

# Geospatial Information and Earth Observations: Data Sources for Climate Change Statistics

Francesco N. Tubiello  
Statistics Division, FAO

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**Workshop on Environment Statistics and Information  
for Sustainable Development in the Arab Region**

Beirut, Lebanon

12-16 November 2018



Food and Agriculture Organization  
of the United Nations

# Outline

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- Agri-Environment Statistics at FAO
- Integrating statistics with GEO
- Applications for Climate Change Statistics



# Agri-Environment Statistics at FAO

## Annual Data Collection, Analysis and Dissemination



### 1. MINERAL OR CHEMICAL FERTILIZERS

For information on how to complete this questionnaire (use of data in calendar year, in tonnes, notation keys, etc.) kindly read the "Instructions" sheet of this workbook.

If the commodity is not produced or is not used in the country, please report 0 (zero) under the corresponding column. If this is unknown, please report NA. Please report under Agricultural Use and Other Uses the use of all fertilizers available nationally, whether produced or imported.

Note on "other uses": use of fertilizers for non-agricultural uses can be relevant for some products in some countries. If information on other uses is available in your country, please report it in the dedicated columns below. Otherwise, please indicate NA (not available).

COMMODITY	Nutrient content:			ELEMENT (UNITS)	PRODUCTION				AGRICULTURAL USE				OTHER USES				NOTES
	Nx	P <sub>2</sub> O <sub>5</sub> x	K <sub>2</sub> Ox		2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017	
<b>TOTALS IN NUTRIENTS</b>																	
TOTAL NITROGEN	100	0															
TOTAL PHOSPHATE	0	100															
TOTAL POTASH	0	0	100														

### LAND USE, IRRIGATION AND AGRICULTURAL PRACTICES - DEFINITIONS

**QUESTIONNAIRE ON PESTICIDES USE**

Country: \_\_\_\_\_, Reference: calendar years from \_\_\_\_\_ to \_\_\_\_\_  
Unit of measurement: tonnes (t)

**1. DEFINITIONS OF CATEGORIES**

COMMODITY	Nutrient content	Category	DEFINITION
<b>STRAIGHT NITROGENOUS FERTILIZERS</b>			
Urea	46 0	LAND USE	
Ammonium sulphate	21 0	COUNTRY AREA	
Ammonium nitrate (AN)	33.5 0	Country area	Area under national sovereignty, 4 in
Calcium ammonium nitrate (CAN) and other mixtures with calcium carbonate	26 0	LAND	
Sodium nitrate	16 0	Land area	Country area excluding area under sea
Urea and ammonium nitrate solutions (UAN)	32 0	Agriculture	The total of areas under "Land under 1. Land under permanent crops", "Land 2. This category includes field and below agricultural purposes. Scattered land and uncultivated patches, banks, footpaths,
Ammonia anhydrous	82 0	Agricultural land	Land used for cultivation of crops and L
		Cropland	Land used for cultivation of crops. The
		Arable land	The total of areas under temporary crop include land that is potentially cultivable
		Land under temporary crops	Land used for crops with a lease-harvested. Some crops that remain in the stubble, grasses, bananas and
		Land under temporary meadows and pastures	Land temporarily cultivated with herbage between temporary and permanent me
		Land not used for one or more	Land that is not seeded for one or more

**National Focal Point**

Name	
Title	
Administration and Office	
Address	
City	
Email	
Tel	
Fax	
Web site address	

This questionnaire is composed of:  
Three introductory sections (Cover, Instructions and Definitions);  
Two data reporting sections (1. Pesticides Data; 2. Additional information); and  
Two supplementary information sections (3. Metadata; and 4. Feedback).

The screenshot shows the FAO FAOSTAT website. At the top, there is a search bar and navigation links for 'About FAO', 'In Action', 'Countries', 'Themes', 'Media', 'Publications', 'Statistics', and 'Partnerships'. Below this, the 'FAOSTAT' logo is displayed, followed by a search bar for indicators or commodities. The main content area is divided into several sections: 'Production' (Crops, Crops processed, Live Animals, Livestock Primary, Livestock Processed, Production Indices, Value of Agricultural Production), 'Inputs' (Fertilizers by Nutrient, Fertilizers by Product, Fertilizers archive, Fertilizers - Trade Value, Pesticides Use, Pesticides Trade, Land Use, Employment Indicators), 'Emissions - Agriculture' (Agriculture Total, Enteric Fermentation, Manure Management, Rice Cultivation, Synthetic Fertilizers, Manure applied to Soils, Manure left on Pasture, Crop Residues, Cultivation of Organic Soils, Burning - Savanna, Burning - Crop Residues, Energy Use), 'Trade' (Crops and livestock products, Live animals, Detailed trade matrix, Trade indices), 'Population' (Annual population), and 'Emissions - Land Use'. There is also an 'Investment' section partially visible.

