

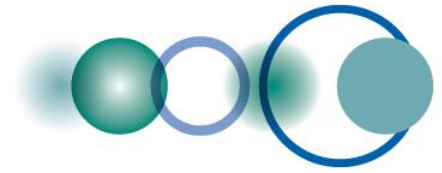
GEOGLAM and RAPP (Rangeland and Pasture Productivity)

Updates and key next steps

Alex Held and Flora Kerblat (and Juan P. Guerschman, Mike Grundy)

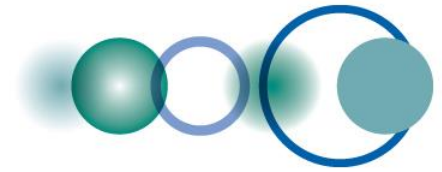
RAPP workshop in South Africa, City of Tshwane - 20 & 21 June 2016





GEOGLAM RAPP is Part of GEO





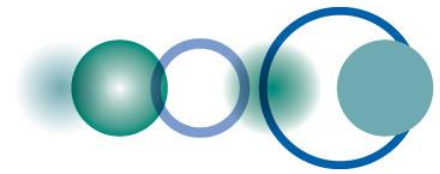
GEO Vision

**To realize a future wherein decisions and actions,
for the benefit of humankind, are informed by
coordinated, comprehensive and sustained Earth
observations and information.**



GEO Objectives

- Improve and Coordinate Observation Systems
- Advance Broad Open Data Policies/Practices
- Foster Increased Use of EO Data and Information
- Build Capacity



102 GEO Members

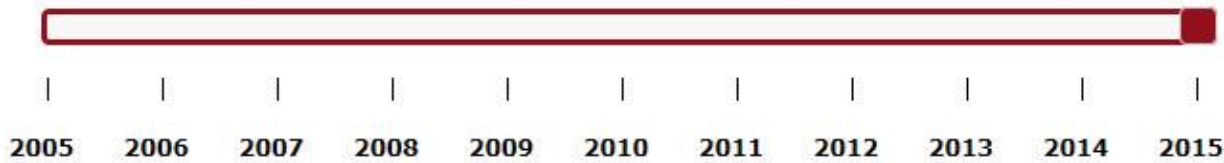
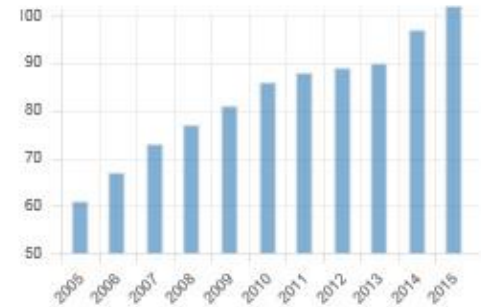


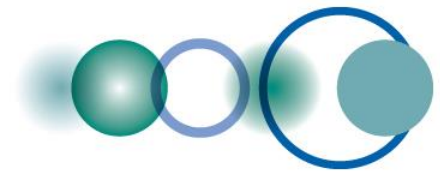
Number of Members (2015)

| | |
|---------------|----|
| Africa: | 27 |
| Americas: | 16 |
| Asia/Oceania: | 18 |
| C.I.S.: | 7 |
| Europe: | 34 |

