



GEO GROUP ON EARTH OBSERVATIONS



Agriculture and Agri-Food Canada



Linking U.S. Agriculture to the World



GEOSYS



STRENGTHENING GLOBAL AGRICULTURAL MONITORING

Improving Sustainable Data for Worldwide Food Security & Commodity Market Transparency

Proposal “The G20 Global Agricultural Monitoring” initiative
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This document reflects the vision, opinion and expertise of its co-authors and not necessarily those of their institutions.

1. State of the art and current situation

Instability in the food supply and demand balance; market uncertainty and price volatility

The world's population has increased by 130% during the last 50 years, from an estimated 3.0 billion in 1960 to 4.4 billion in 1980 and 6.9 billion in 2010. The United Nations projects that it will increase by 0.8% per year to reach 9.2 billion people in 2050. Population densities and demographic trends, however, vary greatly from one region to the other.

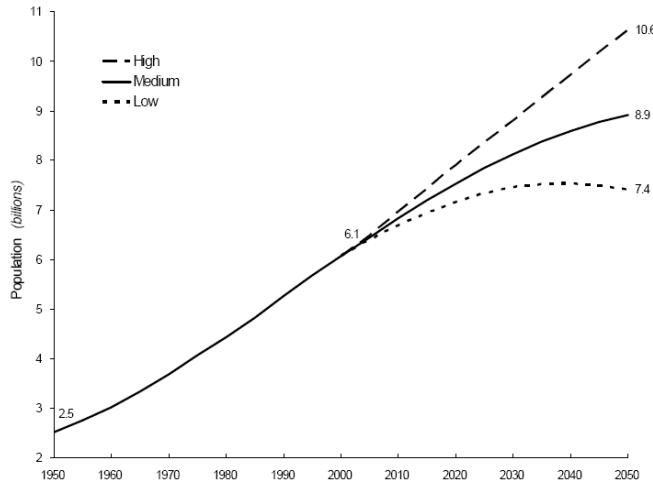


Figure 1 : Estimated world population, 1950-2000, and projections : 2000-2050 (source UNO 2004, report on world population to 2300)

Food demand is driven by population size and consumption habits, which in turn are influenced by culture and standards of living. Average food consumption varies from 4,000 Kcal per person per day in OECD countries to 2,500 Kcal in Africa (2003 data), compared to a recommended nutritional threshold of around 2,700 KCal. According to the UN Food and Agriculture Organization (FAO), an estimated 923 million people are seriously undernourished (2007 data) (Figure 4). In addition to providing food and feed (animal), agriculture also generates products for the energy (biofuels), materials (wood, fibres, textiles) and chemicals industries. The competition among these sectors (4F : Food, Feed, Fuel and Fiber) for agricultural resources is increasing.

The agriculture sector faces new and emerging challenges to meeting the demands of growing populations for an ever-broader spectrum of agricultural products. Estimated crop production in 2003 was 2,625 Mt (of which 62% glycids, 24% lipids, and 14% proteins). However, at the global level agricultural production is marked by high temporal and geographical variability.

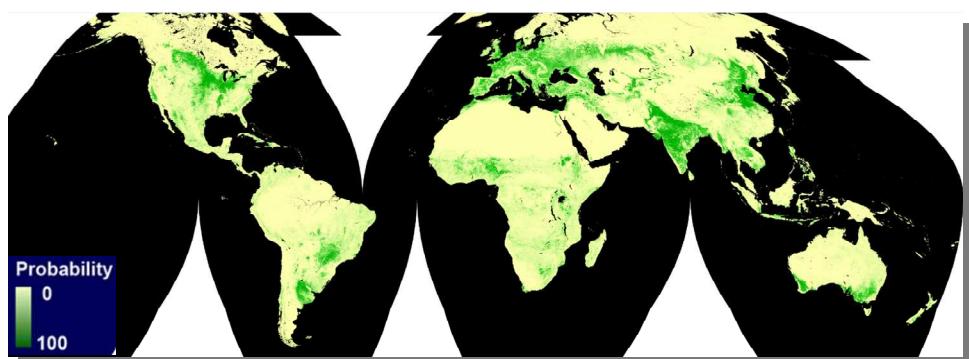


Figure 2 : Global distribution of croplands by cropping intensity (Hansen et al, GLAM SDSU)

This variability reflects the main constraints that influence agriculture: arable land availability, climate conditions, pest control, competition between crops (economic drivers), production systems and associated technical practices, agricultural policies, the investment capacity of farmers, and education (Figure 2; Figure 3). Furthermore, its evolution over the past 40 years shows specific trends for the various continents.