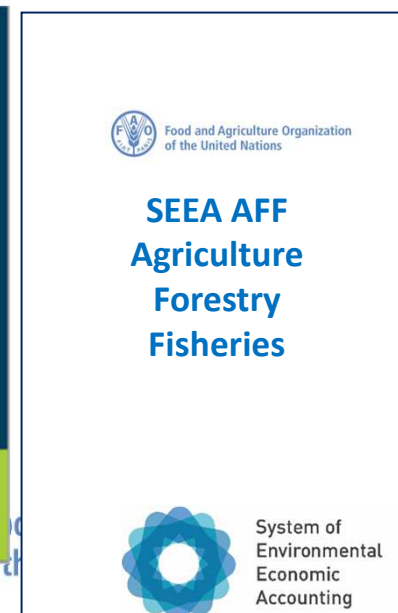
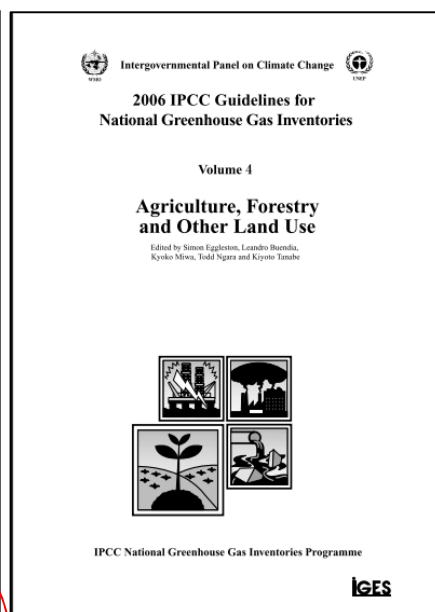
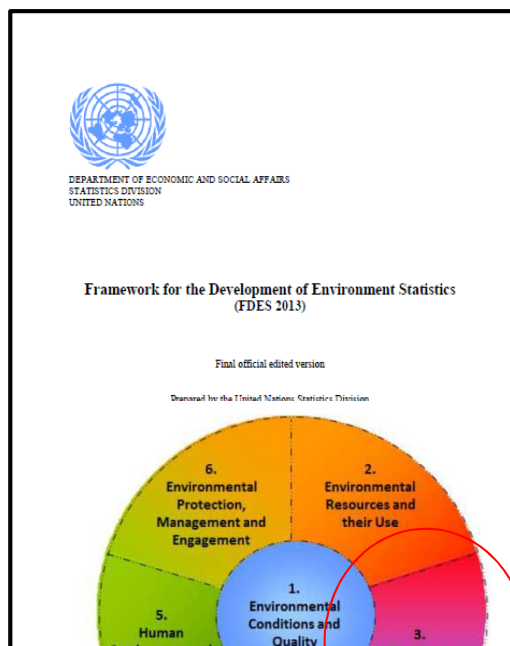
- FAO has a broad mandate towards collection, analysis and dissemination of food and agriculture statistics;
- Collection through official National focal points (NSOs; Min Ag; Other);
- Agri-environment domains: Fertilizers, Pesticides, Land Use, Irrigation & Practices. Elsewhere at FAO: FISHSTAT, FRA, AQUASTAT



