyond the overall GEO approach to manage its Work Plan and target progress assessment.

The structure for the governance model is shown below in Figure 2.

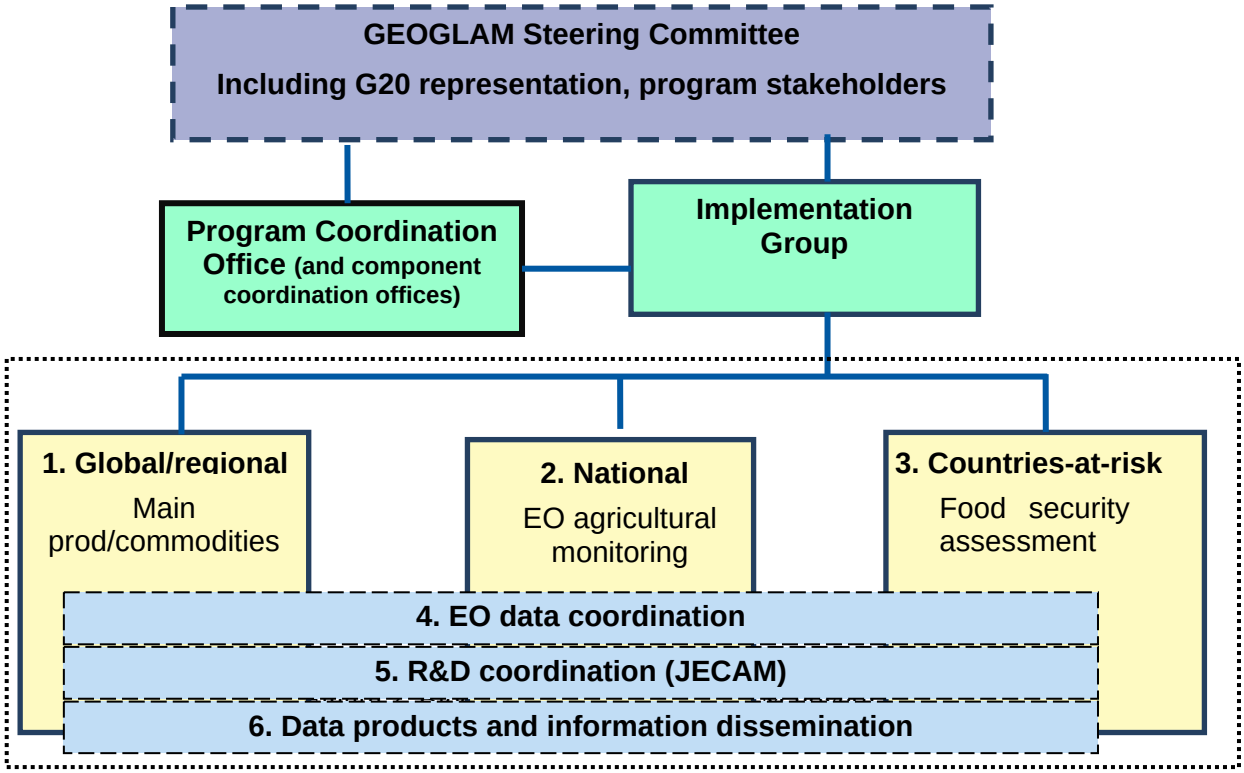

Figure 2 - The GEOGLAM governance model

The governance of GEOGLAM takes into consideration the voluntary nature of GEO, with a dedicated Program Coordination Office initially hosted by the GEO Secretariat, consisting of a Program Coordinator (m-level P5 equivalent), a junior expert (mid-level P3 or P4 equivalent) and a secretary staff. Each GEOGLAM component has an implementation team formed by leads from the projects contributing to its deliverables. Components are encouraged to establish their own coordination offices to help manage the component implementation, working closely with the Program Coordination Office. The structure requires an Implementation Group with membership from its 6 components. The initiative also requires a Steering Committee with membership including G20 representation and other stakeholders (such as AMIS and representatives of donor organizations). The general organization and roles of the governance entities are as follows:

- Steering Committee:
  - Stakeholder Program Steering and Donor Coordination..
- Program Coordination office:
  - Program coordination;

  - fund raising and management;
  - program reporting and outreach;
  - Ex Officio member of the Steering Committee.

- Component Coordination Offices:
  - Coordination of Component Implementation Teams;
  - Component reporting and outreach;
  - Liaison with the Program Coordination Office.
- Implementation Group:
  - Coordination across Implementation Teams;
  - Reporting to and discussion with the Steering Committee on progress and future developments;
  - Coordination with other partner programs;
- Implementation Teams (for each component):
  - Representation from the individual project/activities.
- Projects (with Project Leads):
  - Projects/activities contributing to meeting the GEOGLAM goals.

The Implementation Group will either elect a chair for a two-year term from the team or appoint the Program coordinator to the position.

5.1 Terms of Reference for the Program Coordinator

The (draft) Terms of Reference for the Program Coordinator are to respond to duties in two categories: 1) External Relations with donor, intergovernmental and potential host organizations and, 2) Coordinate GEOGLAM programmatic implementation.

External relations duties are:

- Promote the GEOGLAM strategy and outputs on the international scene, and propose relevant adaptations to GEOGLAM Work Plan in response to the evolution in societal demand;
- Establish interfaces and cooperation with other international Agriculture-related initiatives, programs and institutions (e.g. FAO, AMIS, CGIAR, the World Bank, G20 agriculture and existing global and regional agriculture monitoring programmes);
- Negotiate with potential donor organizations to ensure sufficient funding for a sustainable implementation of GEOGLAM work program with an adequate balance between its components (e.g. projects for R&D, product development, capacity development, animation and coordination);
- Help interface with the Committee on Earth Observing Systems (CEOS) to assure ongoing data supply supporting the requirements of participating countries;
- Negotiate with potential donor organizations, image providers and CEOS to facilitate bulk purchases of (non-core mission) satellite data required to support the Work Plan;
- Support the definition of a long term implementation of GEOGLAM activities in terms of technical, legal and organizational aspects, and commence exploring institutional candidates and criteria for long term hosting of GEOGLAM;
- Coordinate voluntary national leads for the GEOGLAM components;
- Encourage national support for GEOGLAM;
- Liaise with G20 POCs for GEOGLAM and AMIS;

Programmatic implementation duties are:

- Coordinate the implementation of GEOGLAM Work Plan and activities in its 6 components and provide the necessary coordination with the GEO Agricultural Monitoring Task (Ag 01) and the associated Agricultural Monitoring Community of Practice, as well as other relevant tasks of GEO/GEOSS;
- Establish and manage the necessary reporting process for GEOGLAM;
- Ensure the information to partners and stakeholders on activities and progress which may impact their interest with the GEOGLAM implementation, including regular reporting to the GEOGLAM Coordination Committee, preparation of draft reports to the GEO Executive Committee and Plenary;
- Interface with the Agricultural Community of Practice and the science community to ensure that GEOGLAM Best Practices documents are developed, published and updated, incorporating results from coordinated R&D activities;
- Develop criteria and procedures for participation of countries in GEOGLAM, as contributors and/or as beneficiaries, and assure representation of participating countries in the GEOGLAM Implementation, with particular emphasis on developing/risk country participation;
- Help coordinate specific GEOGLAM capacity development activities with related international programmes;
- Manage GEOGLAM Office staff in accordance with WMO HR and participating organizations practices; develop the GEOGLAM Office's budget and human resources;
- Organize outreach, newsletter, workshops and accounting.

5.2 Terms of Reference for the Implementation Group

The (draft) Terms of Reference for the Implementation Group are:

- Coordinating activities across the Components
- Plan and timely review the activities carried out by the Components within GEOGLAM, according to its Work Plan;
- Keep stakeholders informed of progress and activities which may impact their interest with GEOGLAM implementation;
- Develop pathways for participation of countries in GEOGLAM, both producer/exporters and countries at risk;
- Interface with the Committee on Earth Observation Satellites (CEOS) for the ongoing data supply supporting the requirements of participating countries;
- Interfacing with the science community to ensure that coordinated R&D activities are conducted and relevant results incorporated into a GEOGLAM best practices documents, to be updated as necessary;
- Provide liaison to partner programs and develop specific GEOGLAM capacity-development activities while ensure coordination with related international capacity-building programmes.

5.3 TORs for the Steering Committee *(in progress)*

- To represent stakeholder interests;
- To review periodically the progress of the GEOGLAM Program;
- To provide guidance to the GEOGLAM Program to help ensure its success;

- To work with the Program Coordination Office to help identify new stakeholders that would; benefit from the program and funding sources to support the activities.

6 GEOGLAM CURRENT STATUS AND ACCOMPLISHMENTS

There is to-date many achievements to GEOGLAM's credit such as:

1) A substantial effort of coordination with CEOS agencies to develop the GEO agricultural monitoring requirements and the satellite data acquisition plans, through many meetings and teleconferences;
2) Prototype of Global Crop Outlooks for the main commodities of interest to the G20 Action Plan on Agriculture (to be soon communicated to AMIS on a monthly basis) with the establishment of the necessary networks for the global crops outlooks, combining satellite and in-situ inputs and expertise;
3) Clear convergence of evidence between sources emerged with many member countries and institutions involved;
4) Established a network of pilot sites across the globe for developing sharing best practices (www.jecam.org);
5) Development of a new regional system, the Asia Rice Asia-Rice Crop Estimation & Monitoring (Asia-RiCE, http://asia-rice.org);
6) A Community of Practice with more than 300 members engaged in achieving the GEO strategic targets for agriculture;
7) Developed and shared the best available cropland map based on satellite imagery;
8) Set up of the framework for new regional organizations and agencies interested in enhancing their agricultural monitoring services to join (example SADC);
9) Many funded projects in support of GEOGLAM and its components, such as a EC FP7 recent call (proposal selected and undergoing negotiations), NASA funded UMD participation to develop the Satellite Acquisition Strategy with CEOS and in kind contributions from the CoP e.g. the provision of the USDA/NASA's GLAM system to the CoP;
10) Attracted the attention of donors such as the World Bank and Gates Foundation as GEOGLAM goals help them meet their priorities;
11) National engagement in developing capacity for incorporating EO into their crop projections system (Argentina, Australia, Brazil, Ukraine, Mexico …);
12) Many activities for countries-at-risk and involving the GEO Agricultural CoP being better coordinated. France Ministry of Agriculture secondment of GEOGLAM program coordinator; Presentation of GEOGLAM at high level meetings such as at the G8 Open Data for Agriculture; Advanced discussions with US Government, including with USDA leadership on setting up a GEOGLAM Global Component Office by USDA.

7 THE PHASED APPROACH FOR GEOGLAM IMPLEMENTATION

7.1 The Phased approach of main pillar components

GEOGLAM aims at responding to the lack of reliable and up-to-date information on crop supply, in a transparent and timeliness way. The use of satellite based data will bring transparency and timely information for decision making on food security. The expected outcome of GEOGLAM will be an improved and more harmonized system (of systems) taking advantage of new satellite assets, in-situ data and information and methods and a higher level of international coordination.

The phased implementation across all components will have 3 phases through 2017 (see Figure 3).

Phase 1 (P1), spans over the 2012-2014 time frame, focuses on foundation activities, building on existing activities and pilot projects for a few countries, and scoping out the programme for the following phases;

Phase 2 (P2) will review and expand P1 activities with new starts and will be carried out during the 2014-2016 period;

Phase 3 (P3) will be the last building pre-operational one with the completion of P1/P2 projects and geographical expansion, going from 2015 to 2017 when the Operational Phase starts.

Phase 4 (P4), the operational phase, starts at the end of 2017

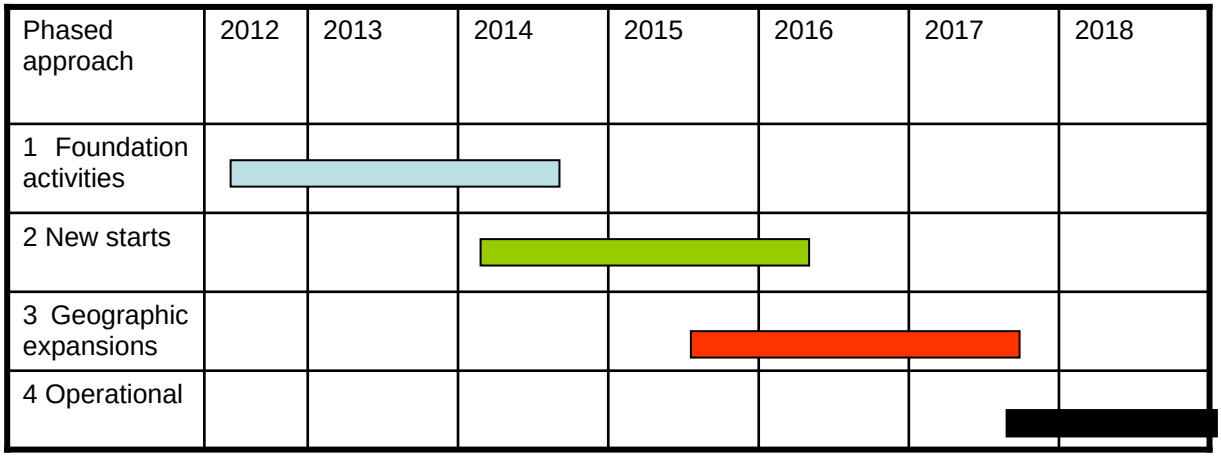

Figure 3. The GEOGLAM phased implementation calendar

7.1.1 Global/regional components phasing

For the Global/Regional systems (Component 1), P1/P2 activities include the Crop Condition Global Outlook for building international consensus and the development of new and improved global baseline data sets needed in support of the monitoring. P2 and P3 activities will include the harmonization within different systems for GEOGLAM ultimate goal to deliver timely information on crop production using repeatable scientific methods to augment current operational procedures.