Figure 3 : Countries producing over 80% of world agricultural crops (source Reynolds, USDA-FAS)

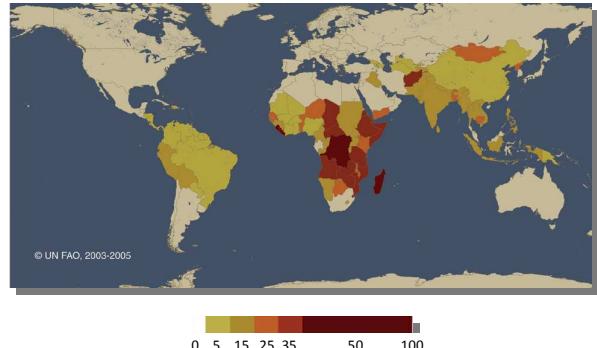


Figure 4 : Percent of population by country with insufficient food 2003-2005 (source UN FAO)

Annual international trade represents 7% of the annual production of rice, 18% for corn, 20% for wheat, 30% for soybeans. The general tension between offer and demand is the result of a number of long term (demography, reduction of global stocks) and medium term trends (development of biofuels, dietary change in emerging countries), aggravated by extreme climatic events, political decisions (trade barrier) or speculations on global market, and generate wide and sudden price variations in commodities markets, as observed in 2007-2008 (Figure 5).

As a general consequence, the global commodity markets become nervous a few months before main harvests (typically in June- July for Wheat and Maize, mainly produced in the northern hemisphere), and our global economy is strongly vulnerable to any major climatic event affecting one or several of the main “grain belts”. This was perfectly illustrated by the impact of the extreme drought which affected Russia in 2010, followed by floods in Australia, with their direct consequence on global market, but also on economy (impact on farms, state subsidies) with indirect consequences on Livestock, 2011 harvest .



1/ ERS calculations based on International Monetary Fund (IMF) average monthly world price quotes for wheat, corn, soybeans, and rice; aggregated by IMF's fixed historical exports weights.

Figure 5 : 2002-2010 monthly average Crop Price Index (aggregated wheat, corn, soybeans and rice) (source IMF)

Commodity price volatility affects local market price and the food security of the poorest households : since the first “tortilla” crisis (Mexico, 2007) food price inflation has recurrently created soaring food price crisis in the vulnerable countries where food represent more than 25-30% of most household’s livelihood, and contributed to the recent political crisis in a number of countries (Tunisia, Egypt, Yemen, Syria...). In 2008 the UN FAO declared a

global food crisis and held a Food Summit. The demand for grain imports is rising worldwide; for example, Saudi Arabia's cereal imports may reach a record this year, while Algeria, Morocco, Iraq, Bangladesh, Pakistan, Turkey and Lebanon all issued tenders to buy more wheat or rice in February 2011 as compared to the last year.

Further issues are compounded by changing food habits by several major countries, thus drastically adjusting food import dependence. China has boosted its demand for pork by 30 percent since 2000 and for beef by about 10 percent, while its population only increased by 5.3 percent in the same period (UN data). Similar trends in import growth are occurring in other emerging economies, especially for feed grains, driven by a shift in livestock, dairy and poultry production from small family farms depending on local-produced inputs to bigger and more energy and chemicals-intensive agro-industrial production. In turn this generates nearly total dependence on food trade, transport, and industrial inputs like pesticides, fertilizers and antibiotics.

Instability in the balance between supply and demand and increasing dependency on food trade have made commodity price volatility a vital issue for the world economy, as it affects food security and social stability, and is a disincentive for long-term investments, which need reasonably stable price. Uncertainty, exacerbated by the lack of transparency in commodities markets and of reliable forecasts of agricultural production, reinforces price volatility, aggravated by inappropriate policy decision (trade barrier, export bans) and the behaviour of diverse stakeholders that often reinforces ongoing upward or downward price movements.

Agricultural monitoring as a tool for strengthening food market transparency

Ensuring the full and open exchange of timely data and information about crop status, crop-yield forecasts and food-commodity supply predictions can lower uncertainty and increase the transparency of global food supply. The enhanced understanding of global production will contribute to reduced price volatility by allowing local, national and international operators to make decisions and anticipate market trends with reduced uncertainty. This is also a prerequisite for the definition and monitoring of any agricultural policy.