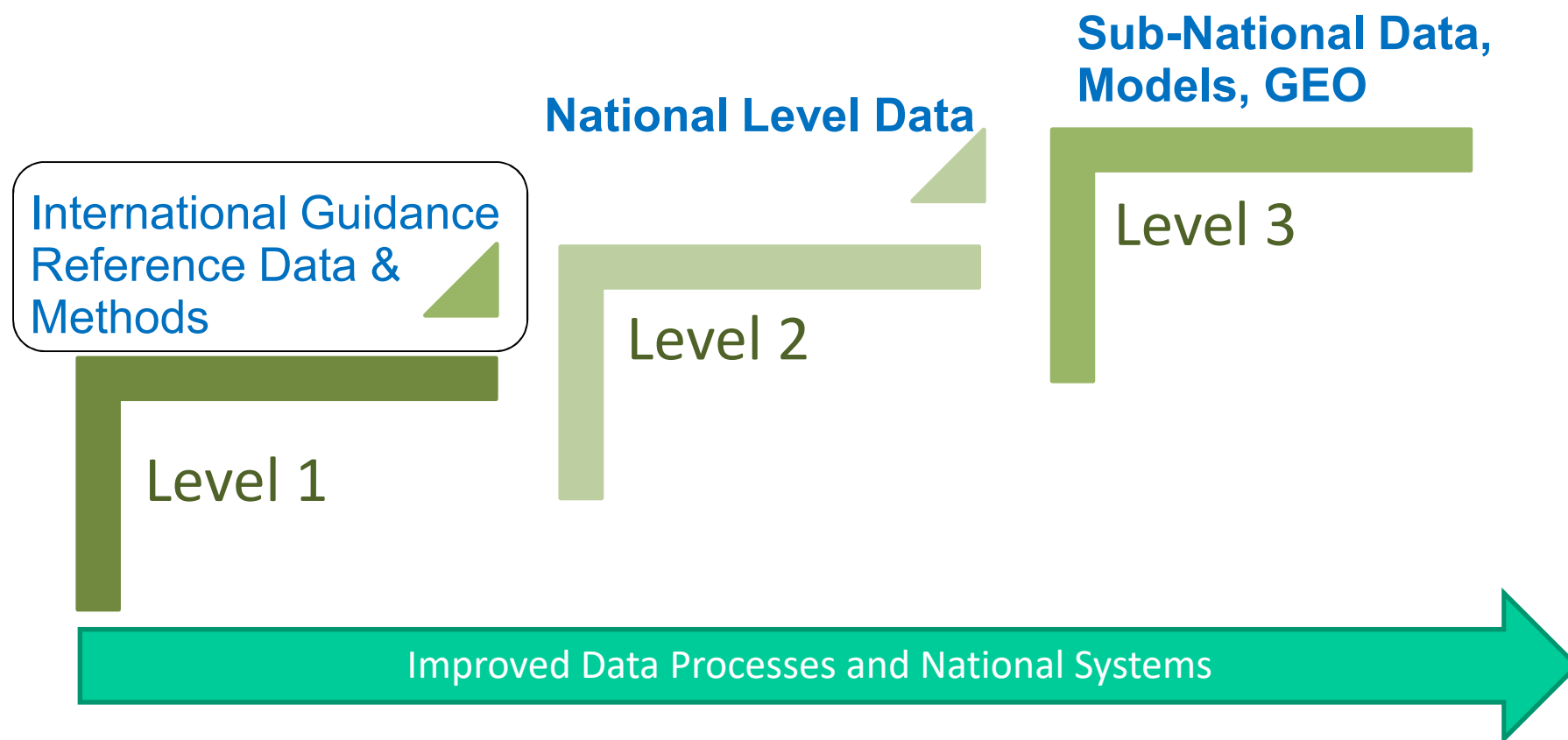
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# Analytical Data Products: Supporting SDGs and Climate Change Actions

- Reference global data products in support of national analysis and international reporting (SDGs, UNFCCC);
- Estimates and Indicators are based directly on FAO core statistics and/or derived from geospatial sources



# Framing FAOSTAT Analytical Data Products:



# Examples of Geospatial applications to FAOSTAT Agri-environmental Statistics

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- Land Cover and Land Cover Change
  - Area burned / emissions from biomass fires
  - Area of degraded Peatlands / emissions
- Temperature Change
- Aggregating to national statistics: GAUL

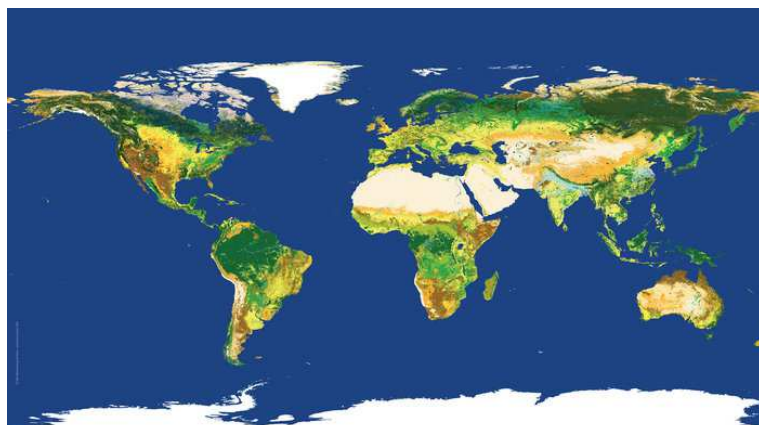
Note: Significant additional Geospatial work at FAO



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# Land Cover

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Source: ESA CCI, 2018

Land Cover is needed for key reporting processes:

- UNFCCC (e.g., IPCC LU classes for NGHGI)
- SDG (e.g., 2.4.1; 15.1.1.; 15.3.1)
- SEEA (e.g., Natural Capital and Ecosystems)