Total: 102

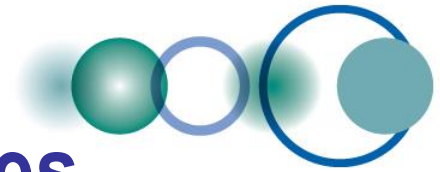
Number of Members by year



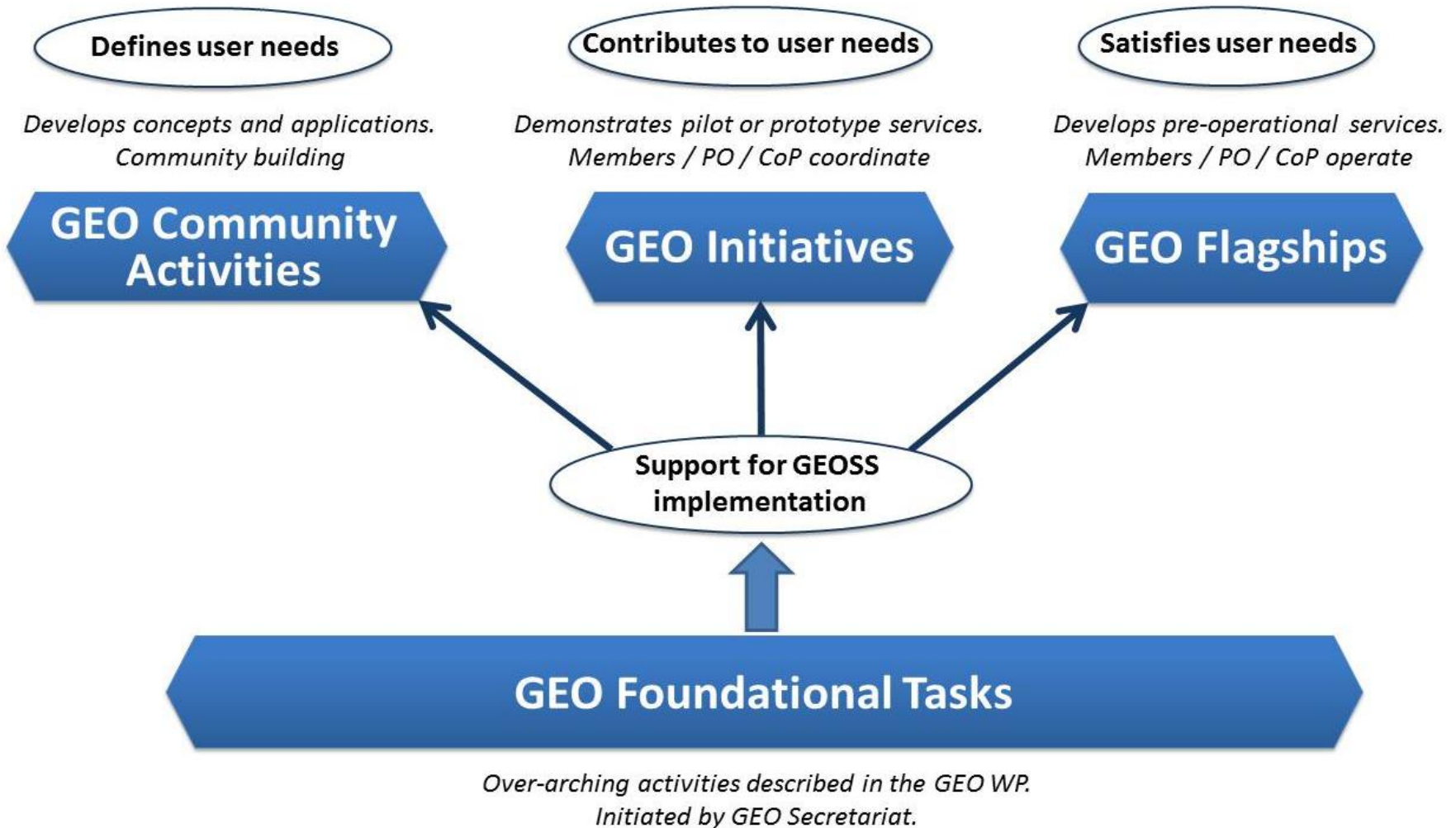


Societal Benefit Areas





Four Types of GEO Activities





- Established in 1984 under auspices of G-7 Economic Summit of Industrialized Nations
 - Focal point for international coordination of space-related Earth Observation (EO) activities
 - Optimize benefits through cooperation of members in mission planning and in development of compatible data products, formats, services, applications, and policies
- Operates through best efforts of Members and Associates via voluntary contributions
- 31 Members (Space Agencies), 28 Associates (UN Agencies, Phase A programs, other existing satellite coordination groups, scientific or governmental bodies that are international in nature, supporting ground facility programs)
- As the “space arm” of the intergovernmental Group on Earth Observations, CEOS is implementing high priority actions to support delivery of societal benefit



Mission

CEOS ensures international coordination of civil space-based Earth observation programs and promotes exchange of data to optimize societal benefit and inform decision making for securing a prosperous and sustainable future for humankind.

Three Primary Objectives

- 1. To optimize the benefits of space-based Earth observation through cooperation of CEOS Agencies in mission planning and in the development of compatible data products, formats, services, applications and policies.**
- 2. To aid both CEOS Agencies and the international community by, among other things, serving as the focal point for international coordination of space-based Earth observation activities, including the Group on Earth Observations and entities related to global change.**
- 3. To exchange policy and technical information to encourage complementarity and compatibility among space-based Earth observation systems currently in service or development, and the data received from them, as well as address issues of common interest across the spectrum of Earth observation satellite missions.**

Background: What is GEOGLAM?

The **G20 Agriculture Priority** (2011) - G20 Final Declaration – Cannes, November 2011:

- A commitment to **improve market information and transparency** in order to make international markets for agricultural commodities more effective.
- Launch of 2 initiatives in 2011:
 - ✓ The "Agricultural Market Information System" (**AMIS**) in Rome on September 15, to improve information on markets
 - ✓ The "Global Agricultural Geo-monitoring Initiative" (**GEOGLAM**) in Geneva on September 22-23: to coordinate satellite monitoring observation systems in different regions of the world in order to enhance crop production projections
- The main objective of **GEOGLAM**: to **strengthen the international community's capacity to produce & disseminate relevant, timely and accurate information and forecasts on agricultural production at national, regional and global scales, through reinforced use of Earth Observations**