State of the art of agricultural monitoring

Large-scale monitoring of agriculture and crop-yield forecasting generally rely on three pillars: (i) regionalized analyses of cultivated areas, crop type distribution and crop condition based on near-real-time satellite imagery merged with available in-situ observations; (ii) meteorological monitoring and mid-term forecasts based on observation networks and model outputs; and (iii) regionalized knowledge of agricultural systems and their sensitivity to meteorological conditions.

Earth observation data provided by advanced satellite constellations are currently used at the global scale for meteorological forecasts and natural-resource monitoring, and some actors have already developed operational geoinformation applications for global agricultural monitoring. Various programs and systems, either public or private, currently generate crop yield forecasts at the national, regional or global scales¹. These programs differ in their objectives, geographical focus, methods used, timing of information release, and dissemination policy.

Key deliverables of these programs generally consist of (i) early estimates of cultivated areas, crop groups and crop-types distribution; (ii) meteorological syntheses of the monitored

¹ Some examples : Crop Explorer (<http://www.pecad.fas.usda.gov/cropexplorer/>); GIEWS (<http://www.fao.org/giews/english/index.htm>); MARS (<http://mars.jrc.ec.europa.eu/>); CropWatch (<http://www.cropwatch.com.cn>);

situation and the scenario forecast; (iii) early crop-yield estimates; (iv) early-warning indicators to detect and communicate emerging anomalies and potential future production difficulties; and (v) agricultural statistics to provide information about trends and changes.

International efforts needed to improve national and global agricultural monitoring

There are today a small number of global agricultural monitoring systems in place and a large number of national monitoring capabilities in different stages of development. The practical expertise for monitoring is found in these institutions that have demonstrated an operational capacity for providing such services. In addition, a number of research organizations and institutes are involved in developing basic research and, in some cases, transitioning proven methods into the operational domain.

However, the potential for further improvement of national and global agricultural monitoring capacity is high, and it raises various challenges.

First, key questions, both generic and region-specific, require coordinated research efforts: how can we develop early estimates of crop type and planted area using satellite imagery observations? how can we improve crop yield and production estimates taking into account knowledge about agricultural systems, meteorological information and forecasts, and near real-time satellite observations? how can we optimize the linkage between field observation networks and satellite imagery? how can we quantify uncertainties in estimates and forecasts?

Second, sharing of experience and capacity building is a major issue. Representatives from the various organizations and institutions interested in enhancing international monitoring capabilities around the world, including the Food and Agriculture Organization (FAO) and the World Meteorological Organization (WMO), comprise the ***GEO Agricultural Monitoring Community of Practice***, that was created in 2007 by the intergovernmental Group on Earth Observations (GEO²) in the framework of its Agriculture Societal Benefit Area.

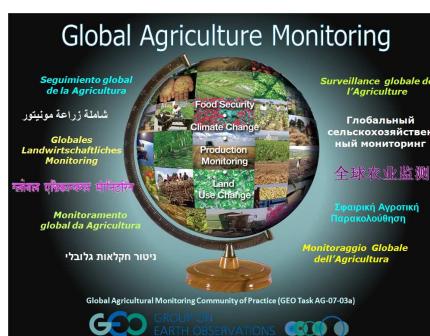


Figure 6 : GEO Agricultural Monitoring Community of Practice

This Community of Practice is fostering increased communication, sharing of experience and engaging institutions in building capacity around the world, through international and bilateral cooperation. The approach advocated by GEO is to implement a multilevel program consisting of a suite of activities aimed at enhancing current monitoring capabilities at the national and global levels and developing new national monitoring capabilities when none are

² GEO is a partnership of governments and international organizations that is coordinating efforts to build a Global Earth Observation System of Systems (GEOSS). It was established in February 2005 by the Third Earth Observation Summit in Brussels in response to calls for action by the 2002 World Summit on Sustainable Development and the Group of Eight (G8) leading industrialized countries. GEO promotes the full and open sharing of data, international collaboration, capacity building and the development of information products and services for decision makers (see www.earthobservations.org).

available. The aim is to build on existing structures and collaborative mechanisms where they are available and effective.

Third, ensuring timely, open and free access to reliable, relevant and spatialized data, is a necessary condition for the full deployment of a global agricultural monitoring capacity. Therefore creating an operational global agricultural monitoring system of systems (satellite and in situ) and ensuring it sustained operation is a major challenge.