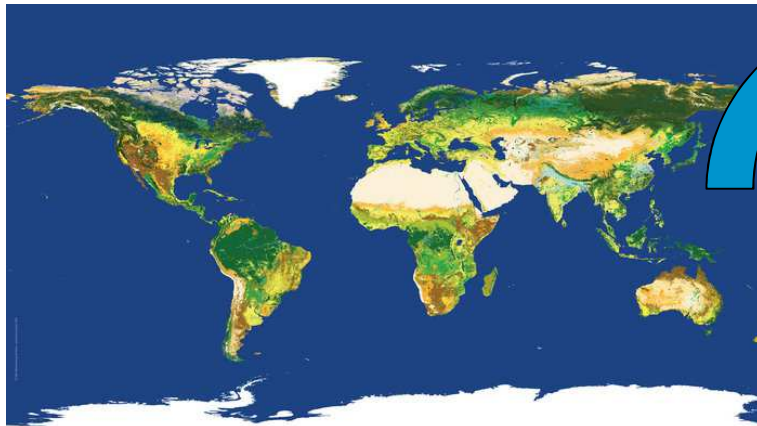
No global statistical data collection

Information available from remote sensing @ 300m



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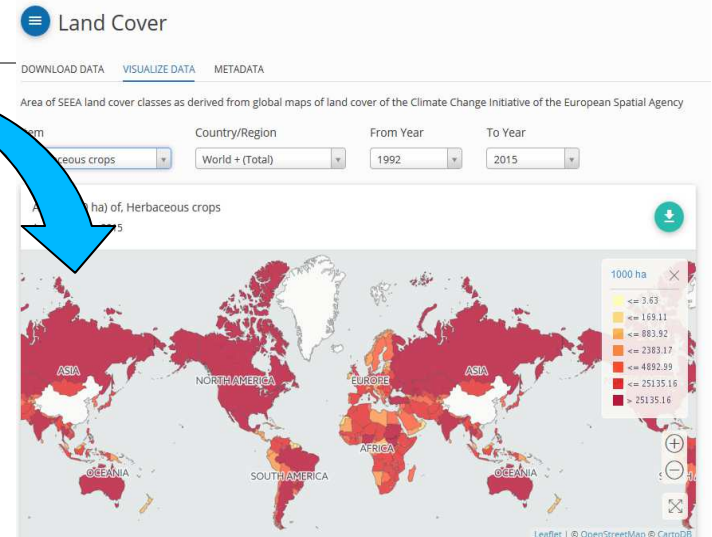
# Land Cover