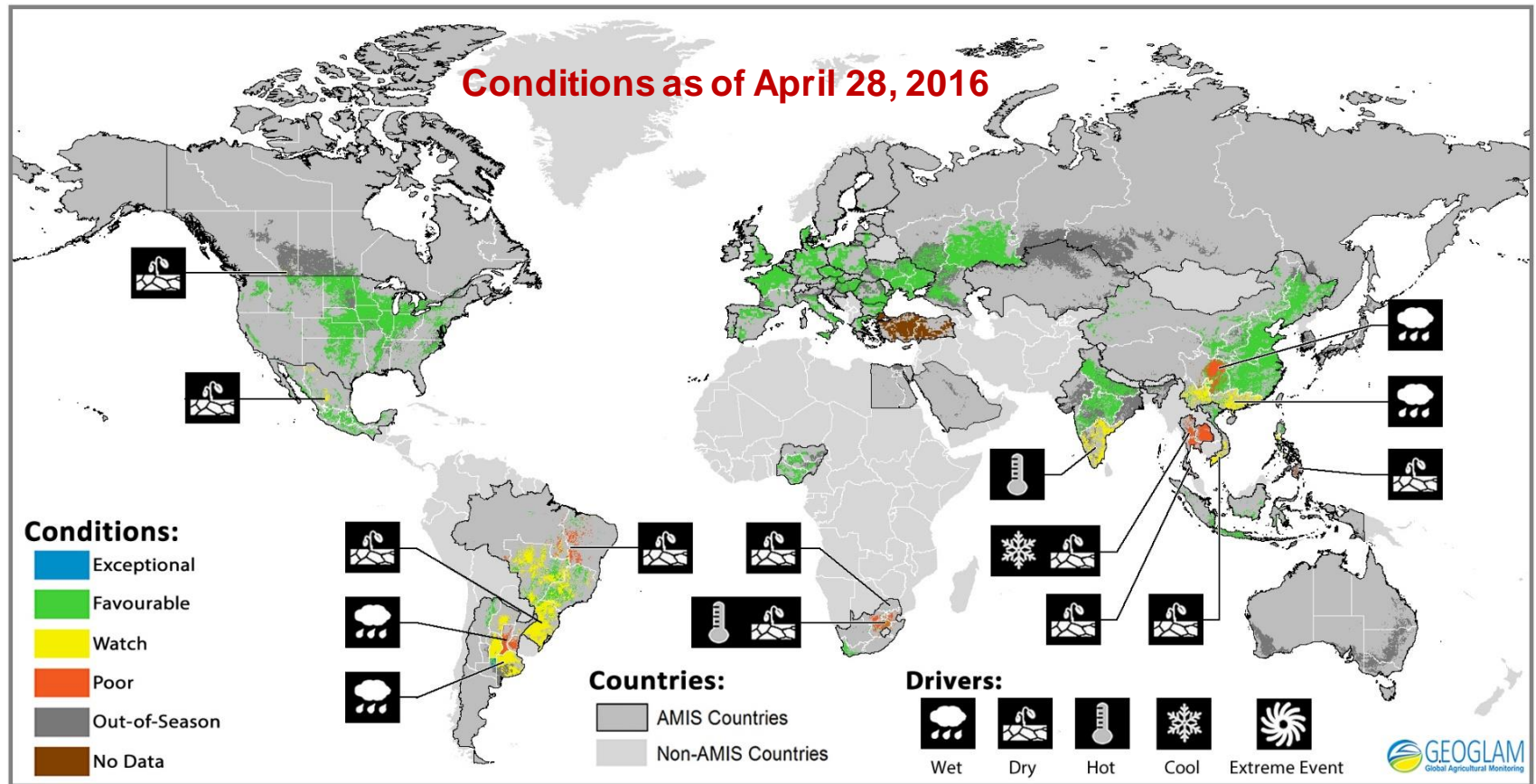
GEOGLAM's Partners



Crop Monitor for AMIS

Presentation of results with graphics and text

A **global map** for the 4 AMIS crops (Maize, Wheat, Soybean, Rice)

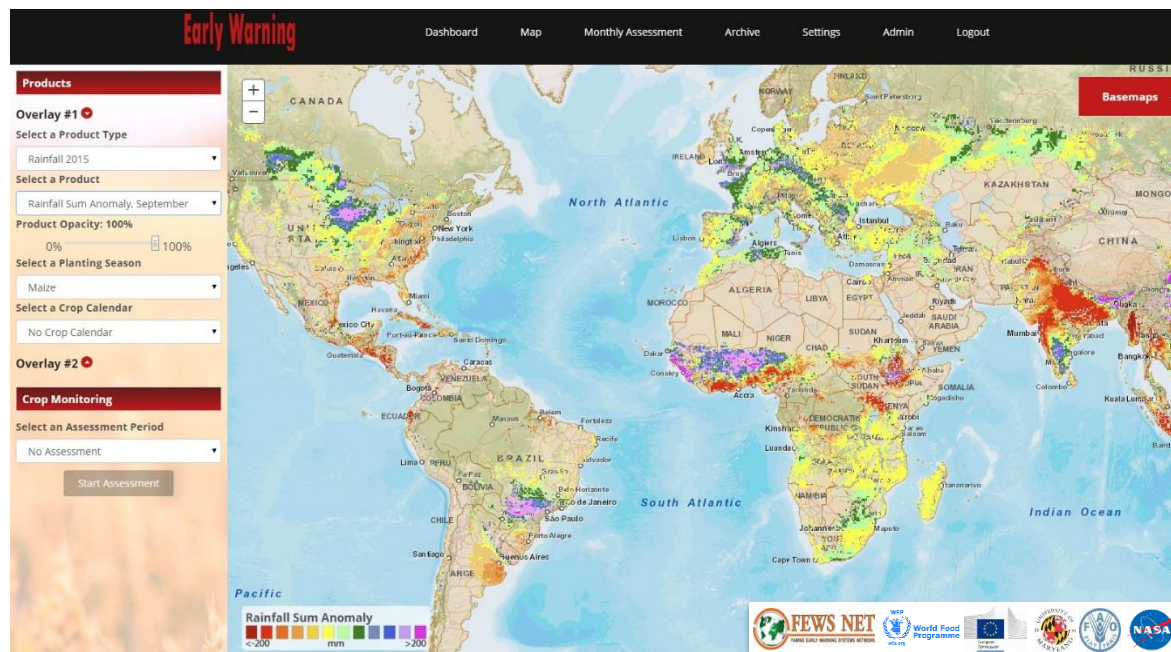


<http://www.geoglam-crop-monitor.org>

Early Warning Crop Monitor (EWCM)

Existing Early Warning activities (GEOGLAM partners having Monitoring activities on Countries at Risk) : FAO (GIEWS), WFP (VAM), USA (FEWSNET), EU (JRC-FS), CN (CropWatch-FS)...

With contributions from a variety of organizations including USAID's [Famine Early Warning Systems Network](#), European Commission Joint Research Centre's [Monitoring Agricultural Resources](#) (MARS), World Food Programme, and the UN Food and Agricultural Organization.



Becker-Reshef, Verdin, Rembold, et al.