Figure 7 : Coordinating satellite Earth Observation strategy for global agricultural monitoring

Due to its skills, international expertise, established coordination system, and strength in Earth observation, GEO is a potential focal point for the next step of any initiative in the domain. Strengthening these applications and actors, and engaging them through an international collaborative network, could contribute significantly to developing the capacity for increased transparency for agricultural and food commodity markets worldwide.

The GEO Global Forest Observation Initiative (GFOI) now under development demonstrates how GEO can stimulate the kind of international cooperation required to establish ambitious global monitoring systems. The GFOI is supporting governments in their efforts to establish national forest information systems by providing access to sustained satellite and ground observations. Consistent with the approach of the UN Climate Change Convention, the Initiative aims to assist governments in processing and analyzing the data using their own models and standards. These data and analyses will make it possible to generate reliable, consistent and comparable reports. The development of the Initiative is being led by governments with a strong interest in forest carbon monitoring; they are Australia, Canada, Japan and Norway. Other key contributors include the Food and Agriculture Organization of the UN (FAO) and GOFC-GOLD (Global Observation of Forest and Land Cover Dynamics).

2. The added-value of this G20 initiative

Building on the experience of the members of the GEO Agricultural Monitoring Community of Practice, an international network of national, regional and global agriculture monitoring capabilities, resources and organisations will be developed based on state-of-the-science and continuously improved methods for crop monitoring. A sustainable Earth Observation infrastructure designed to meet the needs of the agricultural monitoring community will bring a significant added value through more accurate forecasts, wider dissemination of information and, eventually, increased stakeholder awareness.

Improved national and global agricultural monitoring and crop yield forecasting capacity:

Development of satellite Earth observation infrastructure combined with advances in scientific research and international cooperation on crop monitoring methods will enable continuous improvements on key technical issues such as early estimates of cultivated areas, early identification of crop types, and the design of crop yield scenarios and forecasts. The quality of crop-yield forecasts will increase as various time series and satellite and in situ monitoring data are integrated. In particular, Earth observation data and derived products will contribute to strengthening agricultural statistics and developing better understanding of the impacts of meteorological scenarios on crop production.

Increased stakeholder awareness and capacity to use this information :

The state of agricultural monitoring varies greatly from country to country. In many cases, capacity building is needed at the national level to improve agricultural monitoring techniques and infrastructure. The GEO approach is to build networks of practitioners at the broad regional level so that they can share experiences and methods suited to more local national needs. These networks will provide key knowledge relevant to regional agricultural systems, their production capacity, their trends and sensitivities to meteorological and pest scenarios. Through national and regional stakeholder networks practitioners will rapidly collect information on specific events and phenomena that can impact local or regional agricultural production (changes in practices, meteorology, pests, etc). This will result in:

- (1) an enhanced capacity to mobilize and integrate in situ data, field observations, enquiries and declarations, thereby contributing to the increased quality of crop-yield forecasts;
- (2) stronger support by governments, enhanced trust, and a greater regional and global collaboration;
- (3) the stronger involvement of local operators and stakeholders through training, dissemination, and informed decision making;
- (4) the identification of specific global and regional information and capacity-building needs; and
- (5) increased cooperation between space agencies and enhanced Earth observation capabilities for agricultural monitoring.

Improved transparency on agricultural crop production, international coordination and risk-management capacity

Based on improved agricultural monitoring, crop-yield forecasting, information transparency, dissemination of results, and capacity building among stakeholders, actors from both the public and private sectors can adapt and fine-tune their own strategies based on a comprehensive vision of the international situation.

Furthermore, the network structure will help public actors at the national, regional, national and global levels to interact and coordinate their actions and harmonize their strategies in order to face extreme situations and changing markets.

3. Objectives of the initiative and results expected

The objective of this initiative 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. This will be achieved by:

- **enhancing national agricultural reporting systems, including through a global geo-spatial education curriculum to ensure training of participants worldwide;**
- **establishing a sustained international network of agricultural monitoring and research organisations and practitioners; and**
- **creating an operational global agricultural monitoring system of systems based on both satellite and in situ observations.**

This objective will be achieved through a sustained international network of agricultural monitoring organisations and practitioners building on existing initiatives at national, regional and global levels. This international network will mobilize satellite and meteorological data, and in situ agricultural observations, advocating for free and open data sharing. In addition, it will improve agricultural analyses and modelling techniques through shared geoinformation technologies in coordination with established knowledge about regional agricultural production systems and in situ observation.

