AGRICULTURAL MONITORING IN THE AMERICAS: BUILDING A REGIONAL COMMUNITY TO REINFORCE NATIONAL CAPACITY TO USE REMOTE SENSING TECHNOLOGY FOR AGRICULTURAL DECISION-MAKING

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ABSTRACT

The Agricultural Monitoring in the Americas (AMA) Community of Practice is an open community composed of national and international agencies concerned with agricultural monitoring and food security in the Americas (from Canada to Chile). The AMA is the convening body of GEOGLAM Latinoamérica (G-LA) and the AmeriGEOSS Food Security & Sustainable Agriculture sister initiatives. Both initiatives focus on strengthening national systems' monitoring capabilities through the use of Earth observations (EO), as well as on fostering with-in-region international collaboration around research and development and operational implementation of monitoring tools for the main crops types and rangeland/pasture areas in the Americas. Through facilitating contact and coordination between researchers and decision-makers at the ministerial level, the AMA's implementing body (AMA-Working Group) uses EO data to confront challenges around food production, food security, climate change, and sustainable development. This brief paper details the origin, objectives, formation, status, activities, and future work of the AMA and AMA-WG since their early 2018 establishment.

Key words — Agriculture, Americas, Food Security, Earth observations, GEOGLAM

1. CONTEXT & INTRODUCTION

The Group on Earth Observations (GEO) is a coordination body that aims to enhance the use of Earth observations (EO) in environmental decision making through networks of government institutions, academic and research institutions, data providers, and expertise in industry. GEO's vision is to leverage the resources and experiences of these networks to create a Global Earth Observation System of Systems (GEOSS) that aims to maximize integration of existing observing systems and EO-based activities through the use of common standards, protocols, and infrastructures, while promoting free and open data policies [1]. Accomplishing this would reduce duplication of effort and strengthen the application of EO data in decision making. As an international program, the primary work of GEO is coordination across national activities associated with using EO for societal benefit. Recently, GEO launched regionalized efforts to implement GEOSS, for example in the Americas via AmeriGEOSS. The GEO Work Programme 2017-2019 places an emphasis on strengthening AmeriGEOSS as a means of reaching their broader programmatic goals [1].

Meanwhile, GEOGLAM was established in 2011, building off of the efforts of GEO's Agricultural Monitoring Task, and at the request of the French Ministry of Agriculture [2]. With the assumption that greater reliability and transparency of information on crop production will reduce speculation in the agricultural markets and therefore reduce price volatility and strengthen food security, the G20 Agricultural Ministers established GEOGLAM to, "coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections and weather forecasting data" (Agriculture Ministers Declaration, 2011; [3]). The G20 Agricultural Ministers have renewed their commitment to GEOGLAM, including recently under the Argentine presidency [4].

Different initiatives from the Group on Earth Observations Agricultural Monitoring Initiative (GEOGLAM), such as the GEOGLAM Crop Monitor for the Agricultural Market Information System and the GEOGLAM Crop Monitor for Early Warning, have demonstrated the importance and the value of connecting the remotely sensed EO scientific communities and the agricultural statistical and policymaking communities. EO communities provide knowledge and state of the science technologies to these communities, often bridging a gap that prevents the full utilization of all available information for key food security and food systems decisions. The agricultural statistics and economics communities in turn are empowered to provide improved information on food production outlooks and early warnings of crop failures, generating a virtuous circle that provides better tools for more accurate policy decisions. This positive synergy enhances the communication channels and provides a faster way of adopting new technologies.

While the success of GEOGLAM has been apparent globally, there remains incongruent adoption of EO technologies and participation in GEOGLAM at the national level. For example, while North America, Asia, Australia, and Europe have been well-integrated into the GEOGLAM program Executive Committee, the GEOGLAM Crop

Monitor activities, and the broader Community of Practice, there remain critical gaps in the Americas as well as in Africa. Brazil (through INPE and Conab) and Argentina (through INTA), in particular, have been long-time participants in GEOGLAM's success, signaling both the key capacities which exist in the region, as well as the relevance of Earth observations for agricultural decision making in those areas.