7.1.2 National capacity development phasing

Concerning the national capacity development (Component 2), for both main commodities (wheat, maize, rice and soybeans) producer/exporter countries and Countries at Risk. Table 1 below shows the main activities spanning over P1 and P2. Four steps were identified as necessary to establish a road map for national capacity development building on linkages & feedback between global/regional monitoring systems and activities ; 1) Develop a series of regional workshops for status assessment, needs and priorities; 2) National engagement and commitments by interested parties; 3) National Implementation and 4) Regional training / information exchange and continued regional networking.

Table 1 - Phased approach for national capacity development

Argentina	
P1	Assessment of current status and priorities for enhancements – crop monitoring
P1	Crop condition monitoring/cropland mapping/ crop area prototype
P2	Prototype yield, evaluate crop area approach and expand
Mexico	
P1	Regional Needs Assessment Workshop
P1	Cropland mask and crop type mapping
Russia – Ukraine/Belarus/Kazakhstan	
P1	Regional Needs Assessment Workshop
P2	National Engagement
Australia	
P1	Assessment of current status and priorities for enhancements – crop monitoring
P1	JECAM/crop condition/cropland mapping/ crop area prototype
P2	Prototype yield, evaluate crop area approach and expand
Brazil	
P1	Scope out activities for in-country institutional arrangements for including/increasing use of EO in the crop statistics/monitoring system
P2	Prototype/pilot studies
Thailand – Laos/Philippines/Vietnam	
P1	Pilot activities for Agricultural and rural statistics
P2	Implementation and workshop / capacity building
P2	GEOGLAM augmentation needed in terms of data access – ALOS2/RISAT /Radarsat /Sentinel 1.
Pakistan	
P1	Capacity Building for Crop Reporting Services
P2	Capacity Building for Crop Reporting Services
Uganda	
P1	Pilot Early Warning and National Monitoring (NUDC/FEWSNET
P2	Pilot Early Warning and National Monitoring (NUDC/FEWSNET
Ethiopia	
P1	National Monitoring System (FAO and others
P2	National Monitoring System (FAO and others
Algeria	
P1	Crop outlook and yield forecast (EU/INRA Min Ag)
	Crop outlook and yield forecast (EU/INRA Min Ag)

North Africa (regional)	
P1	Regional Workshop on Status and Needs (EU/JRC
Southern Africa (regional SADC)	
P1	AMESD / MESA / GEOGLAM Workshop on National Monitoring (EU)
P2	Pilot activities (crop condition, area, yield)
P2/P3	Implementation of a regional/national operational system / Moderate Resolution Data Delivery

7.1.3 At-risk countries component phasing

Regarding at-risk countries (component 3) East Africa was selected as the initial target region, given that there have been identified potential partners and in-kind sources such as JRC, FAO GIEWS, FEWSNET CMRD, the SERVIR regional hub, ICPAC and the Gates Foundation. The component identified activities in Phases 1 and 2, build on existing systems and established collaborative networks (with potential for growth). The phased approach can be summarized in Table 2. The issues identified are of a capacity development nature in terms data sets, data gaps and training, for food "insecure" countries with specific cropping systems.

Table 2 - Countries-at-risk phased approach summary.

Data Sets	
P1	FEWS NET Global gridded rainfall FEWS NET MODIS ET FAO Agricultural Stress Index
P2	Work with WMO to strengthen national climate station and crop reporting networks
P2	Leverage advanced computing capabilities to apply high- to medium-resolution (5m -30 m) imagery to seasonal monitoring for early warning (Rapid Eye, Landsat, Sentinel 2, etc.)
Data gaps	
P1	FEWS NET/WMO/GEO Workshop with East Africa National Met Services
R&D	
P1	National and sub-national crop production shortfall risk profiling – loss exceedence probability functions
P1	Long time-series agricultural drought indicator
Training	
P1	Exploration and application of FEWS NET gridded rainfall and MODIS ETa data sets
P1	Exploration and application of FAO agricultural stress index data set

With regard to rice monitoring, there are countries in Asia subject to food security issues associated with weather associated disasters such as floods. For management simplicity, this particular area will be dealt with by the GEOGLAM Asia Rice team.

7.2 Cross Cutting Components

Component 4 (Satellite and in situ data coordination) is key to the success of GEOGLAM and is integral to fulfilling the vision for GEO in Agriculture. This component is being developed with the support of CEOS for satellite data and WMO for the weather data. A CEOS Ad-hoc Advisory Team was created to take responsibility for working with GEOGLAM to further develop the space-based observations component suggested by the draft Work Plan. The Ad-hoc Advisory Team is composed of representatives from the following agencies: CONAE, CSA, ESA, INPE, ISRO, JAXA, NASA, and USGS. It includes participation from CEOS Agency staff with expertise in satellite mission planning, coordination, and management, and the use of space-based EO data to generate actionable information for agricultural decision-makers. The composition, skill set and expertise of the CEOS Ad hoc Advisory Team on GEOGLAM allowed the group to develop a coordination framework to address the CEOS SIT actions and initial needs of GEOGLAM.

7.2.1 Earth Observation coordination phasing

The proposed approach suggests an implementation strategy in three phases over five years preceded by an 18 month phase 0 (completed). The phasing is dictated in part by the planned availability of new space-borme assets needed by GOEGLAM. The proposed phasing would permit an evolution of growing capacity in several parameters: a) Increased number of countries; b) Integration of additional sensors as agencies and new sensors come on board, and datasets are made available; c) Assimilation, processing, product creation, distribution and integration of information products into decision making processes, and, d) Capacity building, particularly in at-risk countries for ingestion and processing of EO data. The following phasing for this component is as:

Phase 1/2: Support for demonstration and feasibility (2013-2015). The work will test sample sites and information products, to validate their usefulness, robustness and affordability. The focus will be on major commodities (wheat, maize, rice and soybean). Some observations will be wall to wall, others will be sampled. The Rice Monitoring pilot study plan will be expanded with available SAR data in Asia and other region.

Phase 2/3: Assessment and expansion phase (2014-2016). This phase will pilot a global sampling strategy for the main producers. There will be new regions for wall-to-wall coverage (about 5.) .
New missions will be added (i.e. Sentinels & Brazil's Amazonia). SAR missions will be also added. The Rice Monitoring pilot study plan will be expanded with available SAR data in Asia and other regions. New information products will be added. A sampling strategy will be started for at-risk countries.

Phase3: Pre-operational details (2016 – 2017). This phase will solidify the sampling strategy for at-risk countries. Global information will be produced. At the end of Phase 3, all large producer countries will be covered (global producer sampling), 3-5 at risk countries will be covered, and new missions will be integrated.

7.2.2 R&D phasing

The R&D Component (5) builds on the Joint experiment for Crop Assessment and Monitoring (JECAM) for enhancing international collaboration around agricultural monitoring towards the development of a "systems of systems" and on many other international and national efforts, in particular the EC FP7 call supporting GEOGLAM in its interface with environmental issues.

The phased approach for JECAM in promoting R& towards monitoring enhancements include in Phase 1: a) Annual JECAM Meetings; b) Directed Workshops to address GEOGLAM research needs, including National Capacity building; c) SAR for Soil moisture Monitoring, SAR for monitoring crops in tropical-subtropical regions, d) Sampling Frameworks for agric monitoring, and, e) Best practices for crop monitoring. Phases 2 and 3 will focus on directed research funding for collaborative research in support of GEOGLAM priorities.

7.2.3 Information system development phasing

Component 6 phasing will focus in Phase 1 on organizing the GEOGLAM website and the interface for the Global Crop Outlooks. In 2014, working with the GEOSS Common Infrastructure (GCI) team, a dedicated GEOGLAM team will develop the requirements and road map for the GEOGLAM information system. Help will be also sought from other relevant GEO IT Activities and partnership will be explored with other programs focussed on collection and dissemination of agricultural information e.g. GEOSHARE.

8 FIRST STEPS TOWARDS IMPLEMENTATION – 2013-2014 PHASE 1/2 TIMEFRAME

8.1 Global/regional Agricultural Monitoring Systems (main producer countries)

8.1.1 Background

In recent years, there has been increasing demand for more accurate and timely forecasts of global agricultural production. The Global Monitoring component of GEOGLAM is focused on enhanced provision of timely, accurate, objective, actionable information on crop condition, and crop production forecasts of the major producer and export countries (the G-20 + 7 countries covered by AMIS) which produce over 80 of global crop production and strongly influence international commodity markets. This component is primarily focused on four major crops: corn, wheat, rice and soy, with the eventual extension to other main commodities (such as sorghum and sugar crops). The activities within this task build on the existing key monitoring systems at global and regional scales that are focused on the main production countries. These systems include the USDA Foreign Agricultural Service CropExplorer, EC JRC MARS unit, China RADI/CAS CropWatch, and UN FAO GIEWS. This component is designed to augment the current operational monitoring capabilities within these systems, develop harmonized consensus crop assessments as inputs to the G-20 Agricultural Market Information System, develop enhanced baseline global datasets critical for agricultural monitoring, foster relationships and exchange of methods, data, and tools between the global/regional monitoring systems and national systems, and strengthen linkages with the policy and decision makers that are primary users of within season information on crop condition and prospects. There is an emphasis on 'consensus of evidence approaches' integrating data from multiple sources including earth observations, crop models, weather, surveys, and ground observations to reach, evidence based assessments using repeatable scientifically sound methods.

8.1.2 Current Status

To date, the GEOGLAM Community of Practice has made significant progress within this global component in terms of agency and partner commitments, funds, community building, working relationship with AMIS, generation of new products, visibility and high level support. Specifically these accomplishments include:

- Initial prototype of crop outlooks for AMIS including contributions from over 15 national and international partners;
- Establishment of a working relationship with AMIS including presentation and panel session at the April 2013 meeting;
- High level discussions with USDA leadership, OSTP, and NASA in order to initiate a program office at USDA;
- Release of a beta best available Global Croplands map produced by IIASA;
- Release of beta Growing Season Calendars;
- Prototyping of transition of capabilities from global systems to national/global systems including JRC tools and data availability within FAO, USDA/NASA/UMD GLAM prototype system within Argentina, Australia and Mexico;
- Development of the ASIA Rice program supported by the Asian Development Bank and led by JAXA;
- NRT data processing and dissemination of MODIS data for agriculture by the NASA LANCE system;
- Significant funding commitments :
    - FP7 Sigma Project (with many key contributions to the global GEOGLAM component) 9 million Euros;
    - NASA indicated support for GEOGLAM outlooks development ~ 800K;

- China State Grain Administration supports for enhancing CropWacth (1,3 Million USD), and China GEO indicates support for Coordination and Dissemination;
- Proposed USDA support for GEOGLAM Global Component Coordination Office;
- Asia Development Bank - GEOGLAM Asia-Rice;
- CSIRO- rangelands planning workshop;
- JRC (in-kind and projects);
- FAO (in-kind and projects).

8.1.3 Objectives, activities and expected outcomes

The global component of GEOGLAM aims to strengthen capacity for timely agricultural monitoring of the main producer countries. This will be accomplished through five primary activities:

8.1.3.1 Development of harmonized global crop outlooks

The goal of this activity is to provide timely and transparent information based on EO, agro-met models, and expert knowledge through developing a transparent, timely, qualitative crop condition assessment in primary agricultural production areas highlighting potential hotspots of stress/bumper crops. It will provide elaborated global information to the AMIS Market Monitor with a common global qualitative outlook (overall growing status, areas under specific agro-climatic conditions likely to impact global production and impact factors, at the required frequency (for instance monthly);

8.1.3.2 Coordination and enhancement of global baseline datasets

This activity is focused on compiling and enhancing baseline geo-spatial datasets that are fundamental for improving our capability to effectively monitor global agriculture such as cropland distribution and crop calendars. There is a lack of harmonized, up-to-date, accurate global information at the needed spatial resolution and as such there are several on-going and planned efforts for enhancing these dataset. This component builds on existing initiatives as well as new GEOGLAM projects focused on deriving enhanced products, as well as improved global geo-datasets for required for operational agricultural monitoring. This includes:

- Arable land, crop maps;
- Crop type distribution;
- Growing season calendars;
- Crop specific calendars;
- Cropping systems and crop management;
- Soil moisture;
- Historical statistics a(> 15 years) on area and yield, breakdown at an appropriate sub-national level;
- Field size distribution;
- Rangelands extent/distribution;
- Livestock numbers and distribution;
- Crop variables.

8.1.3.3 Strengthening monitoring systems

- Near real time (NRT) data processing and dissemination of RS data for crop condition monitoring;
- R&D and evaluation of new Earth observation-based indicators of crop conditions, and hotspots including the FAO ASIS indicator;
- Transition of crop condition monitoring systems;
- Initiating a global NRT reporting system on crop condition, pests and diseases;
- Prototyping and developing interoperable EO data sets from similar sensors, ensuring continuity of critical data streams including NASA MODIS-VIIRS;
- inter-comparison and harmonization of existing global monitoring systems concerning their results and methods for understanding discrepancies, system feedback and improvement;

- Development of benchmarking datasets for models/methods and validation through the GEO AG task Joint Experiment for Crop Assessment and Monitoring (JECAM);
- R&D on crop area and yield indicators of main crops within the main producer and export countries including using multi-resolution and multi-sensors Earth observation data to obtain an area-change indicator (early area estimate predictor); soil moisture for water stress; and cropping pattern , crop biomass and harvest index. This would R&D on both process and empirical EO based yield models.

8.1.3.4 Global Rangelands Monitoring

- Adding monitoring of livestock production and productivity from global rangelands and pasture lands; and
- Develop improved methods to model herd dynamics in rangelands and pasture lands.

8.1.3.5 Agricultural Land Use Change and Climate Change (Phase 2/3)

- The mapping and regular monitoring of significant agricultural land use and cropping system changes at global to regional scales;
- Developing the satellite component of spatially explicit projections of the global effect and impacts of extreme weather and climate change on agricultural production (with partner programs and groups e.g. AGMIP, IASSA, JGCRI).