Early Warning Crop Monitor (EWCM)

Agreement on organizing a collaborative monitoring of Countries at Risk
1st Meeting: IMAAFS Conference, Addis-Ababa, Oct. 2014
Multiple prototypes in 2015

First operational prototype bulletin produced early February 2016

Coordinated by the University of Maryland Crop Monitor team

Data Used: NRT 250-500m (e.g. MODIS)

Global-V NRT 100m = a significant improvement for smallholder systems

GEOGLAM: with a strong G20 Policy Mandate, a **global collaborative initiative** with already significant achievements...

- Developed a **Community of Practice** achieving the GEO strategic targets for agriculture
- Developed a set of baseline **datasets**
- Established a network of **pilot sites** across the globe for developing best practices (JECAM - *Joint Experiment for Crop Assessment & Monitoring*, www.jecam.org)
- **CEOS** endorsement of Phase 1 & close working relationship w. Ad-Hoc Working group
- Developed **Asia-RiCE**, new regional system for Rice Crop Estimation & Monitoring
- Supported the creation of a rangelands component, GEOGLAM **RAPP** (www.geo-rapp.org)
- **Funds secured for projects** in support of GEOGLAM [JAXA (Asia-RiCE), EC FP7 (SIGMA), ESA (S2 for Ag), NASA (Crop Monitor), Canada (JECAM), Asia Development Bank, USDA
- Launch of the **Early Warning Crop System** (EWCM) – agreement with countries at risks: first operational prototype bulletin produced early February 2016
- Attracted **attention of donors** such as World Bank, Gates Foundation – shared goals
- **Engaged national governments** in developing capacity for incorporating EO into their crop projections system (Argentina, Australia, Mexico, Pakistan, Ukraine...)
- Presented **GEOGLAM at high level meetings** such as *G8 Open Data for Agriculture*
- Commitment from **USDA** to co-lead GEOGLAM R&D office

.... with a need for continuous support to address **monitoring of continuously changing global agricultural issues**

GEOGLAM also supporting the UN SDGs process (Sustainable Development Goals)

Goal #2: “Zero Hunger”

=> Food Security

Agencies to be involved
(possible custodian):

- FAO
- UNICEF
- WHO
- OECD
- WTO
- UNEP
- World Bank

<http://unstats.un.org/sdgs/files/meetings/iaeg-sdgs-meeting-03/Provisional-Proposed-Tiers-for-SDG-Indicators-24-03-16.pdf>

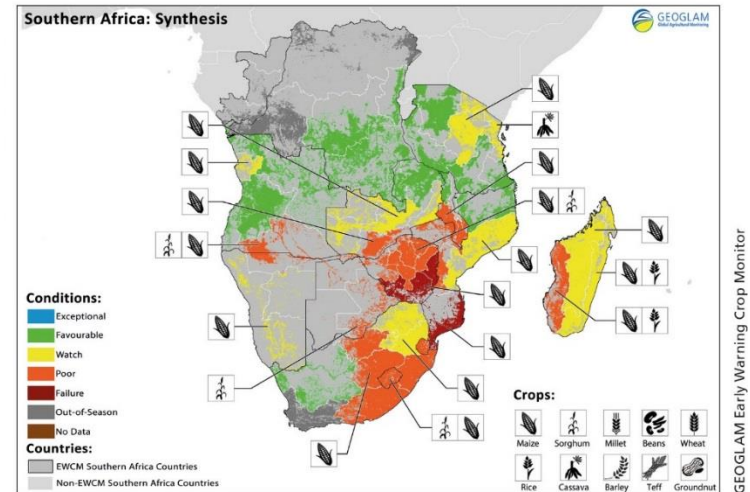


Target 2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility.

MONITORING CROP CONDITIONS WITHIN COUNTRIES AT RISK OF FOOD INSECURITY

Crop condition map synthesizing information for all Early Warning Crop Monitor (EWCM) crops. Crop conditions over the main growing areas are based on a combination of national and regional crop analyst inputs along with Earth observation data. Crops that are in other than favourable conditions are displayed on the map with their crop symbol.

*“Development planning and
SDG outcomes can be visualized
with maps.” (CIESIN)*



GEO product information, March 2016

Background: What is RAPP ?

Rangeland And Pasture Productivity

Component of GEOGLAM

Global rangelands and extensive pasture condition + livestock productivity information system

Users

- Producers: Decisions on sustainable pasture & herd management, movement of livestock to better pastures, etc.
- Governments: National herd stats and seasonal/annual carrying capacity; economic development, trade and market development, food-security
- International Organisations: Global food security, sustainability and global assessments (eg AMIS)

Background -2: RAPP Elements

1. Global Information System

- Rangeland condition & anomalies (remote sensing);
- Standing biomass world-wide (modeling + remote sensing);
- Livestock statistics & productivity (modeling & stats)