Source: ESA CCI, 2018



**GAUL**



## PROCESS (with ESA):

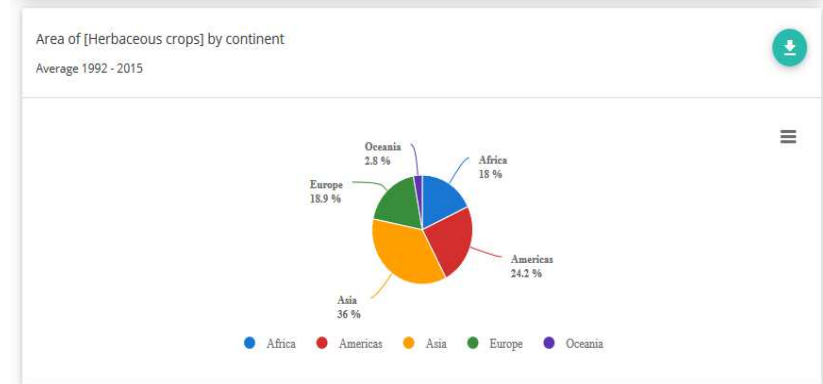
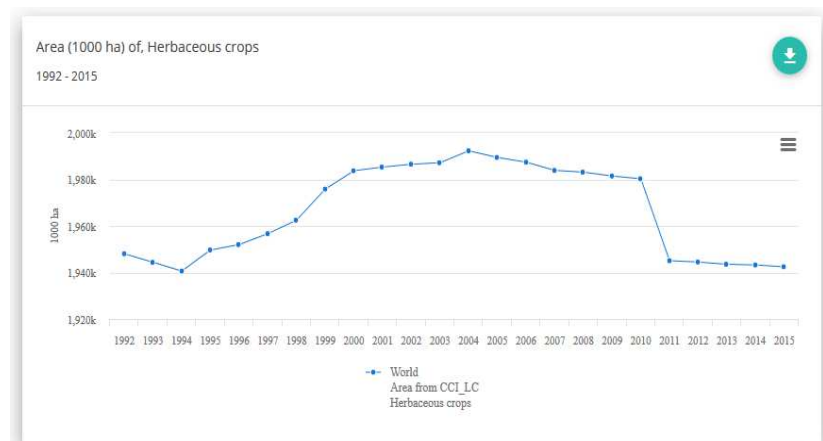
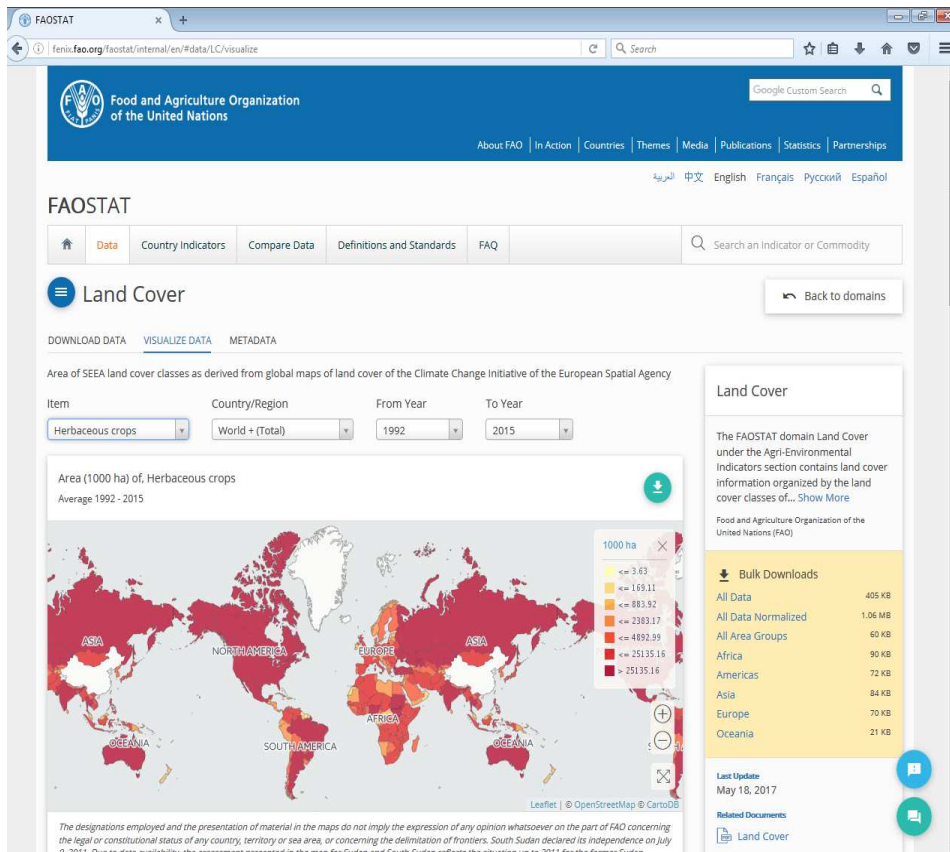
- Use LCCS to map LC classes to SEEA at 300m
- Use GAUL to aggregate from pixel to National Level (MODIS, ESA CCI)



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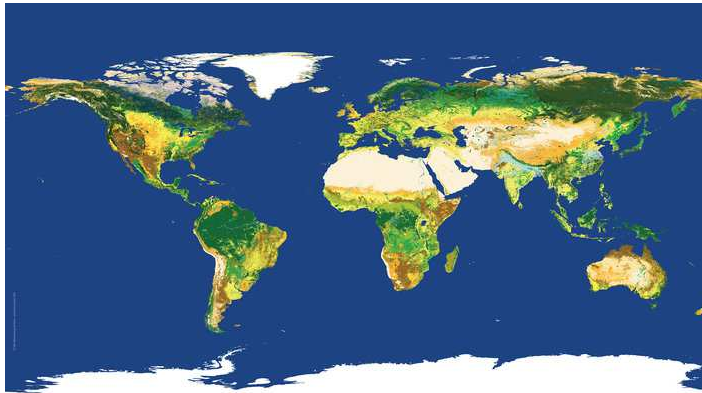


# FAOSTAT Land Cover Accounts

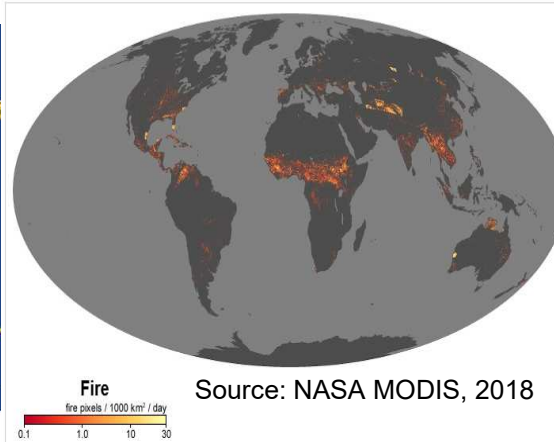


- 14 Land Cover Classes (SEEA)
- 185 Countries and territories
- Time series 1992-2016