8.1.4 Phased approach

The global component will focus on activities 1 and 2 within P1/P2 of GEOGLAM.

This includes developing the Crop Condition Global Outlooks, assembly of best available datasets, inter-operability of MODIS-VIIRS, development of a rangelands community of practice. These activities will continue into phase2/3 which will have an expanded focus on activities 3-5. This includes the harmonization of methods, datasets and tools across the different monitoring systems, R&D on crop area and yield forecasting, R&D on livestock dynamics and rangeland productivity forecasting, agricultural land use change and vulnerability/adaptation in the context of climate change.

Phase 1 Tasks and Activities

Table 3 -Global/regional systems Phase 1/2 Activities and Schedule (2012-2014)

Activity and Short Description	Calendar	Status	Institutions/ coordinating teams	Budget category
1. Crop Outlooks for AMIS				
1.1 Prototype crop condition outlooks for corn wheat soy	7/12-8/13	Ongoing	UMD, JRC, FAO, USDA, RADI	Prototype outlooks
1.2 Operational prototype of monthly harmonized outlooks (corn, wheat, soy) and delivery	9/13-12/14	Planned	UMD/JRC/FAO/ RADI	Routine outlooks (main commodities)
1.3 Prototype development of rice outlooks	6/13-12/14	Planned	Asia-RICE	Prototype outlooks

1.4 Development of outlook information system	6/13-10/14	Ongoing	UMD	Information system
1.5 R&D on crop indices, metrics	7/13-12/14	Ongoing	FAO/UMD/JRC/RADI	R&D forecast
1.6 Development of areas of concern and harmonization	6/13-12/13	Ongoing	JRC	Routine outlooks
1.7 Workshops and AMIS meetings 2 workshops and 2 AMIS meetings/ year	routine	Planned	IKI, JRC, UMD, FAO	Workshops
2. Global Baseline Datasets and Coordination			UCL/ UMD/ FAO/ IIASA/ EC FP7 SIGMA	
2.1 Crop calendars a. Compilation of best available gridded crop calendars b. development of a new enhanced spatially detailed crop type calendar product	2012 - 2014	ongoing	FAO/UMD	Information system
2.2 Cropland distribution a. Compilation of best available products b. New initiatives for enhanced products	2012-2014	ongoing	UCL/ IIASA/ FAO/ NASA	Information system
2.3 Crop type distribution a. Compilation of best available b. new enhanced products	2013-2014	ongoing	UCL/ IIASA/ IFPRI/ NASA	Information system
2. 4 Cropping systems	2013-	planned	EC FP7 Sigma, RADI	Information system
2.5 Crop Variables	2013-	planned	EC/FP7 Sigma	Information system
2.6 Rangelands typology and distribution	2013-	planned	CSIRO	Information system
2.7 Livestock numbers and distribution	2013-	planned	CSIRO	Information system
2.8 Rangelands distribution		planned	CSIRO	Information system

2.9 National sub-national stats on production, area and yield	2012-	ongoing	UMD/ FAO/ RADI/ JRC/ USDA	R&D Forecast
2.10 Evaluation & Validation		planned	EC FP7 Sigma	R&D Forecast
3. Enhancing Existing Monitoring systems			JRC/ FAO/ UMD/ USDA	
Transition capabilities, methods and tools from global systems to regional systems Strengthen collaborations with regional systems		ongoing	JRC/ RADI/ UMD/ USDA/ NASA/ FAO	R&D Forecast
Data integration across platforms This includes interoperability of data across missions (ie. NASA VIIRS/MODIS)	2012-2014	ongoing	NASA/ CNES/ USDA/ USGS	Routine outlooks
Harmonization between global/regional systems	2014	Planned	USDA/RADI/JRC	Routine outlooks
Crop models exchange	2014	Planned	JRC/ FAO/ RADI UMD	Routine outlooks
4. Global Rangelands Monitoring				
Develop community of practice Workshop planned	7/2013	Planned	CSIRO	Workshops
Current status assessment, development of implementation activities and pilot studies	9/2013-	Planned	CSIRO	Workshops

Table 4 – Indicative Cost for Global/regional systems for phases 1/2

		Phase 1 2012	**Phase 1 2013**	***Phases 1/2 2014***
Global/regional systems (main producers & commodities	Prototype outlooks	0.5	0.5	*0.5*
	Routine crop outlooks		0.5	*1.0*
	Asia-Rice Pilot studies	0.4	1.0	*1.0*
	Asia-Rice Forecasts/production	0.2	0.3	*0.3*
	Information system	0.1	0.1	*0.1*
	R&D Forecast	0.1	0.1	*0.2*
	Workshops		0.2	*0.2*
Sub tot Mio US $		***0.3***	***2.7***	***3.3***

8.2 National Capacity Development for Agricultural Monitoring

This component focuses on supporting national and regional institutions willing to develop agricultural monitoring capacities through the use of Earth observation and modelling. Most countries have some form of agricultural monitoring system, but the level of uptake and use of Earth observations is extremely variable. In a number of cases traditional statistical field-based methods are used and do not benefit from the synoptic information that is afforded by current Earth observation data. In many instances, there is a lack of coordination between institutions that develop and utilize remote sensing for agricultural monitoring and the agricultural ministries or statistical services responsible for operational agricultural production monitoring. There is also much to be gained by sharing experiences and approaches for the use of remote sensing between countries with similar crops (and cropping systems) and between countries with significant livestock numbers on pasture or rangelands. This component will provide technical and institutional training, training of trainers, methodological guidelines and tools, facilitated access to Earth observation including meteorological data (component 4), and expert advice and support. GEOGLAM will stimulate networking and the sharing of technical experience between all G20 and other countries focusing on the main producers/exporters identified in relationship with AMIS and FAO, as well as countries identified as at-risk (Food insecure) where Earth observation and crop models could improve present information

8.2.1 Background

GEOGLAM aims at improving operational global and national crop area and production estimates and weather forecasting using EO and their timely dissemination. It will respond to the lack of reliable and up-to-date information on crop supply, bringing transparency and timeliness for decision making on food security. GEOGLAM will enforce countries' capacity to conduct agricultural monitoring by supplying reliable observations, helping to build capacity, developing methods and guidance and encouraging coordinated research and development. Key to success lies in the availability of coordinated satellite and in situ observations, and in providing guidance to help ensure that these data are handled appropriately. Networking and sharing of technical experience between all G20 and other countries focusing on the main producers/exporters and countries identified as at-risk (food insecure) will also be an important outcome of the programme. The National Capacity Development component focuses on supporting national and regional institutions that are willing to develop agricultural monitoring capacities, in the integration of in-situ and earth observation data and methods.

8.2.2 Current Status

Most countries have some form of agricultural monitoring system, but the level of uptake and use of Earth observations is extremely variable. In a number of cases traditional statistical field-based methods are used and do not benefit from the synoptic information that is afforded by current Earth observation data. In many instances, there is a lack of coordination between institutions that develop and utilize remote sensing for agricultural monitoring and the agricultural ministries or statistical services responsible for operational agricultural production monitoring. There is also much to be gained by sharing experiences and approaches for the use of remote sensing between countries with similar crops and cropping systems and between countries with significant livestock numbers on pasture or rangelands.

8.2.3 Objectives and expected outcomes

The GEOGLAM National Capacity Development component aims to develop/strengthen capacity of national agencies concerned with the collection, consolidation, and use of geospatial data to provide timely and precise agricultural statistics based on the integration of improved estimates. The methodology employed will be to increase the knowledge, skills, and competencies of their staff. Emphasis will also be placed on strengthening and sustaining the capacity of regional and national training centres to develop and deliver good-quality training in agricultural statistics and statistics-related subjects, with a focus on the efficient use of EO data.

The National Capacity Development component will provide technical and institutional training, training of trainers, methodological guidelines and tools, facilitated access to Earth observation including meteorological data and expert advice and support.

Building on linkages & feedback with global/regional monitoring systems and activities, several steps were identified as necessary to establish a road map for national capacity development:

1. Define pilot countries/regions according to food surplus/exporter/importer. PI focus on 5 countries (3+2) and 1 Region (Asia);
2. Conduct a series of regional workshops for status assessment, needs and priorities through regional incubator / institutions;
3. National engagement and commitments by interested parties;
4. Assess national capacity in agriculture monitoring and EO data use, and enhancement needs;
5. Define data coverage requirements based on national needs assessment;
6. Define processes and activities that can assist national implementation;
7. Regional training / information exchange and continued regional networking.

Expected outcomes are:

1. Improved crop area estimates and yield forecasts;
2. Strengthened capacity to include EO in national agricultural monitoring;
3. Facilitated access to EO data;
4. Shared information, experiences and data among countries with similar cropping systems;
5. Compiled inventory of active agricultural monitoring organizations and techniques they use.
6. Increased transparency of national monitoring systems and estimates

8.2.4 Phased Approaches

The phased implementation across all components will have 3 phases through 2017:

- Phase 1 (P1, 2012-2014) focuses on foundation activities, building on existing activities and on pilot projects for a few countries, and scoping out the programme for the following phases;
- Phase 2 (P2, 2014-2015) will review and expand phase 1 activities with new starts;

- Phase 3 (P3, 2016-2017) will be the last building pre-operational one with the completion of P1/P2 projects and geographical expansion up to when the Operational Phase starts. Operational Phase (2018 forward).

The Phase 1 (demonstration & early feasibility phase), focuses on 5 countries and 1 Region (4 large producer according to AMIS, and 2 'at risk') for the main commodities of concern to the G20 (wheat, maize, rice and soybeans)

8.2.5 Phases 1/2 Activities, Schedule and Budget

8.2.5.1 Phase 1: Tasks and activities

The Phase 1 (P1) spans between 2012 and 2014 focusing on foundation activities, mainly existing initiatives for few countries, and scoping out the programme for the following phases.

This demonstration & early feasibility phase regards 5 countries and 1 Region (4 large producers according to AMIS and 2 'at risk' and focuses on the main commodities of concern to the G20: wheat, maize, rice and soybeans. Six main tasks have been identified to implement the national capacity development component of GEOGLAM:

- Set-up / preparatory phase;
- National needs assessment;
- National baseline datasets;
- Research & Development; best practices;
- Data, Products and Information Dissemination;
- Technical assistance and capacity building;

Following is a general description of each task..

8.2.5.1.1 Set-up / preparatory phase

Objective of this task is establishing the basis for GEOGLAM national implementation and phased approach by gathering information about the current status of agricultural monitoring and the use of remote sensing techniques. The activities for this task are:

- *Selection of countries / region:*

Determination/grouping of countries/regions among food surplus/exporter/importer (AMIS) and "at risk" (FEWSNET). Three countries and one region as large producer (Australia, Argentina, Ukraine and Asia), two countries at risk (Uganda, Ethiopia) were selected.

- *Identification of point of contacts, regional incubators, national institutions:*

With this activity the program aims to produce and inventory of active regional and national agricultural monitoring organizations (trainer/trainee communities) in order to identify regional centres of excellence that can provide remote sensing capabilities, develop statistical methods, and guide the implementation of information technologies in providing support to national institutions, and country based institutions which are responsible/mandated in the country for agriculture statistics creation and its supply. The establishment of regional centres could be a focal point for support from donors and international organizations. MOU's will be developed as needed.

- *Regional assessment/networking workshop:*

These workshops, which should be conducted in selected institutions/ incubators (statistics commissions, ECA, Regional entities, RCMRD, Agromet, IGADD, CILS, ECOWAS, SDACC, AU, CGIAR Centres), aim to perform regional assessment, national engagement (country willingness, acceptability & uptake), demonstration of capabilities, confidence building in RS results, enhancement of current systems, and regional and international coordination of agricultural, agro-meteorological and meteorological data. Agricultural services, national meteorological services, FAO, WMO, JRC, GEO and FEWSNET will discuss integration of in situ national data with regional/global weather products to improve outputs.

8.2.5.1.2 National needs assessment

Objective of this task is the assessment of national capacities for agricultural monitoring (technical skills, institutional framework...), for the use of Earth Observation for agricultural monitoring, for requirements in terms of capacity development and design of an empowerment strategy to improve agricultural monitoring.

- *Develop country needs assessment methodology and questionnaire:*

This activity regards the development and implementation of a methodology to assess current national agricultural monitoring capacity, analyze gaps and requirements and design roadmaps for capacity development for the use of remote sensing to support agricultural monitoring. A questionnaire will be prepared learning from similar initiatives currently on going in countries such as Argentina. Particular attention will be given in building questions related to the agricultural monitoring system and statistical field-based methods and contribution of EO data. The questionnaire must also be able to assess training needs in order to design a country based training programme, and identify hardware, software and human resources needs for carrying out national monitoring programme.

- *Assess national needs, gaps and priorities:*

The implementation of the national capacity development component builds on a detailed country assessment that defines specific actions at country, regional, and international levels to identify priority areas, resources required, and timeframes. An in depth assessment will be conducted through the compilation of a standard questionnaire and report during country visits (3 weeks per country) and national workshops. The assessment will collect information on:

  - data, models, training and infrastructure gaps, needs and priorities.
  - EO and agrometeorological data requirements (for CEOS and WMO)
  - utilization of weather data by national meteorological services for national crop production estimates;
  - current sampling frame approaches and capacities to implement new approaches based on EO data;
  - The following activity describes a specific country based analysis regarding the current status of agricultural monitoring and the use of remote sensing techniques.

- *Status of EO based national agricultural monitoring:*

Based on existing international and national initiatives, this activity aims to analyze and report on current national agricultural monitoring systems and the level of inclusion of EO. Examples of national programmes that currently utilize EO are: GeoSafras Project of Brazil, Crop Condition Assessment Programme of Statistics Canada, China Agriculture Remote Sensing Monitoring System, FASAL programme of India, Cropland Data Layer (CDL) of the USDA NASS etc..