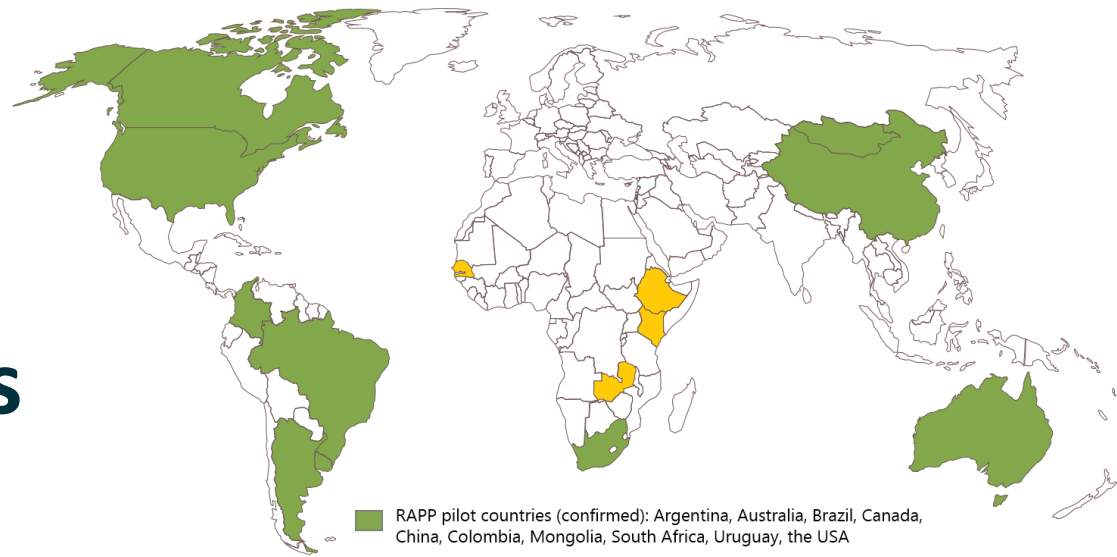
2. National Pilot Sites

At representative rangelands and producer countries – for product validation and model parameterization

3. Community of Practice & Outreach

R&D and technical experts, livestock producers, national & international governmental officials

GEOGLAM RAPP : National Pilot sites

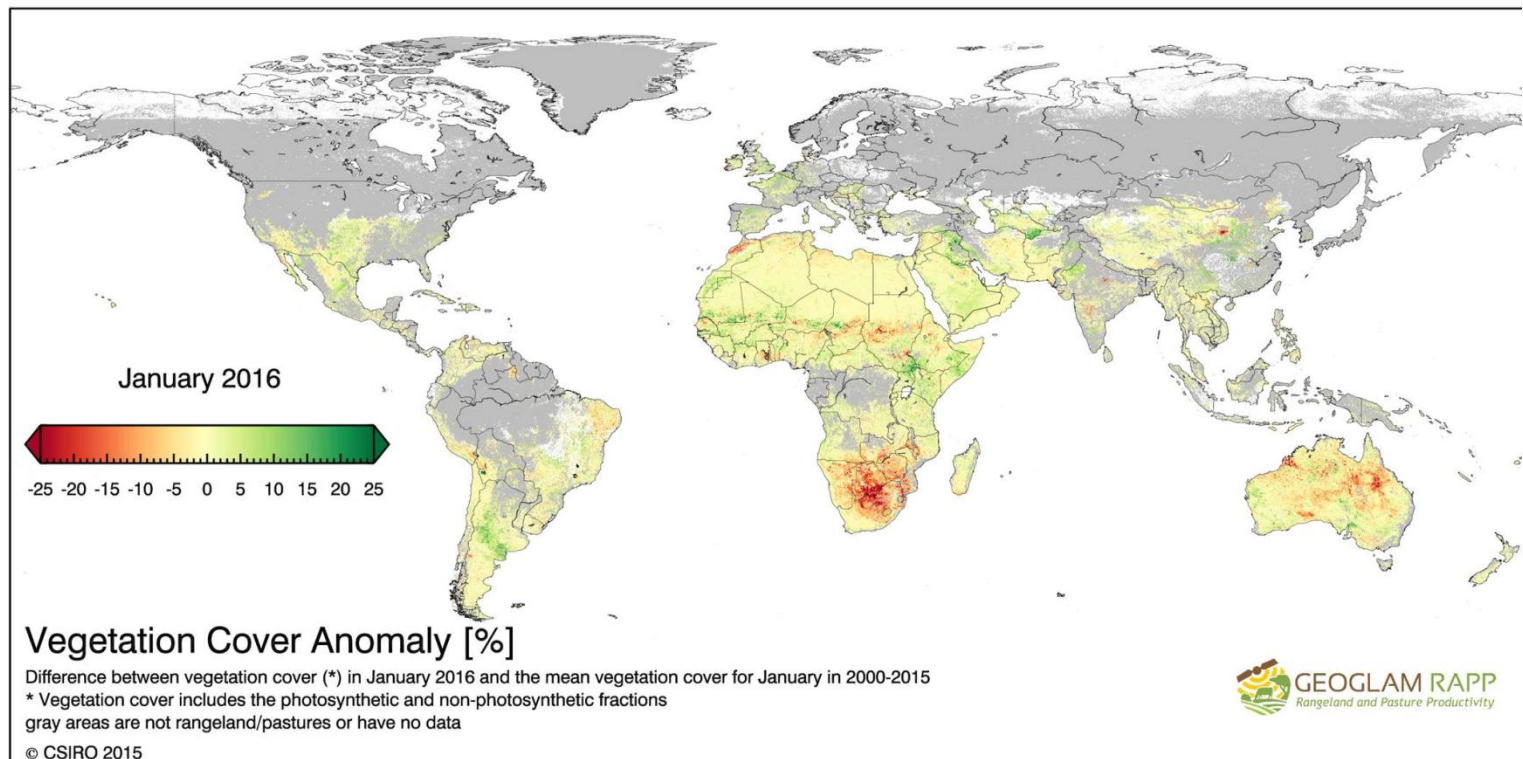


- Growing network of sites
- 10 countries confirmed, ~15 sites
- More to be proposed (collaborations to be discussed), mainly in Africa

GEOGLAM RAPP : Products

- 1. Vegetation Cover Anomaly** (map produced every month and published on RAPP website and twitter account):