2. STRUCTURE & FORMATION OF THE AGRICULTURAL MONITORING IN THE AMERICAS COMMUNITY OF PRACTICE

To address these gaps and capitalize on the opportunities afforded by GEOGLAM, GEOGLAM Latinoamérica was established in 2015, with INTA-Argentina leadership. At the same time, AmeriGEOSS was established focusing on four societal benefit areas, including Food Security & Sustainable Agriculture. This simultaneous push signaled a strong community desire, but it was not until early 2018 that financial support was secured (under NASA NNH16ZDA001N-GEO), enabling the launch of a well-coordinated initiative to formally work toward the objectives of these two complementary thematic and geographic activities: the Agricultural Monitoring in the Americas (AMA) Community of Practice.

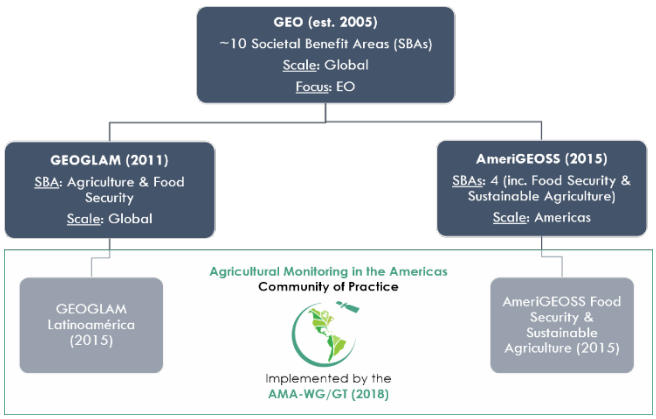

Figure 1. Where the AMA and AMA-WG fit within the structure of the Group on Earth Observations, GEOGLAM, and AmeriGEOSS

The AMA is an open community composed of national and international agencies concerned with agricultural monitoring and food security in the Americas (from Canada to Chile). The AMA Working Group (AMA-WG), like the larger GEO communities to which it contributes, focuses on strengthening national systems' monitoring capabilities through Earth observations (EO) as well as on fostering with-in-region international collaboration around research and development and operational implementation of monitoring tools for the main crops types and rangeland/pasture areas in the Americas. The objectives of the AMA are facilitating contact and coordination between researchers and decision-makers at the ministerial level. For this reason, the AMA Community of Practice is composed of individuals and institutions concerned with agricultural monitoring and food security, both from the community engaged in Earth observation data utilization ("EO-data users and analysts") as well as from the end user/stakeholder community who would be the audience for the information provided by EO (e.g. decision makers from farm to global scales, from food security to agricultural markets). The success of the GEOGLAM Crop Monitor activities has illustrated the impact of connecting communities across the decision chain (e.g. [5, 6]).

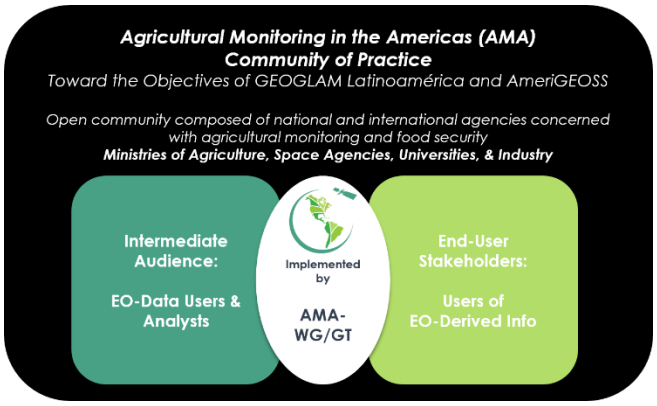

Figure 2. Schematic of the types of organizations which comprise the AMA and the AMA-WG.