The proposed analysis will provide the basis for defining EO data requirements and related attributes (type of data, frequency and timing of acquisitions, geographical areas, etc.) and ensure un-interrupted supply of EO data through CEOS.

8.2.5.1.3 National baseline datasets

Objective of this task is to compile a common set of core data sets comparable across space and time, in part from national available archives, in part produced on an ad-hoc basis.

- *Available national core data sets, including EO and weather data:*

A variety of products is needed for effective agricultural monitoring. This task aims to collect:

  - crop area planted and harvested, yield, and production, field size, irrigated cropland and dynamics, cropping systems, crop type, date of planting, crop calendar;

- precipitation, temperature, evapo-transpiration, soil moisture, snow water content and vegetation condition (via. satellite-based vegetative indices) provided by in-situ and satellite observations;
- grass, forb and browse types, livestock type, numbers and dynamics and pasture condition and seasonality of production because rangelands and pasture lands are included.

- *Caorse resolution cropland map and crop (specific) mask (distribution):*

Coarse-resolution (>250m) satellite-based crop land maps and crop specific distribution

- *National/regional harmonized and standard based land cover:*

FAO is implementing and/or assisting with technical advices, methodologies and tools, several mapping activities for the production of standardized and harmonized general land cover baselines, including croplands. The updated database can be a valid support for many environmental applications, including national agricultural analysis, strengthening national capacity of handling and processing data and conduct agricultural monitoring, and strengthening monitoring countries and region risks. This activity regards the development of national land cover products based on LCCS/LCML – ISO 1914 standard.

8.2.5.1.4 Research & Development; best practices

Objective of this task is to stimulate and coordinate research, development and experimentation to improve methods for the use of Earth observation to support agriculture monitoring at the national level. Through collaborative studies, these activities will include developing methods for an extended variety of crops and rangelands, new satellite sensors and products, and various crop production systems. This task will be closely coordinated with and linked to Component 5.

- *Initiate national JECAM/other sites and associated research agenda:*

This activity regards the establishment of one or two sites at the national level for developing improved methods, testing and validation to include systematic collection of ground based observations; focus on new and experimental EO data acquisition. These sites with better geographic representation can be used to demonstrate new capabilities of EO, develop demonstration projects to show the utility of Numerical Weather Prediction (NWP) products for crop production monitoring and estimates.

Thematic workshops could be arranged bringing together the JECAM research community, and additional thematic expertise as required. Themes could be:

- in situ data collection and minimum datasets;
- optical EO data;
- SAR data;
- Standards.

Sites:

- Ukraine [SRI]: Annual crop types mapping using synergy of new optical and SAR data (SIGMA);
- Argentina [INTA];
- Australia [CSIRO].

- *R&D on crop (specific) area estimate (selected regions) methodologies:*

Remote sensing information has been widely applied in the field of crop area estimates. Objective is testing methods to produce crop area estimates based on frame and ground sampling techniques in combination with Remote Sensing. As part of this activity, the design, implementation and testing of the area frame methodology for crop area estimates could be conducted using high res LC data mapped according to the FAO approach.

- *R&D on crop (specific) yield forecasting:*

Activity regarding test and implementation of Earth Observation (EO) data and processing techniques in combination with process based crop models (FAO) for yield forecasting.

- *Development/sharing of tools, guidelines and documents on standards and best practices:*

Collect lessons learned and good practices in country to be used in trainings and e-learning initiatives. As part of this activity, also compilation of guidelines for area frame implementation using standard LC supported by EO information and guidelines on using IT devices to improve efficiency of field survey.

8.2.5.1.5 Data, Products and Information Dissemination

A wide variety of data and information from multiple sources are required to effectively monitor the diverse range of agricultural systems at sub-national, national, regional and global scales. GEOGLAM will work with the satellite data providers (primarily through CEOS), the national, regional and international agricultural monitoring agencies, meteorological agencies, and researchers to implement a phased, coordinated data and information dissemination approach. This task regards the development of a national crop condition monitoring portal aiming to provide users with real time information on vegetation condition in various crop stages.

- *Crop Condition interface prototyping:*

National tool for monitoring the state of vegetation based on coarse resolution satellite data (e.g. MODIS, VIIRS, Sentinel 3, SGLI).

8.2.5.1.6 Technical assistance and capacity building on the use of EO data

Define processes and activities that can assist national implementation.

- *Need-based training programmes, tools and toolkits:*

Curriculum development for national training programmes, tools and toolkits:

  - Development of standard guidelines for technical assistance and training;
  - Development of training material and curriculum for acreage and yield estimation; crop forecasting; and agriculture environmental indicators;
  - Development of distance /e-learning products (modules);

- *Technical assistance/trainings on methodologies, tools, best use of EO data:*

The activities here include regional and national training courses/seminars and multi-lingual distance learning courses on crop monitoring methodologies, data discovery, analysis and management tools and services. Trainee institutions will be the ones responsible/mandated in-country for agriculture statistics creation and its supply. Support participation to Master level courses / short courses / scholarships. Assist national system design and implementation (cropland mapping, area planted, ground sampling, crop condition, yield forecasting assessment, reporting) with emphasis on building sustainable systems.

- *Improvement infrastructure and human capacity for carrying out national monitoring programme:*

Technical assistance / support (infrastructure revision and technology transfer). Train national staff (Statistical Offices and Ministries of Agriculture) or train the trainers (regional incubators) in accessing and applying improved EO-based methodologies (sampling, survey design, data compilation, and data analysis), and addressing specific technical and methodological gaps.

8.2.5.2 Phase 1: Activities status, Schedule and Responsibilities

Following the overall phased approach, the component National Capacity will focus on foundation activities, building on existing activities and on pilot projects for a few countries, and scoping out the programme for the following phases. The key activities are outlined in Table 5 below.

Table 5 - National Capacity Building activities for Phase 1/2 (2012 - 2014).

TASK / activities ***Descriptionotes***	**Calendar**	**Status**	***Institutions/ Teams***	***Budget***
4.5.1 Set-up / preparatory phase Establish basis for GEOGLAM implementation and phased approach. Gathering information about the current status of agricultural monitoring and the use of remote sensing techniques.				
Selection of countries (producers/at risk) / regions *Australia, Argentina, Ukraine, Pakistan, Mexico, Uganda, Ethiopia, Algeria, Asia RiCE countries - P1* *Brazil - P2*	2013	completed	*GEO Ag CoP*	*Regional assessment*
Identification of point of contacts, regional incubators, national institutions (trainer/trainee community)	2013	ongoing	*GEO Ag CoP*	*Regional assessment*
Regional assessment/networking workshops (link with other components' activities?) *Russia planned(with CIS) 2014* *Thailand, North and South Africa) being considered*	2013-2014	planned	*GEO Ag CoP*	*Regional assessment /Workshops*
4.5.2 National Needs Assessment Assessment of national capacities for agricultural monitoring (technical skills, institutional framework...), for the use of Earth observation for agricultural monitoring, for requirements in terms of capacity development and design of an empowerment strategy to improve agricultural monitoring.				
Development of country needs assessment methodology and questionnaire	2013	ongoing	*FAO* *Ag CoP*	*Workshops*
Assessment of national needs, gaps and priorities *Country visit to perform assessment and compile report (before/after/during workshop). Activity envisioned in budget.*	2013-2014	Planned	*FAO*	*Workshops*
Status of EO based agricultural monitoring *Needs assessment study*	*2013-2014*	ongoing	*CEOS* *Ag CoP*	
4.5.3 Baseline, EO and agro-met data Define data coverage requirements based on national needs assessment. This task aims to compile a common set of core data sets comparable across space and time.				
Available national core data sets *Inventory of existing national data (e.g. crop calendars, cropland and crop type distribution).* *Initial Focus on available Optical and SWIR and on Regional SAR (Asia Rice)*	2013-2014	ongoing	*CEOS* *Ag COP*	*EO Satellite Data*

Moderate resolution cropland map and crop (specific) mask (distribution)	*2013 -*	ongoing	*IIASA* *Ag COP*	*EO datasets* *Cropland mapping*
National/regional harmonized and standard based land cover	*2014*	planned	*FAO* *Ag COP* *Land cover Task*	*EO datasets*
4.5.4 Research & Developments; best practices				
Initiate JECAM/other sites and research agenda.	*2014*	Planned	*JECAM, FAO*	*R&D Best Practices*
R&D on crop (specific) area estimate (selected regions) methodologies *Testing Area Frame methodology with high res LC data, RS support, and mobile technology for field survey.(Countries TBD)*	*2014*	Planned	*JECAM, FAO*	*R&D Best practices*
R&D on crop (specific) yield forecasting *Testing models with inputs from RS and weather data. (Countries TBD)*	*2014*	Planned	*JECAM, FAO*	*R&D Best practices*
Development/sharing of tools, guidelines and documents on standards and best practices *Synergy with development of curriculum and e-learning/distance learning*	*2014*	Planned	*JECAM, FAO*	*R&D Best practices*
4.5.5 Data, Products and Information Dissemination				
Crop Condition interface prototyping	*2013-2014*	Planned	*UMD*	*Information systems*
4.5.6 Technical assistance and capacity building Define processes and activities that can assist national implementation.				
Need-based training programmes, tools and toolkits *Inventory of existing trainings, tools and toolkits* *Development of curriculum for trainings* *Development of distance learning modules*	*2013-2014*	planned	*FAO* *Ag COP*	*Workshops*
TA/trainings on methodologies, tools, best use of EO data *Regional/national capacity building workshops*	*2013-2014*	planned	*FAO* *Ag COP*	*Workshops*
Improvement infrastructure and human capacity for carrying out national monitoring programmes *hardware/ software/Mobile technology/ Master/short courses*	*2014*	planned	*FAO* *AgCoP*	*Workshops/ CB*

Research and EO data coordination				
Regional workshops in selected institutions/ incubators for networking for promotion, sharing, refining requirements, improving data sharing.	*2013-2014*	*ongoing*	*AG COP*	*Workshops*
4.5.7 Asia-RiCE				
4.5.7.1 Phase 1a				
Identification of POCs and responsible agencies	*2012-2013*	*Completed*	*Asia-RiCE*	*Coordination*
Technical Demonstration Site specification	*2012-2013*	*Completed*	*Asia-RiCE*	*Coordination*
Crop calendar determination	*2012-2013*	*Completed*	*Asia-RiCE*	*Coordination*
Space data requirements compilation	*2013*	*Completed*	*Asia-RiCE*	*Coordination*
Communication of requirements to data providers	*2013*	*Ongoing*	*Asia-RiCE*	*Coordination*
4.5.7.1.1 Indonesia				
Develop rice crop growth estimation research	*June 2013 – May 2014*	*Planned*	*LAPAN, IPB, ICALRD-MoA*	*R&D*
Use space data with in-situ and statistical information to make rice crop area estimations	*September 2013 - April 2014*	*Planned*	*LAPAN, IPB, ICALRD-MoA, BPS*	*EO datasets*
Communicate results to the BPS and Ministry of Agriculture (MoA)	*December 2013 – June 2014*	*Planned*	*LAPAN, IPB, ICALRD-MoA, BPS*	*Informations system*
4.5.7.1.2 Thailand				
Use data to produce and verify rice crop area maps in technical demonstration sites	*2013-2014*	*Planned*	*GISTDA, OAE, RD*	*EO datasets*
Develop KKU rice crop growth model	*2013-2014*	*Planned*	*GISTDA, OAE, RD*	*R&D*
Confirm rice crop yield estimation results with in-situ results and statistics	*2013-2014*	*Planned*	*GISTDA, OAE, RD*	*R&D*
Communicate results to OAE and RD	*2013-2014*	*Planned*	*GISTDA, OAE, RD*	*Information system*
4.5.7.1.3 Vietnam				
Use data to produce rice crop area maps and quantify accuracy improvements	*2013-2014*	*Planned*	*VAST, CIS, MARD, STI, GIC, HCMIRG*	*EO datasets*

Develop rice crop growth estimation techniques	*2013-2014*	*Planned*	*VAST, CIS, MARD, STI, GIC, HCMIRG*	*R&D*
Make rice production estimates to supplement in-situ and statistical results	*2013-2014*	*Planned*	*VAST, CIS, MARD, STI, GIC, HCMIRG*	*R&D*
Develop relationships with agricultural managers and planners at the local to national level.	*2013-2014*	*Planned*	*VAST, CIS, MARD, STI, GIC, HCMIRG*	*R&D*
Communicate results to agricultural managers/planners and DARD/MARD to enhance their rice monitoring capability and yield estimation accuracy.	*2013-2014*	*Planned*	*VAST, CIS, MARD, STI, GIC, HCMIRG*	*Information system*
4.5.7.2 Phase 1b				
Investigate full country estimation in Thailand.	*2013-2014*	*Planned*	*GISTDA, OAE, RD*	*R&D*
Identify demonstration sites in other ASEAN countries to, along with India, China and Japan, implement rice crop yield estimation methods and compare the results with in-situ and statistical information.	*2013-2014*	*Planned*	*Asia-RiCE*	*R&D*
Work with technical demonstration site representatives in Chinese Taipei (Taiwan) to perform data processing and information validation activities.	*2013-2014*	*Planned*	*Asia-RiCE*	*R&D*
Develop partnership with AMIS through outlook forecasting in cooperation with existing frameworks using agro-meteorological information derived from space observation data.	*2013-2014*	*Planned*	*Asia-RiCE*	*Coordination*

8.2.5.3 Phases 1/2: Funding / Budget for National Capacity Building

Table 6 -Indicative budget for National Capacity Building, Phases 1/2

		Phase 1 2012	Phase 1 2013	Phases 1/2 2014
National development	Regional assessments	0.1	0.5	0.6
	Crop area mapping	0.2	0.5	0.3
	Workshops	0.2	0.2	0.2
(EO data into crop monitoring systems)	EO satellite data	0.5	0.6	0.9
	Infrastructure			0.7
	Agromet data			0.2
	Information System		0.1	0.1
	R&D Best Practices	0.2	0.2	0.2
Sub tot Mio US $		**1.2**	**2.1**	**3.2**

8.3 Countries at Risk: Agricultural Monitoring in Support of Food Security Assessment

8.3.1 Background

The Countries-at-risk component has a specific focus on countries at risk. It tackles different crops, agricultural systems and calendars and different information needs. Agricultural monitoring in countries at risk supports timely food security assessment and early warning of potential significant food shortages. By at-risk we mean countries that:

- are chronically food insecure, in part due to adverse climate - this is the case of drought prone regions, such as the Horn of Africa or the Sahel region -;
- and/ or are strongly dependent upon the global market for their food security, due to extreme variability of national production (typically South Mediterranean countries), and as such are not major producers on a global scale ;
- Are often characterized by subsistence and low-input agriculture, with mostly fragmented agricultural landscapes, where agricultural production is heavily influenced by climate variability.