<http://www.geo-rapp.org/rapp-monitor/vegetation-cover-anomaly/>

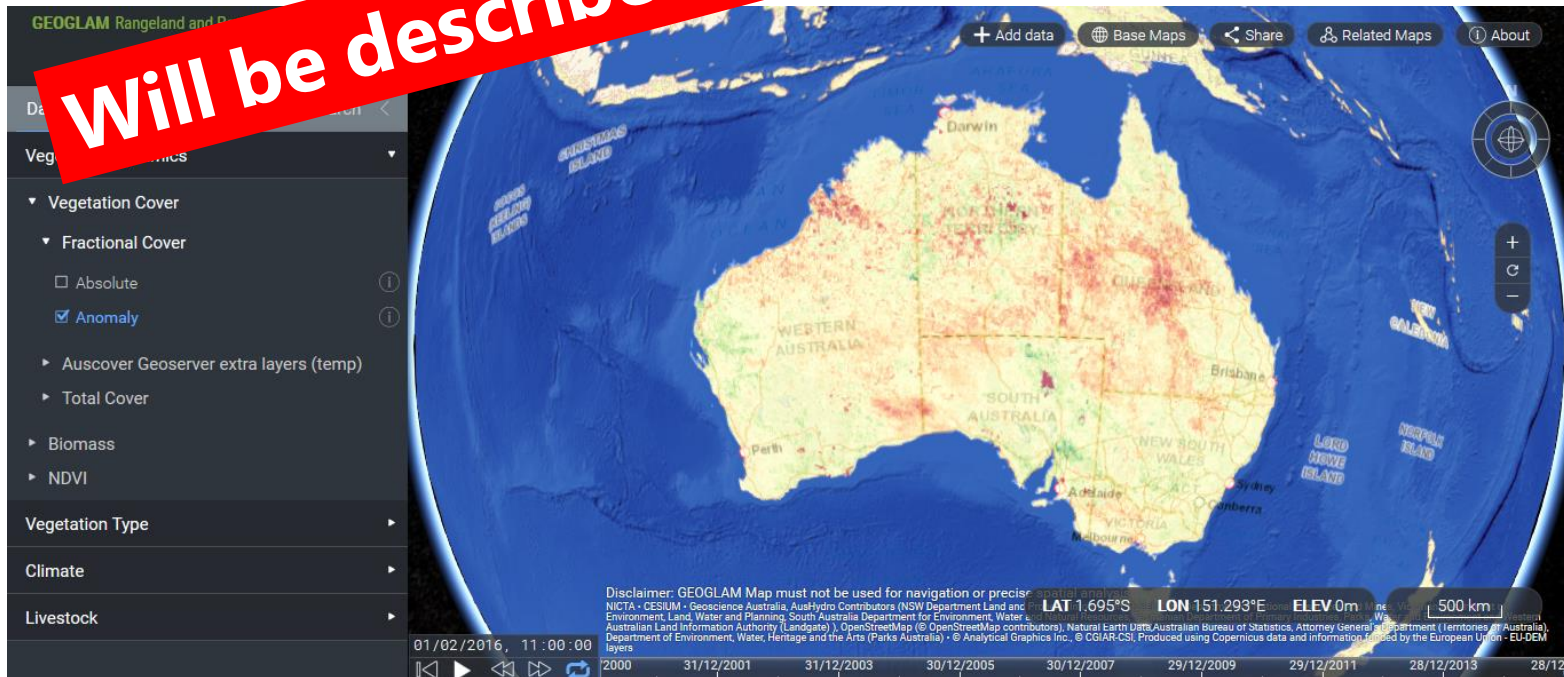


GEOGLAM RAPP : Products

2. GEOGLAM RAPP Map/Visualizer (interactive platform):

- 1st beta phase is being implemented: <http://map.geo-rapp.org/> (still under development)
 - to visualize time series data on vegetation cover and rainfall and soil moisture.
 - ancillary layers on rangeland and population densities from various sources
- 2nd phase (end of 2016) will be implemented: reporting tools

Will be described later by Juan Guerschman



GEOGLAM RAPP: Global & Local Data Requirements & Products

Remote sensing

- Global Rangeland vegetation fractional cover time-series (2-weekly composites) – MODIS/S-3/VIIRS/GCOM-C
- Aboveground biomass (Seasonal/Annual) :
SAR-derived biomass – Sentinel-1, Radarsat Constellation (& other wide-area SAR) - for Model-Data Assimilation Approach
Phase-1: Selected pilot sites; Phase-2: Global rangelands
- Soil Moisture & climatic data – SMOS/SMAP & ECVs - global
- Grassland Types & Nutritional Quality : eg multi-sensor & hyperspectral
Phase-1: Selected pilot sites; Phase-2: Global rangelands

In-situ data for model validation and parameterization



Sample "Core" Satellite Data Acquisition Scenario



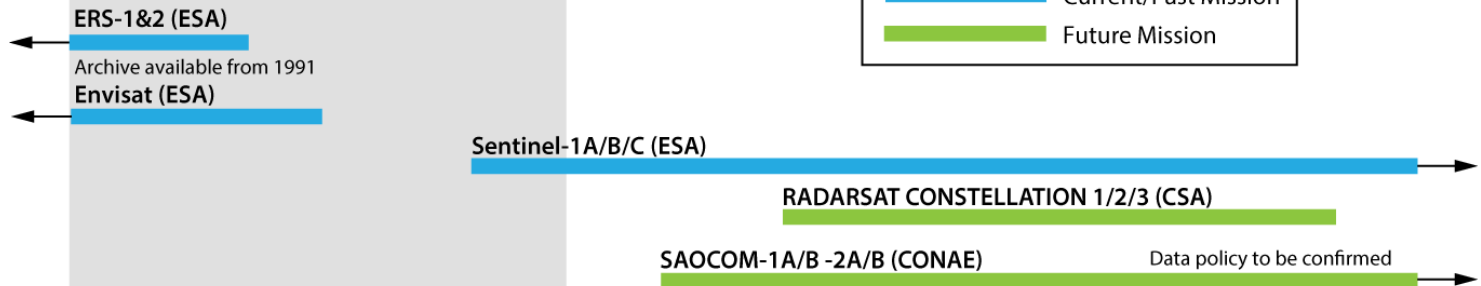
Sub-30m Core Satellite Data For
Continuous, Annual, Global Coverage