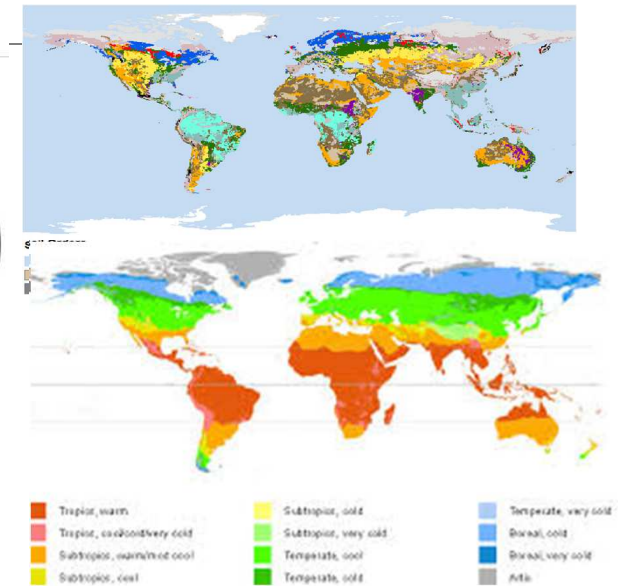
# Land Cover, Fires, Degraded Peatlands



Source: ESA CCI, 2018



Source: NASA MODIS, 2018



Source: FAO, 2018

Information is needed for key reporting processes:

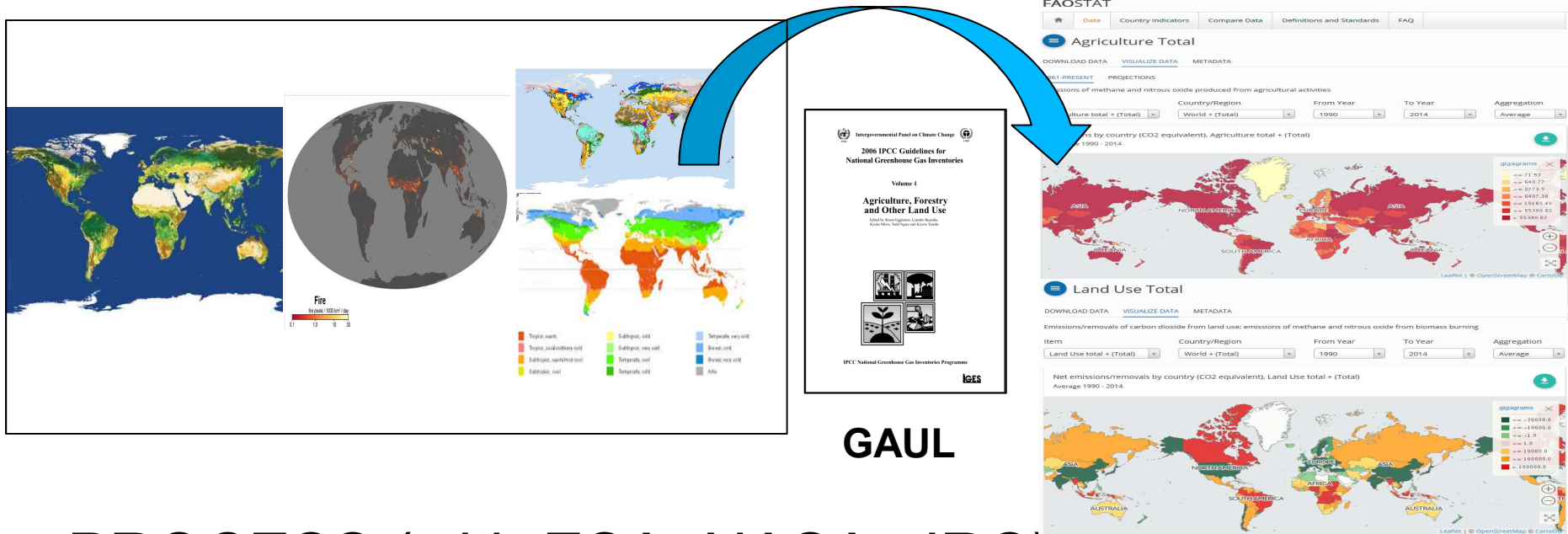
- UNFCCC (e.g., IPCC LU classes for NGHGI)
- SDG (e.g., 2.4.1; 15.1.1.; 15.3.1)
- SEEA (e.g., Natural Capital and Ecosystems)

No global statistical data collection

Information available geospatially @ 300m (LC)

500m (fires), 1km (soil and agro-climatology)