3. AMA-WG OBJECTIVES

The AMA-WG develops and implements unilateral (within country), bilateral, and multilateral activities that support the following goals:

- *Build awareness and demonstrate value of EO:*
  - Increase awareness in the Americas around the potential and value of Earth observations in generating science-based information for decision makers from subnational to national scales in the realms of food security and agriculture;
  - Facilitate communication between economics, statistics, and EO communities, as well as between the scientific and the decision making communities.
- *Improve the State of the Science:*
  - Foster collaboration between institutes and individuals in the AMA Community of Practice, toward addressing critical research and development questions;
  - Gather national and regional priorities, gaps, and challenges related to agricultural monitoring, toward a current account of the state of science and state of use of EO for agriculture in the Americas, and develop implementation plans for addressing these priorities, gaps, and challenges toward enhancing operational EO usage in agricultural decision making at sub-national to regional scales;

- *Improve the State of the Use of EO:*
  - Establish processes and guidance toward developing capacities to "translate" the science into actionable information that is readily interpretable by a non-technical decision making audience;
  - Work to make available sufficient EO data for member usage.
  - Coordinate and organize regional meetings and training events related to increasing EO usage for agricultural monitoring.

Within the WG's first year (as of October 2018), membership has grown to include close to 20 participating organizations from 9 countries.

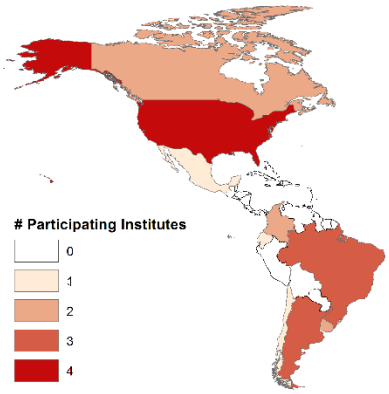

Figure 3. Membership distribution in AMA as of October 2018.

Participating institutes include (acronyms for brevity): INTA (Argentina), Ministerio de Agroindustria (Argentina), Bolsa de Cereales/Buenos Aires Grain Exchange (Argentina), Conab (Brazil), Embrapa (Brazil), INPE (Brazil), Agriculture & Agri-Food Canada, Carleton University (Canada), INIA (Chile), INIAP (Ecuador), IICA (international), IDEAM (Colombia), RED Colombiana de Agricultura (Colombia), SIAP-SAGARPA (Mexico), INIA (Uruguay), Ministerio de Ganaderia, Agricultura, y Pesca (Uruguay), USAID (USA), University of Maryland (USA), and NASA (USA).

4. CURRENT STATUS AND ACCOMPLISHMENTS

The AMA is led and coordinated by the GEOGLAM Secretariat with NASA Applied Sciences support. GEOGLAM-Latinoamérica is led by INTA-Argentina. For the participating countries, participation is voluntary and on a best-efforts basis and all contributions are considered in-kind. Most of the methods used by AMA revolve around establishing processes and guidance toward developing capacities to "translate" the science into actionable information that is readily interpretable by a non-technical decision making audience. AMA works to make available sufficient EO data for member usage, by leveraging GEOGLAM relationships with CEOS [7]. On a regular basis, AMA holds working group teleconferences and also coordinates and organizes regional meetings and training events related to increasing EO usage for agricultural monitoring.

In its first year, in addition to considerable foundational activities, the group has had the following accomplishments.

- Workshop in December 2017 in Buenos Aires organized by Dr. Di Bella with help from Dr. Whitcraft resulted in action by undersecretaries of agriculture and agricultural markets in Argentina taking the action to formally launch GEOGLAM Latinoamérica – leading to the establishment of AMA to help reach its goals.
- Expansion of membership in AMA to nearly 20 institutes since March 2018 launch.
- Development of national-scale 30m cropland maps from Landsat, and associated in-country capacity for Mexico, Argentina, Brazil, and Chile based on Global Land Analysis and Discovery algorithm [8, 9].