Many national and regional agricultural monitoring institutions in at-risk countries have a limited ability to generate agricultural production data, and they are often unable to integrate them into a broader assessment of current or near-future food security. At the same time, the avenues available to them for improving their technical capabilities for producing data and information products are limited. A number of GEOGLAM members including. FAO's Global Information and Early Warning System on food and agriculture (GIEWS), USAID's Famine Early Warning System Network (FEWS NET), China CropWatch and JRC's Monitoring Agricultural ResourceS Unit (MARS) not only generate these products on behalf of national and regional agencies (on an interim basis), but also help them build national and regional institutional capabilities for doing so themselves. Working through the GEOGLAM structure, members will foster the coordination of product delivery and capacity building efforts for national and regional organizations and the development of harmonized methods and tools.

8.3.2 Current Status

The focus of this component is on near real-time Early Warning Systems that help anticipate potential food security emergencies and mobilize appropriate aid. In some countries food aid is typically not needed, but early estimates of national grain harvest are crucial to manage national stocks and optimize import requirements on a highly volatile global market.[1] Key global players in Early Warning Systems are UN FAO-GIEWS (Global Information and Early Warning System on food and agriculture), UN WFP (World Food Program), the USAID Famine Early Warning Systems Network (FEWS NET), and the EC JRC MARS (Monitoring Agricultural ResourceS Unit), all partners in the GEOGLAM Community of Practice[2].

Component 3 involves operational systems providing objective, evidence based assessments for decision making, while reducing as much as possible false positive and false negative determinations. This requires the integrated use of information from multiple sources (crop prospects, livelihoods and vulnerability of households, market prices, public health concerns) and consensus building processes and common analytical methods among stakeholders, national governments, UN, donors, NGO's). [3]

In this context and in particular for drought-prone areas, EO indicators on drought severity (status of vegetation, rainfall estimates and water availability) are very useful.. These EO indicators and other monitoring tools / systems can also support consensus among analysts. There is a high demand for standardization of products and for specific training materials both from producers and users of drought information. The Global Drought Information System (GDIS) being developed through WCRP is key to GEOGLAM components and teams (FEWS NET, USDA/FAS, JRC, etc). The analyses must be done in the context of established national drought management policies, promoted by the recent High-Level Meeting on National Drought Policies held in Geneva in March 2013.

Many countries at risk in semi-arid regions are characterized by **poor data availability**: very sparse meteorological network, little ground information, and/or weak agricultural statistics, which increases the potential contribution of EO. At the same time, inaccurate or non available agriculture statistics hamper the implementation of yield forecasting, making Early Warning Systems more qualitative than quantitative. EWS depend on and complement agricultural statistics services, which need to be improved through the longer term activities described in Component 2 (National Capacity Building).

A number of international programs such as EUMETSAT Satellite Applications Facilities (SAF networks), NASA LANCE, GEONETCAST, USAID/NASA SERVIR, USDA IPAD (International Production Assessment Division), EU Copernicus – MESA-AMESD) already support the Near Real Time delivery of EO products for agricultural monitoring and early warning. However, many national and regional agricultural institutions in at-risk countries have a limited capacity to generate agricultural monitoring information, or they are often unable to integrate them into a broader assessment of current or near-future food security. At the same time, the avenues available to them for improving their technical capabilities for producing data and information products are limited.

The primary sources of meteorological data are the National Meteorological and Hydrological Services (NMHS) of the world, with the data being communicated through the Global Telecommunication System (GTS). The GTS was established by the NMHS's with the coordination of the World Meteorological Organization. However, more weather data are needed for agricultural

[1] Case of Maghreb countries, facing a 1 to 5 variability of domestic production of rain fed cereals

[2] A growing number of National and Regional Early Warning Systems exists, in particular in Africa at the level of the Regional Economic Communities such as ECOWAS (the Economic Community of West African States), COMESA (the Common Market for Eastern and Southern Africa), IGAD (the Intergovernmental Authority on Development for the Horn of Africa), and SADC (Southern African Development Community), as well as in Central America (SICA Central American Integration System).

[3] See for example is the IPC (Integrated Food Security Phase Classification) jointly implemented by 7 agencies (UN FAO, WFP, FEWSNET, JRC, OXFAM, CARE, Save The Children, ACF),,,, http://www.ipcinfo.org/

monitoring and for the calibration and operational use of remotely sensed products such as satellite rainfall estimates (RFE). In many countries, there are many weather station networks and individual data that are not connected nor disseminated through GTS. As a first step, these types of data issues will be addressed in GEOGLAM through regional workshops which have been proposed by WMO and FEWS NET.

WMO is working on developing the WMO Information Systems which will at first augment and then replace the GTS. WIS encompasses three types of centres. For regional and global connectivity, Global Information System Centres (GISCs) will collect and distribute the information meant for routine global dissemination, while serving as collection and distribution centres in their areas of responsibilities; they provide entry points, through unified portals and comprehensive metadata catalogues, for any request for data held within the WIS. Connected to the GISCs, the Data Collection or Production Centres (DCPCs) will be responsible for the collection or generation of sets of data, forecast products, processed or value-added information, and/or for providing archiving services. National Centres (NCs) will collect and distribute data on a national basis and will coordinate or authorize the use of the WIS by national users, normally under a policy established by the respective national government permanent representative to WMO.

8.3.3 Objectives, Activities and Expected Outcomes

In particular, Component 3 activities will include:

- Improving ground-based national meteorological networks, to the benefit of EWS, including calibration and operational use of spatially complete satellite rainfall estimates (RFE);
- Collection of in-situ crop information (phenology, yield);
- Development of user-friendly, dedicated software for food security analysts (e.g., SPIRITS[4] by VITO-JRC);
- Application of seasonal climate forecasts to help build food security outlook scenarios;
- Coordination with regional economic communities;
- Strengthen the capacity of national and regional institutions to integrate their climate and crop data collection programs with globally available Earth observation datasets and models to fill gaps and obtain new, more robust agricultural monitoring products;
- Strengthen the capacity of national and regional institutions to apply improved agricultural monitoring to produce timely in-season yield and production figures to support national programs and food security early warning systems.

GEOGLAM partners will foster the coordination of product delivery, the development of harmonized methods and tools and the capacity building efforts for national and regional organizations, with a key role for technical Regional Centres such as AGRHYMET – Niamey (for CILSS ECOWAS) or RCMRD – Nairobi (for East Africa).

In order to strengthen linkages with decision makers that are the primary target users of the information from the national and regional agricultural monitoring organizations GEOGLAM will coordinate with regional economic communities such as the Economic Community of West African States (ECOWAS), the Common Market for Eastern and Southern Africa (COMESA), the Intergovernmental Authority on Development (IGAD) in Eastern Africa, and the Central American Integration System (SICA), as well as with other continental and global bodies and initiatives dealing with food security, such as the New Partnership for African Development (NEPAD) Planning and Coordination Agency, the Food Security Information Network, the WMO-led Global Framework for Climate Services, and the Global Drought Information System. GEOGLAM members will help to

[4] "**SPIRITS**" (Software for the Processing and Interpretation of Remotely Sensed Image Time Series) is developed and disseminated by VITO and JRC –see https://rs.vito.be/africa/en/software/Pages/Spirits.aspx

develop these links through a variety of user-training mechanisms, such as regional food security forums and international policy dialogues.

Also, the GEOGLAM partners will liaise with other potential partners and projects that seek to improve in-situ soil moisture observations. These projects include the WMO/George Mason University project that will integrate coarse resolution satellite information with in-situ soil moisture measurements in South Africa. Other countries will be added pending on new funding. Also to be brought into the early warning systems is the global in-situ soil moisture database being established by the International Soil Moisture Network (http://ismn.geo.tuwien.ac.at/). There are also several drought prediction products that are being developed in coordination with the Global Drought Information system.

Originally initiated by WMO, National Meteorological and Hydrological Services (NMHSs), regional institutions, and other international organizations, Regional Climate Outlook Forums (RCOFs) were developed to focus on applications of seasonal climate predictions. RCOFs bring together international and regional climate experts to develop consensus-based seasonal forecasts and information addressing questions having critical socio-economic significance. Regional assessments of observed and projected climate change, including the development of downscaled climate change scenario products for impact assessments, are often included in the product portfolio of RCOFs. The core concept of all the RCOFs remains the same: delivering consensus based user-relevant climate outlook products in real-time through regional cooperation and partnership. However, since national and regional capacities are varied and, in some cases, are inadequate to face the task individually, the implementation mechanisms of the RCOFs in different regions have been tailored to meet the local conditions.

The outcome of Component 3 is an improved and harmonized system and tailored agriculture monitoring products for Countries at Risk.

These will include:

- gridded datasets for precipitation, temperature, evapotranspiration, soil moisture, snow water content, and vegetation condition;
- updated crop calendar and cropland area extent, more focused analyses of gridded products;
- collection of moderate and fine resolution satellite observations; and
- generation of up-to-date area-planted statistics, supported by best available remote and on-the-ground survey numbers, to anchor year-to-year estimates of relative change in agricultural production.

8.3.4 Phased approach for Countries-at-Risk

The phased approach for Countries-at-Risk on Phases 1 and 2 (present-2016) will be based on improving the datasets for early warning system, identifying the data gaps and leveraging resources for solutions and on capacity development (in close coordination with Components 2 and 5).Table 7 provides the list of priorities for datasets, attempts to overcome data gaps and capacity development for at-risk countries

Table 7 – Priority data sets, data gaps and capacity development for Countries at Risk

Data Sets	
P1	FEWS NET Global gridded rainfall FEWS NET MODIS ET FEWS NET Pastoralist Water Point Monitoring EUMETSAT LANDSAF products distribution over Africa

	EU COPERNICUS GIO Land Products (VITO - SPOT VGT –PROBA V) FAO (VITO –JRC) Agricultural Stress Index System (ASIS)
P1	Work with WMO to strengthen national climate station networks
P2	Leverage advanced computing capabilities to apply high- to medium-resolution (5m -30 m) imagery to seasonal monitoring for early warning (Rapid Eye, Landsat 8, Sentinel 2, and others)
Data gaps	
P1	FEWS NET/WMO/GEO Ag CoP Data Workshops Africa (East, West, Southern)
P1	Promote weather data issues with National Met Services (brochure)
P1	Liaise with other projects and GEO tasks (drought, soil moisture)
P1	Promote WMO Information System (WIS) to national and international organizations
P1	Data gap analysis and agro-environmental stratification (FP7 SIGMA)
Capacity development (R&D and training)	
P1	Thematic workshop establishing an R&D agenda (FP7 SIGMA)
P1	National and sub-national crop production shortfall risk profiling – loss exceedence probability functions (FEWS NET, ISDR)
P1	Long time-series agricultural drought indicator (FEWS NET, SERVIR)
P1-P2	Crop mapping, monitoring methods and environmental impacts of agriculture (EC FP7 SIGMA)
P1-P2	Pilot project on the use of Sentinel-2 for agricultural monitoring (ESA Sen2-Agri)
P1	Exploration and application of FEWS NET gridded rainfall and MODIS ETa data sets
P1	FAO-JRC E-learning Course on Crop Monitoring
P1	JRC VITO training and dissemination MARS Viewer – SPIRIT software's
P1-P2	MSGToolBox training (VITO)
P1-P2	Regional trainings in Africa on GEONETCast data exploitation (FP7 AGRICAB)
P1-P2	National workshops on Agricultural statistics, Early warning and yield forecasting (FP7 AGRICAB)
P1-P2	Regional trainings on Agricultural monitoring (FP7 AGRICAB)
P1-P2	Exploration and application of FAO-VITO-JRC agricultural stress index (ASI)
P1-P2	Exploration and application of FEWS NET Pastoralist Water Point Monitoring

8.3.5 Phases 1/2 Activities, Schedule and Budget

The following table lists activities for Phases 1 and 2 happening in 2013 and 2014. Status is categorized as completed, ongoing and planned. The budget is divided into in-kind (resources including salaries and funded activities from existing projects of GEOGLAM partners) and new GEOGLAM projects.[5]

[5] From agencies (e.g. NASA) and programs such as EC-FP7, GEO members in-country expenditures (China, Brazil, Australia, Argentina…), Regional Development Banks and non–profit Foundations.

Table 8 - Countries-at-risk activities for Phase 1/2 (2012 - 2014).