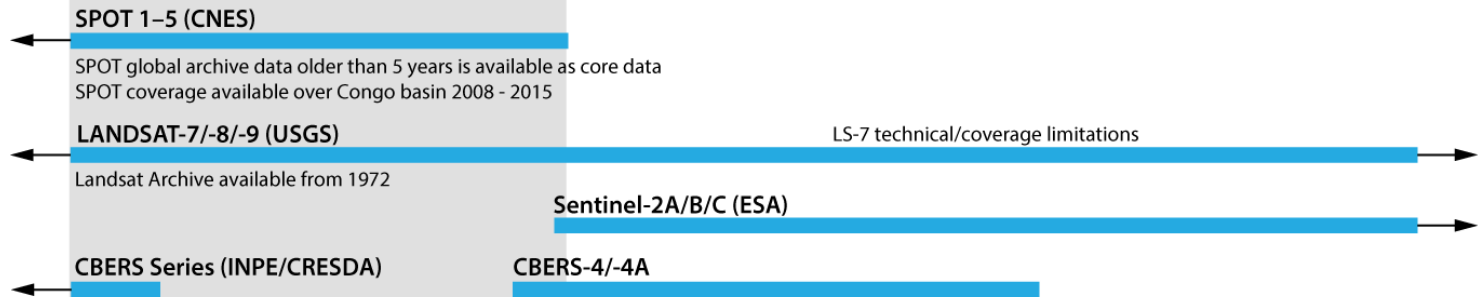
2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025

Radar sensors

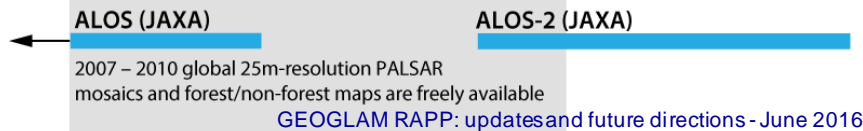
C-band



Optical sensors



Special Core Data Sets



GEOGLAM RAPP : RS data requirements

=> CEOS:
 RAPP requirements similar to GEOGLAM (crop) but some specific data might be required (to overcome technical issues: clouds or trees in savannas hiding the grass)

Will be described later by Brian Killough

| Req# | How ? | | When ? | Where ? | | What ? Information Products and Applications | | | | | | Rangelands and Pastures | | | | | | | | |
|---|--------------------|-----------------------|--|---------------------------|------------|--|-------------------------------------|----------------|------------|----------------------------|--------------------|---------------------------------|-----------------------------------|--|--|----------------|---------|------|----------------------|--------------------|
| | Spatial Resolution | Spectral Range | Effective observ. frequency (cloud free)* | Sample Type | Field Size | Crop Mask | Crop Type Area and Growing Calendar | Crop Condition | Crop Yield | Crop Biophysical Variables | Environ. Variables | Ag Practices / Cropping Systems | Rangeland and pasture mask (type) | RP seasonal Calendar and phenology metrics | RP Condition Indicators (grass, shrub, tree) | RP biophysical | Pasture | Soil | Vegetation / Biomass | Environ. Variables |
| Coarse Resolution Sampling (>100m) | | | | | | | | | | | | | | | | | | | | |
| 1 | >500-2000 m | optical | Daily | Wall-to-Wall | All | | | X | | L | | | | | | | | | | |
| 2 | 100-500 m | optical | 2 to 5 per week | Cropland Extent | All | X | X | X | | | | | | | | | X | | X | |
| 3 | 5-50 km | microwave | Daily | Cropland Extent | All | | | | | | | | | | | | | | | X |
| Moderate Resolution Sampling (10-100m) | | | | | | | | | | | | | | | | | | | | |
| 4 | 10-100m | optical | Weekly (8 days; min. 1 per 16 days) | Sample | All | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 6 | 10-100m | SAR Dual Polarization | Weekly (8 days; min. 1 per 16 days) | Cropland Extent or Sample | All | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 6.5 | 10-100m | Hyperspectral | Seasonal (3-4 per year) | Sample | All | | | | | | | | | | X | | | X | X | |
| Fine Resolution Sampling (5 to 10m) | | | | | | | | | | | | | | | | | | | | |
| 7 | 5-10 m | VIS, NIR, SWIR | Monthly (min. 3 in season) | Cropland Extent | M/S | M/S | M/S | | | | | | | | | | | | | |
| 8 | 5-10 m | VIS, NIR, SWIR | Weekly (8 days; min. 1 per 16 days) | Sample | All | | M/S | X | | X | X | X | M/S | X | X | X | X | X | X | X |
| 9 | 5-10 m | SAR Dual Polarization | Monthly | Cropland Extent or Sample | M/S | M/S | M/S | | | | | M/S | M/S | | X | | | X | | |
| Very Fine Resolution Sampling (<5m) | | | | | | | | | | | | | | | | | | | | |
| 10 | < 5 m | VIS, NIR | 3 per year (2 in season + 1 out of season); Required every 3 | Cropland Extent | S | S | S | | | | | | S | | S | | | S | | X |
| 11 | < 5 m | VIS, NIR | 1 to 2 per month | Refined Sample | All | | X | | X | | | X | | | S | | | S | | |