All agricultural regions around the world will be involved, with some national and regional organizations operating as focal points for cooperation with enhanced networks of local scientific and technical resources.

The international network of agricultural monitoring organisations will have five main missions:

- to produce early estimates of cultivated areas and crop-type distribution at national, regional and global scales;
- to produce meteorological syntheses and short-term and mid-term forecasts;
- to produce agricultural monitoring syntheses and regularly updated crop-yield forecasts, with quality assessment;
- to disseminate these data and contribute to stakeholder awareness of their interest in meeting national needs, and to stakeholder training for their use and analysis; and
- to contribute to the development of improved monitoring and forecasting methods, through research development and experience sharing.

International coordination amongst space agencies to support the design and implementation of an operational satellite observing system for agricultural monitoring, similar to the one being designed and developed for the GEO Global Forest Observation Initiative, will be a key component of the project. The global observing system for agriculture must reach operational standards similar to those currently used in meteorology and oceanography.

Major actors such as FAO, CGIAR, national and international space agencies, CEOS, and WMO will also need to play key roles in the dynamics of this GEO-coordinated network.

4. Actions to be developed

The G20 initiative to strengthen agricultural monitoring at national and global scales in order to increase the transparency of food markets will build upon advances already achieved by the Group on Earth Observations, particularly through its Task on the Global Agricultural Monitoring System.

The initiative will be implemented through three main actions:

Action 1. Strengthening national capacities for agricultural monitoring including capacity building, sharing of experience, research development, institutional strengthening and facilitated access to Earth observation data.

Action 2. Harmonizing, connecting and strengthening of existing regional and global agricultural monitoring systems and boosting confidence in their results by inter-comparing and disseminating their information.

Action 3. Developing an operational global agricultural monitoring system of systems, based on sustained and coordinated satellite and in-situ systems for Earth Observation and weather forecasting with a free and open access data policy and a commitment to continuity.

Action 1 and 2 are fully complementary. Strengthening national capacity to monitor agriculture (Action 1) will allow the community to improve the quality of monitoring and forecasting and raise the awareness and involvement of stakeholders as well as their use of information. Establishing harmonized regional and global agricultural monitoring systems (Action 2), will allow the international community to make the overall system more homogeneous, robust and responsive, resulting in more reliable and defensible information for policy makers.

Action 1. Strengthening national capacities for agricultural monitoring including capacity-building, sharing of experience, research development, institutional strengthening and facilitated access to Earth Observation data.

The project will build and bring support to an international network of agricultural monitoring organisations, practitioners and researchers to develop national and regional capacities for providing real-time information on agricultural production, including cultivated area, the spatial distribution of crops and crop-yield forecasts.

Regional networking of these national actors, sharing of experience and capacity building where relevant will allow disseminating and strengthening the use of standardized and validated techniques based on regional agricultural expertise, field observation data, satellite imagery, weather forecasts, statistical analysis and modelling. Access to Earth Observation data (see Action 3) will be facilitated. The project and network will function on the basis of a full and open exchange of data, both input data –facilitating access to Earth Observation data- and output data –ensuring international sharing and dissemination of results-.

Developing at national scale the technical capacity to monitor agriculture and to forecast crop yields will make the required information on agriculture available for stakeholders and decision-makers. Beyond information availability, further steps are required to make information readily accessible. Steps to achieve this include the open dissemination of

information and the enhancement of stakeholders' capacity to make proper use of the information products for developing relevant and effective strategies, policies and programs.

Although a few regional communication structures are in place for example for periodic assessments of seasonal forecasts, these could be significantly strengthened and expanded. Strengthening or establishing networks of regional stakeholders, from both the public and private sectors, and stimulating collaborative regional and global situation analyses will play a key role. Risk management, linked with both climate variability and international trade, will be a particular focus.

Action will consist of:

(1.1) defining the framework, missions, rules and resources for the establishment of an international network of national and regional agricultural monitoring organisations (including capacity-building, sharing of experience, research development, institutional strengthening and facilitated access to Earth Observation data).