Short Description	**Calendar**	**Status**	**Institutions/ Teams**	**Budget category**
Global activities				
Start of COPERNICUS Global land Services	Dec. 2012	Completed	VITO (JRC)	EO satellite data
Availability of PROBA V Copernicus services (VGT Gap filler)	Nov. 2013	Ongoing	VITO	Eo satellite data
Release of ASIS (Agricultural Stress index System)	Oct. 13	Ongoing	FAO –VITO - JRC	Water Stress Index maps
Development of ASIS Standalone Version	2014	Planned	FAO –VITO - JRC	Information system
Release of the MSG ToolBox	Dec. 2013	Ongoing	VITO	R&D best practices
Completion and Release of FAO e-learning on Crop Monitoring for Food Security - Complete e-learning course in 8 modules (English version)	Dec. 2013	Ongoing	FAO -JRC	R&D best practices
FAO e-learning on Crop Monitoring for Food Security - (French version)	July 2014	Planned	FAO -JRC	R&D best practices
Training on SPIRITS / WFP headquarters Rome	Dec. 2012	Completed	JRC –VITO	R&D best practices
EO Analysis protocol and documentation supporting FAO CFSAM	Since 2012	Ongoing	VITO - FAO	R&D best practices
Regional capacity building workshops (5) on agricultural monitoring	Oct. 2013 – Dec. 2014	Planned	FP7 AGRICAB- VITO	Workshops/ Cap. Development
Thematic workshop to establish SIGMA R&D agenda	Q1 2014	Planned	FP7 SIGMA	Workshops/ Cap. Development
Promote weather data issues with National Met Services (brochures)	Aug. 2013 – Dec 2014	Planned	WMO	Global gridded datasets

Liaise with other projects and GEO tasks (drought, soil moisture)	Aug. 2013 – Dec 2014	Planned	WMO / GEO	Workshops Cap. Development
Promote WMO Information System (WIS) to national and international organizations	Aug. 2013 – Dec 2014	Planned	WMO	Information system
Sub Saharan Countries (Regional and national)				
Start of MESA (AMESD 2) 4 yrs Program / AUC-RECs	March 2013	Completed	FP7	EO satellite data
Training course on the use of satellite products for agro-meteorological applications.	June 2013, Accra, Ghana	Completed	WMO, EUMESAT, FAO, JRC, PMA-Portugal, AGRHYMET, TAMSAT Nat Meteo Agency	Workshops/ Cap. Development
FEWS NET/WMO/GEO Data Workshop in East and West Africa.	2013-2014	Planned	FEWSNET/WMO/GEO	Workshops/ Cap. Development
Training on MARS Viewer and SPIRIT / 10 countries Ispra	17-21 June 2013	Completed	JRC –VITO-ALTERRA	Workshops/ Cap. Development
Launching of SPIRIT Software Africa GIS 2013	4-8 Nov. 2013	Planned	JRC –VITO	Information system
4th CRAM (Crop and rangeland Monitoring) Conference	May- June 2014	Planned	JRC- FAO FEWSNET-WFP	Workshops/ Cap. Development
National Capacity building workshops on agricultural monitoring (Mozambique, Kenya, Senegal)	Jan 2013 – December 2014	Ongoing	FP7 AGRICAB, VITO	Workshops/ Cap. Development
WRMF project – Evaluation of Remote sensing for Index insurances in West Africa (Senegal)	Feb. 2014	Ongoing	WFP IFAD VITO (steering involving FEWS NET, JRC, FAO)	R&D Best Practices
Regional ICPAC training on gridded climate data sets	Aug. 2013	Planned	FEWS NET, ICPAC	Workshops/ Cap. Development
Regional FEWS NET on crop modeling (GeoWRSI) and on improved rainfall estimates (IRE)	Jan. 2013	Completed	FEWS NET	Workshops/ Cap. Development

South Sudan Remote and GIS applications to FS and EWS	Jan.- March 2013.	Completed	FEWS NET	Workshops/ Cap. Development
Horn of AFRICA USGS/FEWS NET remotely sensed products awareness and availability (Quarterly Greater Horn of Africa – Climate Outlook Forums (GHACOF) workshops.	Feb. and June 2013.	Completed	USGS FEWS NET	Information system
Rwanda and Burkina Faso Training on High Resolution satellite data interpretation for, in support of crop acreage estimation	June – July, 2013 Narobi	Ongoing	FEWS NET, RCMRD (Nairobi)	Workshops/ Cap. Development
Regional Development of gridded climate datasets (Geo-Data) for the PREPARED project (USAID/) ICPAC staff	July 2013 UCSB US	Ongoing	UCSB - FEWS NET ICPAC	Global Gridded datasets
Ethiopia National training on Remote and GIS applications to FS and EWS	2nd Half 2013 Addis Ababa	Planned	FEWS NET	Workshops/ Cap. Development
Improvement of satellite based RFE's (Geo-Data)	Sept. 2013	Planned	FEWS NET, WMO:	Global gridded datasets
Uganda: National training on Remote and GIS applications to FS and EWS	2nd Half 2013 Kampala	Planned	FEWS NET	Workshops/ Cap. Development
Regional SADC- Contribution to capacity development for SADC "at Risk" countries on crop monitoring for an improved sub regional bulletin.	2014	Planned	NEOSS (SA) MESA, JRC	Workshops/ Cap. Development
Ethiopia	TBD	TBD	FAO	Workshops/Cap. Development
North African Countries				
Training on MARS Viewer and SPIRIT / DZ Ispra	June 2013 ISPRA	Completed	JRC – INRAA	Workshops/ Cap. Development
Prototype EC MARS Bulletin on 5 North African countries	March 2013	Completed	JRC	Information system
EC MARS Bulletin on 5 North African countries	June 2013	Completed	JRC	Information system

Crop Monitoring and Yield forecast in Maghreb (Mo, TB, DZ)	Nov. 2013	Planned	JRC	R&D best practices
DZ Crop monitoring and Yield forecast Bulletin	March, May 2014	Planned	INRAA - JRC	Information system
EUROMED workshop on Crop monitoring and area Estimates in Mediterranean Countries	Sept. 2014	Planned	JRC –FAO- INRA MO, DZ, CNCT, MinAGRIs	Workshops/ Cap. Development
Central Asia and other At-risk countries				
Support to National EWS in Armenia	July 2013	Completed	FAO	Workshops/ Cap. Development
Support to National EWS in Tajikistan	Dec. 2013	On-going	FAO	Workshops/ Cap. Development
Support to National EWS in Kyrgyzstan	Dec. 2013	On-going	FAO	Workshops/ Cap. Development
Support to National EWS in Timor-Leste	Dec. 2014	On-going	FAO	Workshops/ Cap. Development

Table 9 – Indicative budget for at-risk countries for phase1/2 (2012-2014)

		Phase 1 2012	**Phase 1 2013**	**Phases 1/2 2014**
Countries-at-risk)	Global Gridded Rainfall	0.2	0.3	0.3
	MODIS ET MAPS	0.2	0.3	0.3
	Water Stress Index Maps	0.2	0.2	0.2
Food security	Workshops/Cap development	0.1	0.2	0.2
	EO satellite data	0.5	0.6	0.6
	R&D best practices	0.1	0.2	0.1
	Information System		0.1	0.1
Sub tot Mio US $		**1.3**	**1.8**	**1.8**

8.4 Earth Observations

8.4.1 Background

The vision for GEOGLAM initiative is the increases use of both satellite and in situ Earth observations to improve operational agricultural monitoring for the benefit of society. As such, the GEO Partners include UN Agencies such as FAO and WMO. GEO has been developing a requirements dialogue with the Committee on Earth Observation Satellites (CEOS), a group of the world's civil remote-sensing space agencies, in order to coordinate EO and develop and acquisition strategy to meet the needs of a suite of agricultural monitoring applications – the fourth component of the GEOGLAM initiative.

As GEOGLAM also needs meteorological syntheses and short-term and mid-term forecasts, the initiative will liaise with the Coordination Group for Meteorological Satellites (CGMS) – as this group coordinates the access to all data distributed by operational meteorological satellite agencies and some of its members are not CEOS agencies. By partnering with WMO Agricultural Meteorology program, GEOGLAM will help foster the availability of gridded data sets into WMO Information System (WIS).

8.4.2 Current Status

CEOS has established an ad hoc advisory team to work with the GEOGLAM team to support the development of the satellite data requirements. The Ad hoc Advisory Team is composed of representatives from CONAE, CSA, ESA, INPE, ISRO, JAXA, NASA, UMD, and USGS. It includes participation from CEOS Agency staff with expertise in satellite mission planning, coordination, and management, and in the use of space-based EO data to generate actionable information for agricultural decision-makers. The composition, skill set and expertise of the CEOS Ad hoc Advisory Team on GEOGLAM allowed the group to develop a coordination framework to address the CEOS SIT actions and initial needs of GEOGLAM. During 2012 and first half of 2013 the CEOS advisory team supported the user requirements definition, and is contributing to the phased-implementation approach through a co-community effort (through regular teleconferences and meetings) wherein analysis of requirements for phase 1 are being completed. The CEOS team has been reporting on the GEOGLAM efforts though the CEOS Strategic Implementation Team meetings and will report to the CEOS plenary in November 2013 on the phase 1 data plan.

For information on the coordination of in situ Earth observations, please refer to Section 5.6: Countries at Risk.

8.4.3 Objectives, Activities and Expected Outcomes[6]

The expected outcomes of this component are two-fold: a) An improved coordination of satellite observations for agricultural monitoring to respond to the G20 action plan on agriculture and to the GEO strategic targets for agriculture, and; b) An improved coordination of and availability of data from in situ agricultural observation networks and meteorological observation and forecasting networks. These outcomes will be reached through the implementation of the GEOGLAM Phased approach (Section 5.7.4), of which the ad hoc advisory team is currently engaged in Phase 1.

In July 2012, the ad hoc advisory team met and developed a table of satellite data requirements for meeting the needs of a variety of agricultural monitoring applications (Table 10). Though this table provides the basic "bones" of the EO requirements to coordinate satellite imagery, it required additional spatially explicit baseline data, in order to be implementable it also requires the inclusion of a cropland identifying mask (Figure 4, left), field size information (Figure 4, right), growing season

[6] Although it is an integral part of GEOGLAM in achieving its goals the meteorological observation activities are being developed in the context of the three main pillars of GEOGLAM and will not be part of this section

timing (Figures 5, 5b), cloud cover impacts (for optical + SWIR imagery), and sampling strategy. To that end, members of the ad hoc team have been working to create these baseline data.

Table 10 - Earth Observation Requirements Table

OBSERVATION & SENSOR TYPE			REGIONAL CHARACTERISTICS & GEOGRAPHICAL EXTENT					
SPATIAL RES.	SPECTRAL RES.	TEMPORAL RES.	WHERE? (+ cropland mask & sampling scheme)				WHEN?	
Spatial resolution	Spectral range	Effective observ. frequency (cloud free)*	Swath / Extent	Sample (s), Refined (rs) or Wall -to-Wall (w2w)	Large, Medium, Small fields	Crop types diversity	Calendar/ Multiple cropping	Cloud coverage
2000 - 500 m	thermal IR + optical	few per day	global	w2w				
100-300m	optical + SWIR	2 to 5 per week	global	w2w	L/M/S		*	
1-15km	passive microwave	daily	global	w2w				
50-150 m	SAR dual pol. (X,C,L) ****	5 per season	main crops	s	L/M/S	rice area	entire growing season	high cloud cov.
5-20m	SAR dual pol. (X,C,L) ****	5 per season	main crops	s	L/M/S	rice area		high cloud cov.
Footprint	RADAR Altimetry	weekly		s				
50-100m	thermal	daily ?	main crops	s	L/M/S		entire growing season	
20-70m	optical + SWIR	3 per growing season[&&]	croplands	w2w	L		post-dormant growing season; w/in 1 month of one another	
20-70m	optical + SWIR	1 per month (if possible same sensor) (min 2 out of season + 3 in season)	croplands	s (want w2w)	L/M/S		year-round, focus on growing season	
20-70m	optical+SWIR	1 per week (min. 1 per 2 weeks)	main crops	rs	L/M/S		entire growing season	
5-10 m	optical (+SWIR)***	1 per month (if possible same sensor) (min 3 in season)	croplands	rs	L/M/S (focus on S)	if >1 cycle per year	focus on growing season	
5-10 m	optical (+SWIR)***	1 per week (min. 1 per 2 weeks)	main crops	rs2	S		entire growing season	
< 5 m	optical	1 to 2 per month	croplands	rs3	demo. case (2 - 5% of croplands L/M/S)		2 - 4 coverages per year	

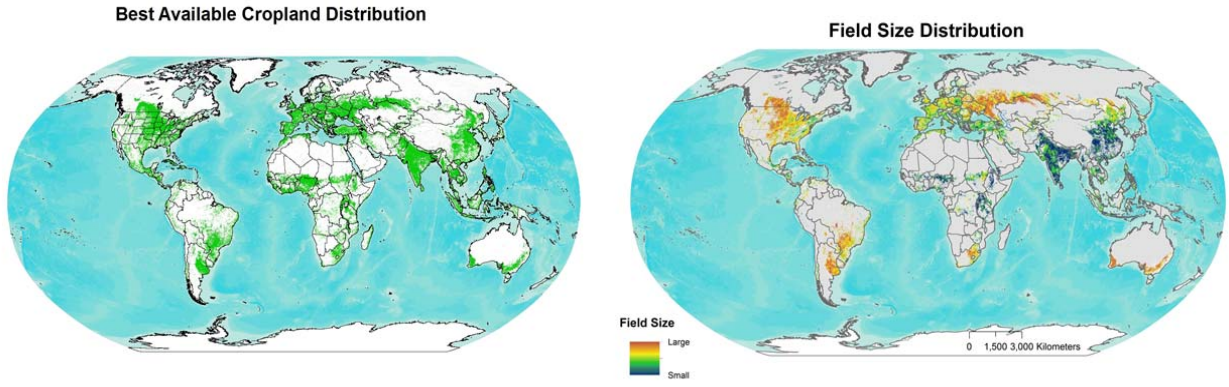

Figure 4 - Best available cropland distribution (left) and Field size distribution (Beta version; Fritz et al, IIASA)