X = for all field sizes Optical = VIS, NIR, SWIR, TIR
 L = large field (>15 ha)
 M = medium field (1.5 ha-15 ha)
 S = small field (<1.5ha)



GEOGLAM RAPP : RS & Field data requirements

Example - AUSTRALIA - 3 pilot sites, 3 regions, but with similar objectives and research teams:

- **Spyglass** beef research facility, near Charters Towers (Queensland, QLD)
- **Old Man Plains**, south of Alice Springs (Northern Territory, NT)
- **Liveringa Station**, in the Kimberley district (Western Australia, WA)

Spyglass - Project overview :

(...) This project will develop algorithms for mapping grass biomass in Australia's northern rangelands from radar and optical satellite imagery, and methods to validate these models in the field. (...)



- ⇒ **CEOS : SENTINEL 1 data requirements have been defined, given to George (Symbios) for him to contact ESA and get SENTINEL data**
- ⇒ **Please provide us with technical information as requested (emailing last week) for us to request directly to CEOS/ESA for now**

GEOGLAM RAPP : Communication & Outreach

- **RAPP work plan** (post 2015) written for GEOGLAM (end 2015)
- **Website** regular updates: <http://www.geo-rapp.org>
 - News/events, Products (vegetation cover anomaly)
 - Pilot sites recent updates (Argentina, Colombia, and Mongolia)
 - Interactions with GEOGLAM (RAPP has a dedicated page on their new website)
- **Twitter** account
[@geoglamRAPP](https://twitter.com/geoglamRAPP)
- **Quarterly newsletter**
(Dec. 2015, April 2016 – next one in July)



GEOGLAM RAPP : Communication & Outreach

Community of Practice

- Domestic RAPP workshop (Brisbane on Monday 21st March)
- USDA/LTAR workshop in the US (May 2016): J. Guerschman, C. Adjorlolo & 2 other RAPP partners attended
- **RAPP workshop** (South Africa, 20-22 June 2016)

Collaboration with CEOS & GEOGLAM Ad-hoc team

- Meetings in Canberra (March) with B. Killough (NASA)/Symbios team to discuss RAPP data requirements
- CEOS SIT-31 + GEOGLAM side meetings in Frascati (April), A. Held & F. Kerblat attended)
- B. Killough is here this week (data req.)

GEOGLAM RAPP : Workshop & logistics

4th RAPP workshop - South Africa (Pretoria), 20-21 June 2016 (+tour 22nd)

- Local host: SANSA with Support of DST (Department of Science and Technology) and City of Tshwane (South Africa) – CSIRO (Australia)
- Location: **City of Tshwane (Pretoria)** in South Africa
- Venue: **Protea Hotel Centurion** (near Pretoria):
 - Lunch/break/dinner provided
 - Accommodation: Protea Centurion hotel or nearby hotels
- **2-days workshop** (Monday 20 and Tuesday 21)
- **TOUR** organized by the City of Tshwane on Wednesday: Departure 8:00 am – return by 2:00pm, see itinerary
- **GROUP PHOTO (Today – coffee break 10:30 am)**
- **GALA DINNER (Today - 7pm)**
- Agenda final version sent on Friday 17 – any comments?
- **Presentations** and **Email addresses** will be collected: let us know if you do NOT want to share something
- Airport transfer requests: see with Clement or hotel
- Any other questions/requests: contact Clement A. or myself



“Faces of RAPP” : Resources & Capabilities

- **Component Lead:** Juan-Pablo Guerschman (CSIRO) + ??? (another co-lead would be helpful)
- Pilot Site Coordinators (~10 people) and wider CoP (~20 people)
- General coordination and science strategy – A.H., F.K., & M.G.
- Expertise in Optical & SAR processing and high-performance data analytics
 - J.P.G. L.R., C.T., Z.S. & friends
- Field data Coordination and livestock statistics
 - P.S., M.S., ...
- Pasture & Livestock Modeling:
 - B.H., C.G., M.H., R.D., L.R.
- Regional Outreach, Communications & Capacity Development: F.K.

=> **Coordination currently at ~10% capacity (mostly Australia based);
Need to grow (~ 4-5 FTE), mainly across key other global regions
(Americas, Europe, Africa, Asia)**

GEOGLAM RAPP : Next steps

- Reinforce & develop the CoP: key stakeholders at various scales, especially **high-level institutional partners** (firm involvement, funding) to give an official and continuous framework to the initiative
- Identify and implement a **data acquisition plan with CEOS** (similar to GEOGLAM) – compiling your requirements defined this week
- Give regular updates on RAPP activities through emailing, RAPP **website** and twitter account, and a quarterly **newsletter**
- Launch the **RAPP Map** (interactive visualizer) and pursue its development
- Continue the production of a monthly **Vegetation Cover Anomaly** (adapt algorithms for new sensors – Sentinel-3/VIIRS/GCOM-C)
- Provide active input to GEOGLAM/AMIS CROP Monitor and EWCM Bulletins
- **Development of RAPP network in Africa** (partnerships with FAO – Felix T. will present remotely tomorrow)
- R&D on pilot sites and **collaboration with JECAM** (part of GEOGLAM)
- Development: explore **growth opportunities** for RAPP (external support)
- Organize 5th RAPP international workshop next year (Asia?)



Spyglass, QLD, Australia, credits Michael Schaefer CSIRO

Thank you

Land & Water Business Unit
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