# Land Cover, Fires, Degraded Peatlands



GAUL

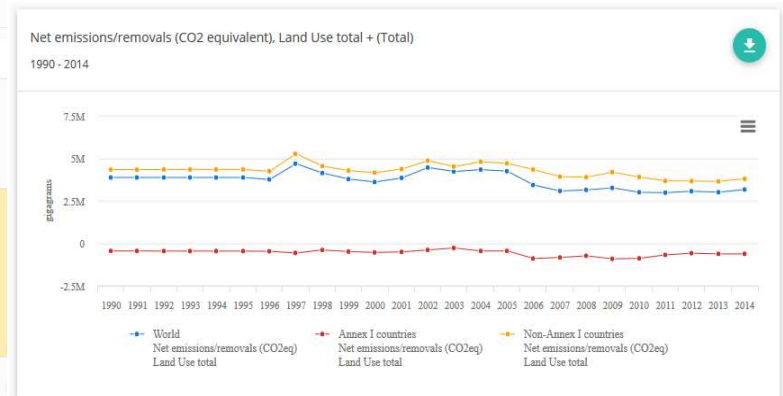
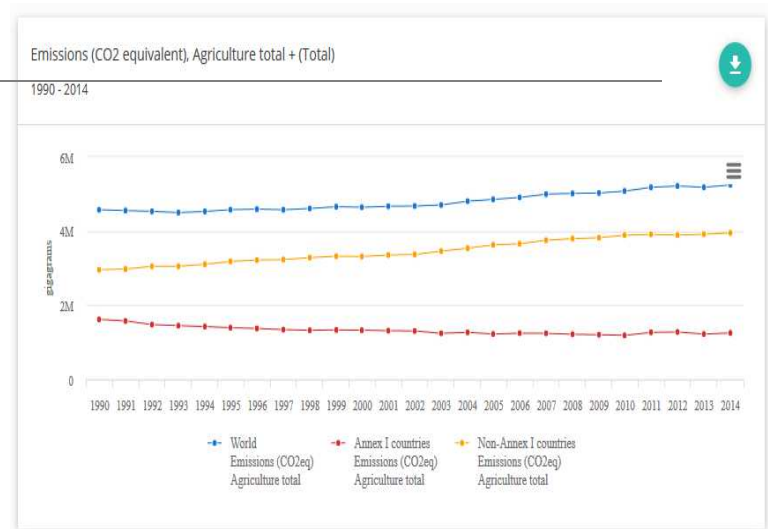
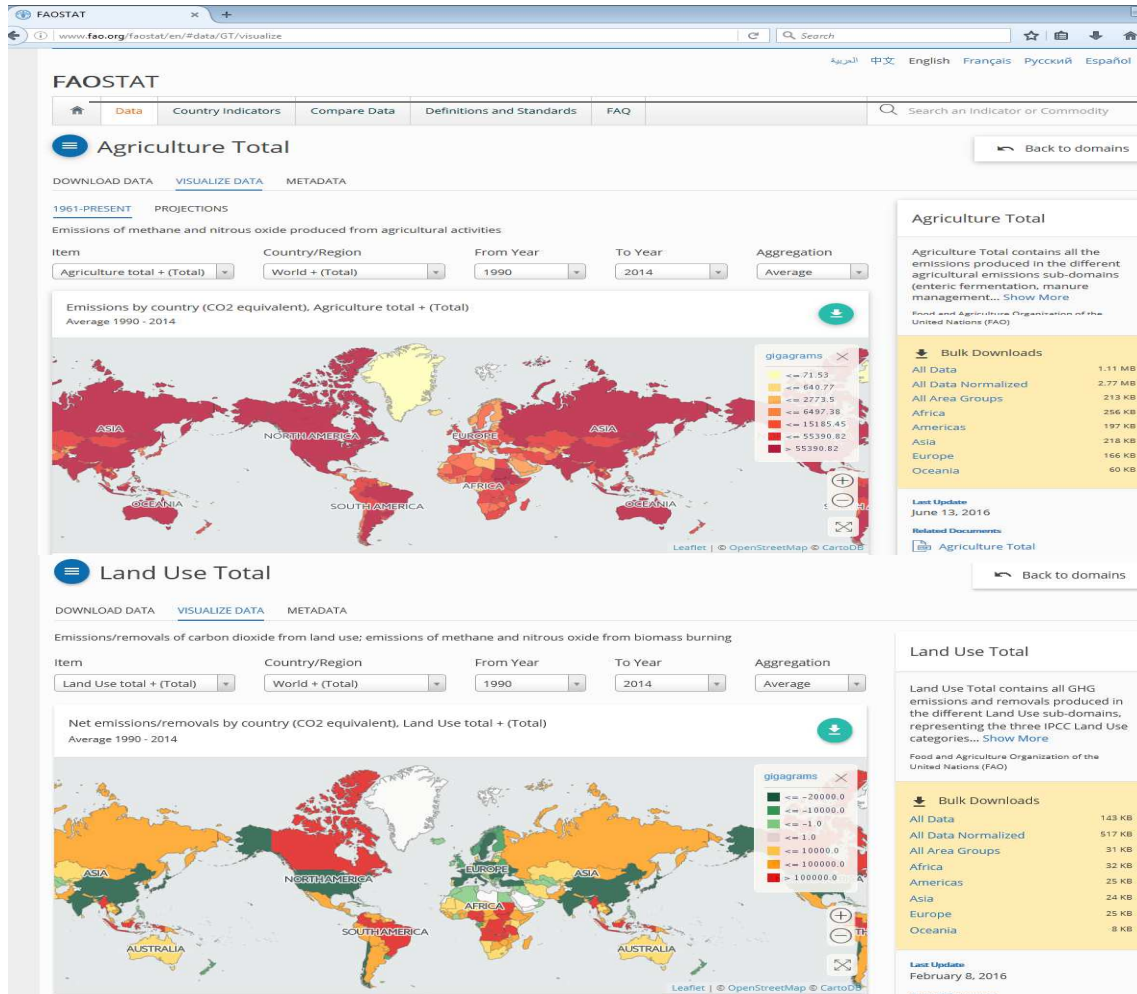
PROCESS (with ESA, NASA, JRC):