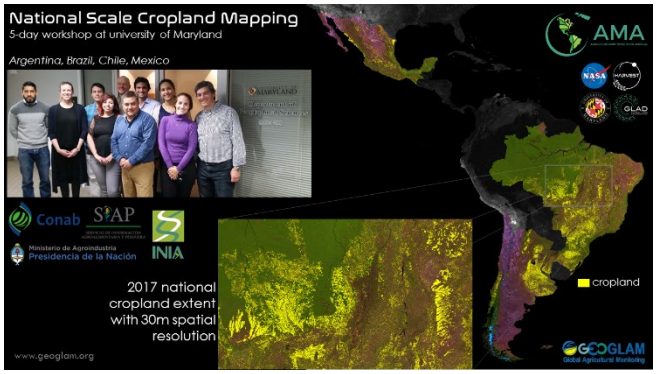

Figure 4. Map output (30-m cropland map for 2017, based on Landsat)and group picture from 1 week workshop at University of Maryland where participants from Ministerio de Agroindustria (Argentina), Brazilian National Food Supply Company (Conab, Brazil), Instituto Nacional de Investigaciones Agropecuarias (INIA, Chile), and the Servicio de Información Agroalimentaria y Pesquera (SIAP-Mexico). Accomplished with NASA Harvest funding.

- Facilitated within-country, interagency connections & coordination around EO for agriculture:
  - o Conab, Embrapa, and INPE (Brazil) discussing coordinate contributions to GEOGLAM, as well as intra-national coordination on agricultural monitoring;
  - o MGAP-UY and INIA-UY undertaking internal needs assessment (stock take of current use, gaps – development of priorities).
- Development and deployment of pilot Global Agricultural Monitoring System for INIA-Chile – near-real time agricultural monitoring based on MODIS [10]'
- Improvements to the Brazilian GLAM system that Conab uses to produce their operational monitoring bulletins [11];
- In early 2018, INTA and Ministerio de Agroindustria worked closely to declare a state of emergency in Argentina due to drought – uniquely facilitated through

the use of satellite data and connections through GEOGLAM Latinoamérica and AMA;
- Inclusion of Chile, Ecuador, and Uruguay in the GEOGLAM Crop Monitor for Early Warning Reports (www.cropmonitor.org);
- AMA partners seeking co-funding for their activities;
- Beginning of addition of Chilean site into GEOGLAM's operational R&D network (www.JECAM.org);

5. NEXT STEPS

In August 2018, the AMA-WG met in person for the first time at the AmeriGEOSS week in San Jose dos Campos, Brazil, and developed priority working areas for 2018-2019. These include:

1. Take inventory of available assets, including products, tools, methods, training materials, and white papers.
2. Develop Protocol for Needs & Priorities Assessment.
3. Participate in broader GEOGLAM effort to document best-practices for knowledge transfer and capacity development for EO-based agriculture monitoring.
4. Identify and connect with "end users" in country and regional integrating bodies (toward scoping regional instance of the GEOGLAM Crop Monitor).
5. Increase participation (broaden and deepen).
6. Continue foundational activities of group.

The AMA and the AMA-WG, as is the case with GEO, GEOGLAM, and AmeriGEOSS, are only as strong as the efforts put forth by the participating membership. To secure active and sustained participation of a diverse community, the value proposition of such a group will need to be made consistently clear. Success for the AMA would mean:

- Membership is steady and/or growing throughout region, with partners engaging new members;
- Systems developed are institutionalized and have low risk of funding gaps;
- Working areas are proposed and implemented by partners throughout region;
- Countries participating use EO for defined decision support, with full ownership;
- Strong connections formed between EO, statistics, economics, and policy communities;
- National networks are organic outcomes of regional group.

6. CONCLUSIONS

Improved capacity for using EO for agricultural knowledge and decision support can enhance food security by stabilizing markets and providing early warning of failures in crop production. There is great potential and current motivation to increase the use of satellite data to empower informed agricultural decisions. However, there is still a long way in order to achieve the sustained use and strong connections between the EO, economics, and statistical communities. The AMA will continue to engage in outreach activities and leverage national, regional, and global efforts to improve the visibility and the use of satellite data for agriculture monitoring in the Americas. More information can be found at www.agamericas.org.

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