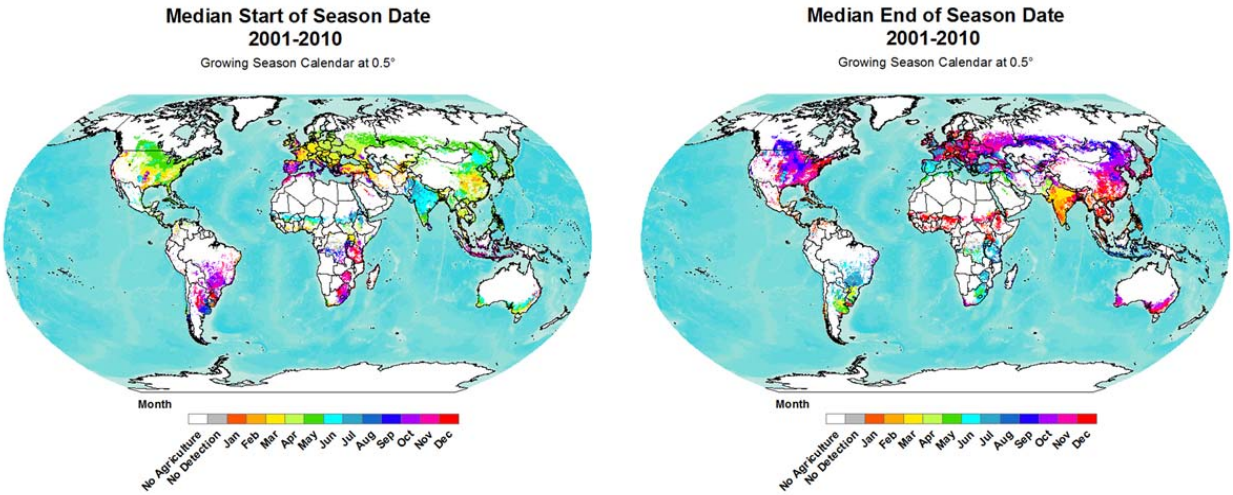

Figure 5 - Agricultural Growing Season Calendars; median start of growing season (left) and median end of growing season (right) as observed 2001-2010 (Beta Version; Whit craft et al., UMD)

8.4.4 GEOGLAM Phased Implementation Approach

The proposed approach suggests an implementation strategy in three phases over five years. Each phase will bring with it an increased number of countries, the integration of more sensors, and the increased assimilation of information products into decision making processes. The activities of this component will be phased according to the approach that has been developed over the past year. Since its "go ahead," the CEOS advisory group is continuously working with GEOGLAM leads on the demonstration & early feasibility phase, which spans through 2015, for which initial volumetric assessments and baseline datasets are being developed.

There are three phases:

Phase 1: Demonstration of Feasibility (2013-2015) For Earth Observations coordination efforts
Phase 1 is divided into two parts to take into account growing season timing: Phase 1A (June 2013 – June 2014) and Phase 1B (November 2013-September 2015).

- Build on exiting activities, engagements with country partners;
- Generation of baseline datasets;
- Develop requirements and request imagery for 4 large/main producers/exporters and 2-4 Countries at Risk;
- Test preliminary sampling strategies and increase scope of effort over time- Asia RiCE has a tandem effort coordinating SAR data for rice growing regions.

Table 11 - Phase I Countries/Regions, Crops, Data Types, and Time Period of Initiation

Region/Country	**Crop**	**Data Types**	**Initial Time Period**
Argentina (main producer)	Soybeans	Optical & SWIR	Phase 1A
Australia (main producer)	Wheat	Optical & SWIR	Phase 1A
Ukraine (main producer)	Wheat	Optical & SWIR	Phase 1B

Russia (main producer)	Wheat, Corn	Optical & SWIR	Phase 1B
Uganda (at-risk)	Multiple	Optical & SWIR	Phase 1B
Algeria (at-risk)	Multiple	Optical & SWIR	Phase 1B
Ethiopia (at-risk)	Multiple	Optical & SWIR	Phase 1B
Pakistan	Wheat; multiple	Optical & SWIR	Phase 1B
Asia- RiCE	Rice	SAR	Ongoing (Phase 1)

Phase 2: Assessment and Expansion (2014-2016)

- Introduce approximately 5 additional main producer countries;
- Pilot global sampling strategy for main producers;
- Initiate sampling strategy for at-risk countries;
- Integrate new missions (Sentinels, Amazonia, SAR);
- Expand RiCE Monitoring pilot study plan with available SAR data;
- Generate and disseminate new information products, assimilate into agricultural decision making processes;

Phase 3: Pre-operational Details (2015-2017)

- Solidify sampling strategy for at-risk countries;
- Cover at least 5 at-risk countries;
- Increase observation footprint for main producer countries; incorporate all main producer countries;
- Integrate additional new missions;
- Seek synergy with other monitoring initiatives to optimize acquisition efficiency and use.

8.4.5 Phases 1/2 Activities, Schedule and Budget category

Table 12 – Earth Observation coordination activities for Phase 1/2 (2012-2014)

Activity and Short Description	Calendar	Status	Institutions/ coordinating teams	Budget category
Phase 1	2012-2015	In Progress	All	EO satellite data
1.1 Develop baseline datasets	2012-2014	Ongoing	Ad-hoc team; UMD	
1.2 Identify and plan acquisitions for Main producer Countries (See Table Y)	2012-2015	Ongoing	Ad-hoc team; Country partners; Asia RiCE	

1.3 Identify and plan acquisitions for Countries At-Risk (See Table Y)	2012-2015	Ongoing	Ad-hoc team; Country partners; FAO	
1.4 Pilot sampling strategy for Phase 1 main producer countries	2013-2014	Ongoing	Ad-hoc team; UMD	
1.5 Asia RiCE coordinating SAR data for rice growing regions	2012-2015	Ongoing	Asia-RiCE	
Phase 2				EO satellite data
2.1 Incorporate new main producer Countries	2014-2016	Planned	Ad-hoc Team; Country partners	
2.2 Develop and pilot global sampling strategy for main producer countries	2014-2016	Planned	CEOS Ad-hoc teams Country partner	
2.3 Initiate sampling strategy for at-risk countries	2014-2016	Planned	CEOS Ad-hoc team	
2.4 Integrate new missions (Sentinels, Amazonia)	2014-2016	Planned	CEOS	
2.5 Expand RiCE Monitoring pilot study plan with available SAR data	2014-2016	Planned	Asia RiCE	

The indicative cost for activities in all cross-cutting components is imbedded into the main components.

8.5 Research Coordination (R&D) for Monitoring Enhancements

8.5.1 Background

The GEOGLAM monitoring system of systems will be based on the best available science and technology. Satellite remote sensing is recognized one of the main source of information for operational crop monitoring and area estimate. However, there are gaps between the current practices of operational systems and the scientific state of the art. On one hand, gaps are explained by the fact that most scientific experiments cover very limited spatial (often one scene) and temporal scale (one or two years) and the scaling-up to national or international levels is a very distinct research effort. On the other hand, the poor availability of synchronized relevant in-situ and satellite data over the large scale hampers optimal calibration and. In addition, it must be recognized that science and technology are moving targets and that the creation of an operational GEOGLAM will require ongoing improvements based on emerging research and ever-improving and changing satellite data streams and in situ data networks. As such, the goal of the R&D component is to respond to specific GEOGLAM needs as articulated in other sections of this document and harness the development of new methods, identify existing best practices.

8.5.2 Current Status

R&D Coordination will be achieved through the networking of existing research and experimentation efforts. leveraging of work underway in the GEO Joint Experiments for Crop Assessment and Monitoring (JECAM, www.jecam.org), contributing projects (i.e. EU FP7 SIGMA, EU FP7-IMAGINES, EU FP7 AGRICAB, ESA Sentinel 2-Agri, etc.) and national monitoring initiatives. Coordination, exchange of experience, reporting on scientific progress, and, reaching out to the broader agricultural monitoring community takes place through workshops and meetings. The aim of the coordination activity is to build consensus on the development of operational prototypes, standards and best practices that will establish the technological foundation for, and continual improvement of GEOGLAM.

JECAM contributes to these activities by developing monitoring and reporting protocols and best practices for a variety of agricultural systems. JECAM strives to establish a convergence of approaches by enabling the global agricultural monitoring community to compare results based on disparate sources of data, using various methods, over a variety of cropping systems around the globe. JECAM will also help facilitate the interaction with CEOS, supporting the development of the GEOGLAM global system of systems for agricultural crop assessment and monitoring.

8.5.3 Objectives, Activities and Expected Outcomes

To achieve the required R&D to meet GEOGLAM goals the following specific sub-tasks are foreseen: 1) Coordination and Networking; 2) JECAM-GEOGLAM Science Activities, and 3) Standards and Best Practices for Global Agricultural Monitoring.

Sub-task 1, in addition to coordinating the existing JECAM efforts, the task will focus will be on methods to assess environmental impacts of agriculture, as this aspect is currently not sufficiently addressed. This includes:

- Consolidate a common research agenda and facilitate sharing of experiences and review methods used in various parts of the world and for various agricultural systems;
- Establish a forum for JECAM participants, to facilitate communication, through workshops, science paper collection and JECAM.org website;
- Coordinate interaction with CEOS regarding in particular the multi-year data acquisition over the JECAM sites and the definition of agriculture requirements for future missions;
- Coordinate the available and forthcoming in situ and EO data sets acquired over the research sites, enable the data exchange process, and create minimum data sets for multi-site GEOGLAM research activities;
- Ensure reporting of scientific and technical progress and results to the larger Agricultural Monitoring stakeholder community.

Sub-task 2 starts by recognizing that JECAM is only one contributor to the GEOGLAM science agenda. As such the GEOGLAM R&D component will also work with other agricultural monitoring initiatives, such as EU FP7 SIGMA, EU FP7-IMAGINES, EU FP7 AGRICAB, ESA Sentinel 2-Agri, to leverage and focus work from the broader agricultural monitoring community. Once funding is established, work will be undertaken to coordinate and harmonize the JECAM in-situ and satellite data sets to facilitate broad usage. As well, research proposals will need to be solicited and funded that address specific GEOGLAM research to operational needs.

The research to operations (RtO) activities will be in response to the detailed GEOGLAM plan and as such require further development, and take into consideration capacity development needs. This will be fully articulated in the Phase 1 development of the science plan (Table 6, sub-task 2.1). Notwithstanding this, GEO Ag task research topics include:

- in situ field campaigns:
  - sampling strategy at different scales;
  - measurement methods and instruments;
  - data processing;
  - data management and quality control;

- croplands extent mapping;
- main crop type mapping;
- crop acreage estimates;
- crop status indicators and biophysical variable retrieval;
- data integration or assimilation within crop growth models;
- anomaly, stress and disease detection;
- yield estimates (empirical methods, crop modeling);
- yield forecasts;
- sustainability and environmental impact indicators.

Sub-task 3 will be achieved through thematic workshops and the results of collaborative research studies that integrate applied agricultural monitoring research around the world. Where possible JECAM research will be leveraged and JECAM meeting venues will be used to maximize community participation. Further, the staging and priority of these workshops will be based on the needs of GEOGLAM activities. Based on a preliminary assessment of needs, priority thematic areas include:

a. Best practices for field data collection and EO products validation;
b. Best practices for yield monitoring and forecasting (agro-meteorological modelling, remote sensing based methods, SAR);
c. Crop mapping and crop masks (SAR, optical, merged methods);
d. Improving Agricultural Statistics systems (Area sample frames, statistical methods integrated with remote sensing);
e. State and change of environmental impact of agriculture.

Deliverables will consist of documentation of 'best practices' that will inform global and national capacity building and the development of monitoring improvements.

8.5.4 Phased Approach

As of today, the phased approach for GEOGLAM R&D towards monitoring enhancements is basically divided into 3:

Phase 1 will concentrate on maintenance of the JECAM network and re-focusing efforts towards GEOGLAM requirements. Activities include a series of workshops to address regional and global JECAM activities held in conjunction with workshops to focus on GEOGLAM research needs. These could include national capacity enhancement, SAR for soil moisture monitoring, SAR for monitoring crops in tropical-subtropical regions, Sampling frameworks for agricultural monitoring and best practices for crop monitoring, as defined by the needs of the other GEOGLAM components.

Phase 2 and Phase 3 will focus on directed research funding for collaborative research in support of GEOGLAM priorities and the definition of best practices to advise the construction of the agricultural monitoring system of system in later phases of GEOGLAM.