(1.2) implementing the network starting with existing active national entities, and structuring the network at sub regional, regional and continental levels

(1.3.) defining and implementing national and regional strategies for the dissemination of agricultural monitoring information, for stakeholder networking, awareness rising and capacity building

Deliverables:

- Inventory of active agricultural monitoring organisations, the techniques they use and their dissemination strategies;
- Capacity- building strategy and products to support this strategy (including a global geo-spatial education curriculum to ensure training of participants worldwide);
- Regional networks of national agricultural monitoring organisations, sharing of experience (workshops), sharing of research programmes results, institution strengthening
- Support to the development of new national and/or regional capacities for agricultural monitoring when requested

Action 2. Harmonizing, connecting and strengthening of existing regional and global agricultural monitoring systems, increasing confidence in the results through inter-comparison and disseminating information.

While Action 1 is dedicated to strengthening national agricultural monitoring capacities, Action 2 will aim at harmonizing, connecting and sustaining existing regional and global agricultural monitoring systems by (i) supporting and networking groups that ensure regional and/or global agricultural monitoring and disseminating their results, (ii) strengthening and coordinating research and development efforts at international level.

(1) Support to groups ensuring regional and/or global agricultural monitoring.

Results provided by a few global monitoring systems will allow (i) to ensure the robustness of the international data production system, even in case some countries stop providing their monitoring results, (ii) to evaluate and characterize the level of confidence of results by inter-comparing results provided by independent systems, (iii) to create a an international dynamics

both in terms of improvement of methods and in terms of analysis of agricultural monitoring information. The project will support these systems and contribute to their synergy.

Based on the resulting products, international networking of stakeholders, public and private, regional and international, will allow developing collaborative analyses of regional and global situation. A particular focus will be dedicated to risk management, linked both to climate variability and international trade.

(2) Strengthening international scientific research for agriculture monitoring.

Basic and applied research supported by modelling, field studies and satellite observations, is needed to provide an improved understanding of global agricultural land use, productivity, and food supply in the context of global change.

Testing the performances of monitoring methods: A number of approaches and methods for monitoring crop conditions and modelling yield predictions have been developed for different crop types and cropping systems. The Agricultural Monitoring Community of Practice is developing best-practices documents. In order to test the performance of different methods and data types in various cropping systems around the world and to evaluate new sensing capabilities, the GEO Agricultural Monitoring Task has established the Joint Experiments on Crops and Agricultural Monitoring (JECAM), a network of distributed regional experiments. It will facilitate the inter-comparison of monitoring and modelling methods. In research terms, JECAM could be seen as providing a microcosm of what the operational global agricultural monitoring capacity can be. Open issues that require specific research include the early identification of crop type, estimation of evapotranspiration and early estimation of crop yield.

Improving crop yield forecast capacity: Crop-yield forecast usually result from regional-scale statistical relationships between meteorological data and crop yield data. Integrating satellite data with in situ network data and assimilating them in crop-growth models is an alternative, spatially explicit approach that needs further scientific developments.

Developing satellite based sensors and techniques: Although emphasis from this initiative is on developing robust operational observing systems, continuous R&D is needed to develop and validate new satellite-based sensors and techniques for monitoring crop growth (particularly on the fusion of optical, microwave, thermal data) and measuring and mapping soil moisture conditions and evapotranspiration. Increased research is needed to test these sensors and the associated analysis methods and techniques on different cropping systems.

Action will consist of:

(2.1.) supporting regional and global agricultural monitoring systems by coordinating the inter-comparison of results and evaluation of information consistency and confidence levels; designing and coordinating the dissemination strategies of the resulting information;

(2.2.) defining and implementing stakeholders' networking strategies at international level; ensuring the transfer of results from the global level to regional and national levels,

(2.3.) defining requirements for international programmes to support experiments and research activities in global agricultural monitoring; implementing these programmes and supporting the dissemination of their results.

Deliverables:

- Regional and global scale agricultural monitoring results (early information on planted areas by crop-type, and yield forecasts)

- Inter-comparison of results from the various global monitoring systems; analysis, evaluation and characterization of confidence levels
- International research and experiment programmes; dissemination of results
- International networking of stakeholders from the agricultural sector

Action 3. Developping an operational global agricultural monitoring system of systems, based on a sustained and coordinated Earth Observation satellite (this will involve commitments to specific orbiting frequencies, swaths, spatial resolution, spectral characteristics, acquisition and open data policies) and in-situ systems, weather forecast data, with a free and open access data policy and continuity commitment.

The capacity for satellite monitoring of agricultural land is currently affected by the limited availability of satellite data at the appropriate spatial and spectral resolutions at critical times during the growing season. For example, the growing cycle of major crops is about 100 days long and its temporal monitoring requires high repetition rate (daily to weekly). Land use in some regions presents highly fragmented patterns and its spatial monitoring requires high resolution imagery (10 to 20m) with sampling at fine resolution (1 to 3m). Crop identification and vegetation-dynamics monitoring require specific spectral information (visible, near-infrared, mid-infrared, thermal infrared and, in areas of high cloud cover, microwave).

This action will aim at developing a satellite system of systems for global agriculture monitoring, similar to what exists in the domains of meteorology and oceanography. The GEO Agricultural Monitoring Task is providing a comprehensive review of the observation requirements and guidelines for the acquisition of coarse, moderate and fine spatial resolution satellite observations to meet agricultural monitoring needs. A strong coordination effort of space agencies (through GEO working with the Committee of Earth Observation Satellites, CEOS) is needed at the global level for providing an operational commitment for timely coverage of agricultural regions worldwide. Similarly, applied research is needed to develop effective near real-time data streams from the current and future satellite systems.

In the domain of meteorological data, national and regional meteorological agencies and WMO are expected to make available observation and forecasting data for agricultural forecasting, particularly in food-insecure regions, with an emphasis on Africa (WMO).

In the domain of in-situ agricultural data these observation will remain national with definition of sampling networks where data can be shared at regional and global level between partners of the agricultural monitoring network.

Action will consist of:

- (3.1) defining a roadmap for international coordination among space agencies on the design and implementation of a satellite observing system covering agricultural monitoring needs, and on ensuring its long-term operation (30 years).
- (3.2) implementing this roadmap and establishing data policies that will enable global agricultural monitoring
- (3.3.) in a transitory phase, requesting national and international space agencies to provide the optimum acquisition for data from current sensing systems and to ensure that the needs of agricultural monitoring are considered in the development of new space assets.
- (3.4) setting access rules to meteorological data and forecast, and agricultural in-situ observations.

5. Governance, role and implication of the different partners

The approach to be adopted by this initiative will be to build upon existing capacities and structures, particularly at the national and regional scales (such as the Government of Canada, IRD, Cemagref, the University of Maryland and the EC's Joint Research Centre), and to develop new capacities where they do not currently exist.

Major actors such as FAO, CGIAR, CEOS, the world's space agencies and WMO should play key roles in the international dynamics of this network. GEO could serve as the coordinating mechanism.

If the G20 Ministers of Agriculture agree to this initiative, a full proposal identifying activities, actors, budget, timelines and deliverables will be further defined at a dedicated workshop to be held by September 2011.

Governance

Specific roles and responsibilities of the various actors participating in this initiative will be identified at that time. Our vision at this stage is that the proposal is to be coordinated by the intergovernmental Group on Earth Observations secretariat hosted by WMO in Geneva. GEO has proved its ability to coordinate international collaboration in the domain of agricultural monitoring and gather the main actors of the domain, including FAO, Space Agencies and national agricultural monitoring organizations. The project will be closely articulated with the G20 AMIS (Agricultural Market Information System) project through a GEO-FAO agreement.

6. Costs Figures

As stated above, the impetus for this initiative is to contribute to reducing the volatility in food markets. The approach is to improve global agricultural monitoring, leading to better information and increased transparency in agricultural forecasts and statistics. This proposal complements the G20 AMIS proposal, which is focused on improving market information.

G20 will help in defining the objectives of the initiative, in providing it with political support, in mobilizing resources necessary for its preparatory phase (2011-2012) and in supporting open Earth Observation Data Sharing Principles.

The funding of the overall project (2012-2017) is not the responsibility of the G20. It will be gathered from dedicated national and international funding agencies.

Preparatory phase (2011-2012)

Based on the present proposal, building a detailed international programme for global agricultural monitoring, involving all interested G20 countries, national, regional and international stakeholders of the agricultural domain, space agencies and meteorological organisations, requires an in-depth preparatory work.

Coordinating this preparatory work, informing and involving main actors, securing the budget for the overall project (see estimate below) will require the organisation of workshops (regional and international) and dedicated contacts with funding agencies during the mid-2011 / mid-2012 period.

The **necessary budget for this preparatory phase is estimated 120 KUS\$.**(missions 70 K\$; workshops 50 K\$).

G20 countries can support this preparatory phase both by direct contribution to the budget and by funding the participation of their national experts and representatives.