8.5.5 Phases 1/2 Activities, Schedule and Budget

Table 13 JECAM Activities and budget category for Phase 1/2 (2013-2014)

Activity and Short Description	**calendar**	**Status**	**Institutions/ coordinating teams**	**Budget category**
1. Coordination and Networking				R&D best practices
1.1 **General coordination**. Ensure Communication and coordination between the JECAM sites	1/13-12/14	Ongoing	Canada, JECAM sites	JECAM coordination In-kind
1.2 **Annual JECAM Meeting.** Review of JECAM experiments and results	12/11/13 Canada	Planned	Canada, JECAM sites	workshops/R&D
1.3 **Support to JECAM database collection and preparation**. Develop a minimum standard data set for all sites, data pre-processing, harmonization, in situ database, documentation of data, support for data dissemination	2014-on	Planned	UCL, Canada	EO data
1.4 **JECAM.org Website**. Maintain/update website	01/13-12/14	Ongoing	Canada	JECAM coordination In-kind
1.5 **CEOS Meetings.** Coordination meetings with CEOS, to facilitate data JECAM data acquisition	As required	Ongoing	Canada	Workshops
1.6 **Regional JECAM Workshop**. Russia and Eastern Europe	11/13, Russia	Planned	IKI, Canada, JECAM sites	Workshops
1.7 **Regional Workshop**. Africa. Reviewing status of agricultural monitoring activities in Africa	11/13, Ethiopia	Planned	FP7, AGRICAB Project	Workshops
1.8 **Regional Workshop**. Africa. Reviewing status of agricultural monitoring activities in Africa	TBD, Niger, Kenya	Planned	FP7, AGRICAB Project	Workshops

1.9 **Additional Regional JECAM workshop**s. China, Europe, South America	TBD	Planned	Host organization, JECAM sites	Workshops
2.0 **GEOGLAM Research and development Towards Operational Enhancements**			In-kind and NPO from: Canada (AAFC and CSA), EC-FP7, UCL, IKI, VITO, SIGMA project, JECAM sites, new funding sources TBD	R&D Best Practices
2.1 **GEOGLAM Science Plan.** Develop the GEOGLAM research agenda by identifying knowledge gaps	01/14	Planned	Canada, UCL,VITO	R&D coordination
2.2 **GEOGLAM Coordination and Research Support.** Post-Doc to work with R&D component co-chair (Defourny)	13/14	Planned	UCL	R&D projects
2.3 **GEOGLAM Research Projects to address specific GEOGLAM needs.** Project funding based on directed research proposal call	13/14	Planned	Call for proposals	R&D projects
2.4 **Travel Support.** Funding to help post-doc, student travel costs to attend meetings and workshops	13/14	Planned		R”D projects
3.0 Standards and Best Practices for Global Agricultural Monitoring			Canada (AAFC and CSA), EC-FP7, UCL, IKI, VITO, SIGMA project, JECAM sites, new funding sources TBD	
3.1 **Scientific / Thematic Workshop.** Best Practices for Wheat Yield Monitoring and Forecasting	11/13, Russia	Planned	IKI	Workshops

3.2 Scientific / Thematic Workshop. Methods to generate dynamic crop masks	12/11/13 Canada	Planned	SIGMA EC-FP7	Workshops
3.3 Scientific / Thematic Workshop. SIGMA/JECAM workshop	Q4 2013, Brussels TBD	Planned	SIGMA EC-FP7	Workshops

Budget for components 4, 5 and 6 are embedded in the three main pillars. For clarification purposes, Canada will continue to support the overall JECAM coordination (USD 180 K, in kind). Thorough the EC FP7 there will be funds available for GEOGLAM research including staffing, coordination, workshops and travel support to many institutions and GEOGLAM teams.

8.6 Data, products and information dissemination

8.6.1 Background

Data and information dissemination are at the core of the GEOGLAM initiative. GEOGLAM will strongly promote timely and open sharing of the data, products and derived information from all components. A wide variety of data and information from multiple sources are required to effectively monitor the diverse range of agricultural systems at sub-national, national, regional and global scales. These data range from satellite and agro-meteorological observations, to cultivated-area maps, crop calendars, crop models, crop statistics, and soil-moisture measurements. Where possible, access to GEOGLAM data and information will be made openly available, recognizing that data generated through the national capacity-building component may be subject to national data policies. However, in principle, data sets developed through GEOGLAM support will follow GEO data principles. As mentioned under research coordination, dissemination can be optimized by taking advantage of the geographic and thematic specificities of GEO Agriculture CoP. For instance, CropWatch has broad experience with rice productivity and acreage estimation. Additional spatial specificity can also be achieved by involving some of the above-mentioned regional systems, such as AGRHYMET in CILSS countries and the SADC regional Early Warning System in Southern Africa.

GEOGLAM will work with the satellite data providers (primarily through CEOS), the national, regional and international agricultural monitoring agencies, meteorological agencies, and researchers to implement a phased, coordinated data and information dissemination approach.

8.6.2 Current Status

The GEO Ag CoP is focusing on organizing the GEOGLAM website with a design being already completed; also under development is the interface for the Global Crop Outlooks, in preparation for starting delivering monthly outputs to AMIS at the end of the third quarter (2013). In 2014, working as appropriate with the GEOSS Common Infrastructure (GCI) team, a dedicated GEOGLAM workshop will be held to develop the requirements and road map for the GEOGLAM information system. For this workshop effort will be made to involved other programs and organizations currently working in this area.

8.6.3 Objectives, Activities and Expected Outcomes

Activities in this component will include: a) Developing a detailed inventory of data (input, intermediate and output data) and methods currently available from the existing agricultural monitoring systems; b) Developing data processing standards, protocols and related metadata that enable the inter-use of data from various platforms, c) Working with the Earth observation data providers to develop, a system for management and dissemination of the Earth observation data required by GEOGLAM, d) Holding training workshops on model and data use, in coordination with

Component 2, and e) Disseminating crop condition outlooks and projections through AMIS, in coordination with GEOGLAM Component 1.

The outcomes will be the development of consistent data, products and information strategy

8.6.4 Phased Approaches

Phase 1 activities include the development of the dedicated GEOGLAM website and the interface for the Crops outlooks. Phase 2 (in 2014) will see an activity by a group between the GCI task team and GEOGLAM core team to develop a road map to build the information system.

8.6.5 Phases 1/2 Activities, Schedule

Table 14 Information system activities for Phase 1/2 (2013-2014)

Activity and Short Description Phases 1/2	**Calendar**	**Status**	**Institutions/ coordinating teams**	**Budget category**
1.1 Develop GEOGLAM website	2012-2013	Ongoing	Agri-food Canada, GEO Secretariat	Information system
1.2 Develop global crops outlooks interface	2012-2013	Ongoing	UMD/	Information system
1.3 Interface with the GCI task team to develop the overall information system	2014-2015	Planned	GEOGLAM coordination office and GCI task team	Information system

9 LOGIC MODEL FOR GEOGLAM IMPLEMENTATION AND FUNDING

Recalling the policy mandate given by the G20 Governments to GEO, to bring transparency on the main crop production across the globe through the sustained use of Earth Observation data, one can sate that a substantial progress has been made towards reaching this goal. Early demonstration of GEOGLAM added value success can be highlighted:

- MODIS data being made available in near real time to GEOGLAM COP through the LANCE system (NASA). Joint Polar Satellite System (NOAA/NASA) Visible Infrared Imager/Radiometer Suite, being made available globally and in near real-time to GEOGLAM (NASA under development);
- Establishment of a planning process for coordinated acquisitions and joint processing of LDCM and Sentinel 2 data (NASE, ESA under development);
- The GEO Agriculture Community of Practise (AG COP) working with WMO to improve in-situ rainfall observation distribution for Africa;
- Successful targeted national capacity enhancement efforts, e.g. in Pakistan, Argentina, Mexico, Australia, Russia, and Ethiopia;
- Prototypes for agricultural outlooks inputs for AMIS, as done with the Northern hemisphere and Southern Hemisphere crop conditions assessment in 2012;
- Routine inputs on Global crop outlooks to the AMIS market monitor starting in September 2103;
- Continuous development of best satellite based global cropland areas;

Though the document, one can find examples of current and potential national funding (including in kind) for GEOGLAM. More specifically the list bellow shows strong evidence of support and resourcing for the initiative:

- USA NASA's funded projects related to GEOGLAM operations: Global Soy Area Estimation, Drought monitoring system prototype and wheat Yield Forecasting prototype, and USDA's participation in Pakistan Capacity Building as well as USDA's GLAM operations with NASA;
- Canada will continue to support the JECAM office and might consider seconding staff to the Geneva's GEOGLAM office;
- France, through its Ministry of Agriculture, undergoing final arrangements to second a senior expert (P5 level) for GEOGLAM Coordination office, starting September 1st;
- Mexico and Argentina will continue to support in-country's capacity development;
- Argentina is in the process of setting up a GEOGLAM office to develop the country's capacity and indicate the country's readiness to participate in the development of a regional GEOGLAM effort;
- Brazil, through CONAB, has indicated the country's intention to continue developing its EO Agricultural crop monitoring in collaboration with GEOGLAM partners;
- China has indicated the country's intention to support GEOGLAM coordination office next year, through MOST, in addition to the country's engagement with resourcing CropWatch;
- Germany is in a process of internal coordination with regard to GEOGLAM's funding.

And at regional level:

- The EC funded MARS project is expanding its geographical scope, and participates in many Capacity Development activities;

- European Commission has selected, through a call of 9 Million Euros in the FP7 framework, a proposal (and is undergoing final negotiations) to support GEOGLAM related environmental activities;
- The new GEOGLAM Asia Rice Monitoring initiative (www.asia-rice.org) lead by JAXA for JAPAN with some activities funded from the Asia Development Bank;
- The GATES Foundation has indicated strong interest in supporting EO capacity development Activities in Africa;
- The World Bank has indicated potential interest in supporting GEOGLAM projects should it be requested by the G20 members.

The logic model for full GEOGLAM implementation and funding being worked out by the GEO Agricultural Community of Practice includes the following steps and activities, with some running in parallel:

- Setup of the GEOGLAM coordination office with seconded/hired staff to be initially co-located with the GEO Secretariat in Geneva, formed by a Program Coordinator, a dedicated expert (P3 or P4) and a staff assistant;
- Setup distributed regional offices to coordinate the GEOGLAM Components. Further planning and coordination needed for this, but preliminary discussions are underway For example USA for Global Component Office; FAO for Capacity Development; EC (JRC) for Food Security and Countries at Risk, Canada for R&D (JECAM), Asia (Asia-RiCE), Australia (rangelands), South Africa (SADC) and South America (Brazil, Argentina);
- Setup up the Implementation Group nominating representatives from the components teams;
- Continue building on national contributions from current and/or new projects, until substantive fund raising activities are in place with the dedicated Program Coordination office;
- Initiate full budget program/proposal development and fund raising activities by the program coordination office working close with the Coordination Group.

Although, detailed budget proposal development will start once the Coordination Office is in place at the GEO Secretariat, it is anticipated that new funding is required for the office itself as well as for the distributed Component Offices (can again include in-kind funding), capacity development targeted workshops and outlook synthesis and coordination. The initial figures are as follows:

- Establish GEOGLAM Coordination Office (US$800 K/year, including staffing and in-kind support);
- Implementation Team Lead Activities (distributed Component Coordination Offices – US$250K/year each), likely to be funded by projects (example, prospect of a USDA funded office to manage the country's participation in the Global systems);
- Core Support for Developing Country Workshop Participation – seed money for workshop follow-up (US$ 300K/year in P1 and P2 in addition to in-kind ongoing and planned workshops to advance capacity development and food security issues);
- Outlook Synthesis and Coordination (US$ 500K/year), with dedicated staff.

The ballpark proposed budget for GEOGLAM is in Table 14. The costs are indicative and include in-kind and new funding needs though projects and in-country expenditures. Once the GEOGLAM governance model is implemented and starts operating according to its Terms of Reference (TORs), the coordination office will, working with the components coordination group, establish a process for refining the budget as a fund raising step. It is anticipated that Coordination Office is the primary new need concerning the GEO Secretariat Trust Fund.

Table 15 - GEOGLAM Implementation proposed budget (Indicative cost breakdown on the 3 pillars with cross-cutting imbedded)

		Phase 1	***Phase 1***	***Phases 1 /2***	***Phase 2***	***Phases 2/ 3***	***Phase 3***	***Total (Mio US$)***
	Activities/ deliverables	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Global / regional systems (main producers & commodities)	Prototype outlooks	0.5	0.5	0.5				**1.0**
	Harmonized annual crop outlooks		0.5	1.0	1.0	1.0	1.0	**4.5**
	Asia Rice Pilot Studies	0.4	1.0	1.0	1.0			**3.0**
	Asia Rice Forecasts/production	0.2	0.3	0.3	0.3	1.0	1.0	**2.9**
	Information System	0.1	0.1	0.1	0.1	0.1	0.1	**0.5**
	R&D Forecast	0.1	0.1	0.2	0.3	0.2	0.1	**0.9**
	Workshops		*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	**1.0**
Sub total		**1.3**	**2.7**	**3.3**	**2.9**	**2.5**	**2.4**	**13.8**
National development (EO data into crop monitoring systems)	Regional assessments	0.1	0.5	0.6				**1.1**
	Crop area mapping	0.2	0.5	0.3	0.3	0.3	0.2	**1.5**
	Workshops	0.2	*0.2*	*0.2*	*0.2*	*0.2*	*0.1*	**0.9**
	EO datasets (Satellite, met, in situ)	0.5	0.6	0.9	1.2	1.2	0.9	**4.8**
	Infrastructure			0.7	1.5	1.5	0.9	**4.6**
	Agromet data			0.2	0.2	0.2	0.2	**0.8**
	Information System		0.1	0.1	0.1	0.1	0.1	**0.5**
	R&D Best Practices	0.2	0.2	0.2	0.3	0.3	0.2	**1.2**

		Phase 1	*Phase 1*	*Phases 1 /2*	*Phase 2*	*Phases 2/ 3*	*Phase 3*	*Total (Mio US$)*
	Activities/ deliverables	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	
Sub total		**1.2**	**2.1**	**3.2**	**3.8**	**3.7**	**2.6**	**15.4**
Countries-at-risk (Food security)	Global gridded rainfall	0.2	0.3	0.3	0.3	0.3	0.3	**1.5**
	MODIS ET maps	0.2	0.2	0.2	0.2	0.2	0.2	**1.0**
	Water Stress Index Maps	0.2	0.2	0.2	0.2	0.2	0.2	**1.0**
	Workshops	0.1	*0.2*	*0.2*	*0.2*	*0.2*	*0.2*	**1.0**
	EO datasets (Satellite, met, in situ)	0.5	0.6	0.6	0.8	0.6	0.6	**3.6**
	R&D best Practices	0.1	0.2	0.2	0.3	0.2	0.1	**1.0**
	Information System		0.1	0.1	0.1	0.1	0.1	**0.5**
Sub total		**1.3**	**1.8**	**1.8**	**2.1**	**2.2**	**1.7**	**9.6**
Secretariat	**Program development Staffing (P5, P3+G)**	**0.3**	***0.5***	***0.8***	***0.8***	***0.8***	***0.8***	**3.7**
Total Mio US $		**4.1**	**7.1**	**9.1**	**9.6**	**9.2**	**7.5**	**42.5**

- Phase 1 2012 are past cost inferred by participants on their (in-kind) participating at the activities outlined (not added to the total budget).
- Budgets will be adjusted on a case by case with each funder separately - according to needs, their interests and funds available.