Expectations are also that G20 countries will commit to provide, as in-kind contributions through their space agencies, the necessary satellite data for all countries involved. Satellite data for the project should be regarded as public good data, considering the need to evolve towards the Data Sharing Principles established by GEO members and acknowledged by Ministers at the GEO Summit in Beijing (2010).

The necessary remote sensing data include (this list is not exhaustive of all possible satellite resources) LANDSAT series (USA), Spot 4/5 and next generation (FRANCE), Resource Sat series (INDIA), CBERS series (CHINA and BRASIL), RADARSAT (CANADA), ENVISAT and SENTINEL (next ESA generation, Europe), Rapid Eye (GERMANY) and next generation, JAXA L-Band and multispectral sensors (JAPAN).

Budget estimate for the overall Project (2012-2017)

The proposed strategy for implementing the global agricultural monitoring initiative is articulated in 2 components :

- during the first three years (2012-2014) activities (Actions 1, 2 and 3) will focus on the 26 countries that account for 80% of global crop production as of 2010, in order to optimize the efforts and reach the goals of the initiative (component 1). The emphasis will be on enhancing existing systems, including integrating in-situ and earth observation methods.
- then during the following three years (2015-2017), activities will be pursued on these 26 countries while a large spectrum of countries-at-risk will be included (Action 1), with a greater emphasis on capacity building for agricultural monitoring (component 2).

The **overall budget estimate is 48 000 K\$ for a 6 year period** (6500 K\$/y during the first 3 years ; 9 500 K\$/y during the following 3 years). The costs figures below are broad estimates. A more detailed budget will be developed following a planning meeting of the principles that will involve the UN FAO and will establish liaison with the complementary G20 AMIS proposal as appropriate.

Component 1 (Actions 1, 2 and 3)– Producer Countries (2012-2017)

Coordination : Community Planning and Coordination Initiatives (Workshops, Reporting)	400 K\$/y
Action 1 : Crop Production Initiatives (Monitoring System Enhancements (crop area, type, condition, yield forecast, reporting and evaluation) in major Producer Countries such as Brazil, Russia, Argentina, Ukraine) – needs assessments, integration of in-situ and satellite methods, targeted enhancements	3200 K\$/y
Action 2 : Crop Monitoring Data Inter-use initiatives a) JECAM Test Sites – data collection and methods inter-comparison b) Best Practices Development and Documentation for crop monitoring according to cropping system c) Production Acreage and Yield Statistics Inter-comparison	1500 K\$/y
Action 3 : Satellite Data Coordination and Access Initiatives (coordinated acquisition strategy, data access improvements, operational demonstration studies, data inter-calibration/ fusion)	1400 K\$/y
Total component 1	6500 K\$/y

Component 2 (Action 1)– At Risk Countries (2015-2017)

Action 1 : Regional Workshops (needs assessment, high level/management training)	300 K\$/y
Action 1 : Targeted national operational prototyping for crop area, type, condition, yield forecast, reporting and evaluation - (integration of in-situ and satellite methods, monitoring system and reporting enhancements)	2000 K\$/y
Action 1 : Enhanced distribution of in-situ meteorological network w. WMO	300 K\$/y
Action 1 : National Capacity Building – technical training	400 K\$/y
Total component 2	3000 K\$/y

7. Schedule

2011 May 2nd : Presentation of the G20 initiative during the meeting of the GEO Task team for AG-07-03 on Joint Experiments on Crop Area Monitoring (JECAM), Curitiba, Brazil

2011 May 11-12: Meeting of the G20 Agriculture representatives, presentation of the initiative on “Global Agricultural Monitoring”

2011 June 22-23: Meeting of the G20 Agriculture Ministers, presentation of the initiative on “Global Agricultural Monitoring”

Preparatory phase (mid 2011- mid 2012)

2011 September: An international workshop on “Strengthening agricultural monitoring at national and global scales to improve market transparency for food security” will be organised to finalize the definition of activities 1, 2 and 3 above.

2011 October:

- Definition of framework, missions, rules and resources for the establishment of an international network of national and regional agricultural monitoring organisations (Activity 1)
- Definition of international programmes in support to experiments and research activities in global agricultural monitoring (Activity 2)
- Establishment of Roadmap for international coordination of space agencies in the design and implementation of a satellite observing system covering agricultural monitoring needs, and ensuring its long-term operation (Activity 3)

2012 (January-June) : Contacts with main actors and funding Agencies to secure the overall project resources for a 6 year period.

Implementation phase (mid 2012- 2017)