- Overlay SEEA LC classes and fire data to estimate burned areas by LC at 500m
- Compute biomass using IPCC and FAO AEZ at 1 km
- Estimate emissions using IPCC at 1km
- Use GAUL to aggregate from pixel to National Level



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# FAOSTAT Agriculture and Land Emissions Accounts

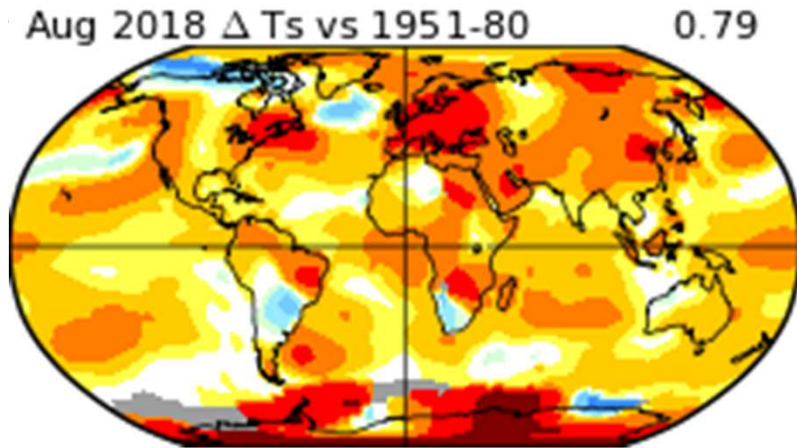


- Burnt area, drained peatland area, burned biomass and emissions over SEEA Land Cover/IPCC Land Use Classes + Peatlands
- 185 countries and territories, 1990-2016

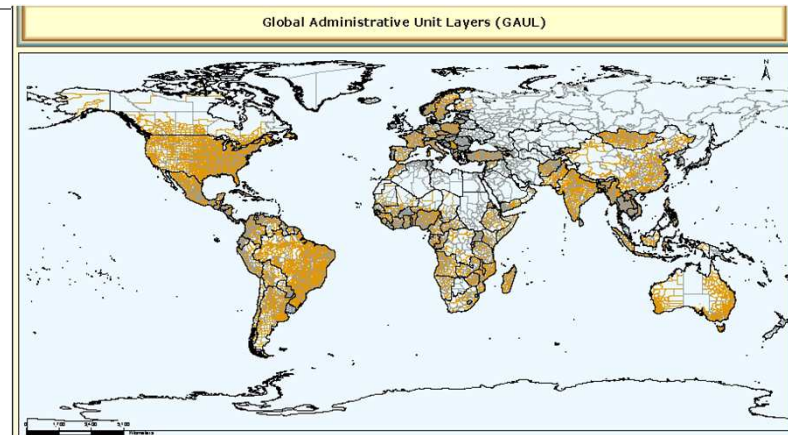


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# Temperature Change



Source: NASA GISS, 2018



GAUL. Source: FAO, 2018

Information is needed for key reporting processes:

- UNFCCC (e.g., NCs, BURs, NDCs)
- SDG (e.g., 13)
- SEEA (e.g., Natural Capital and Ecosystems)

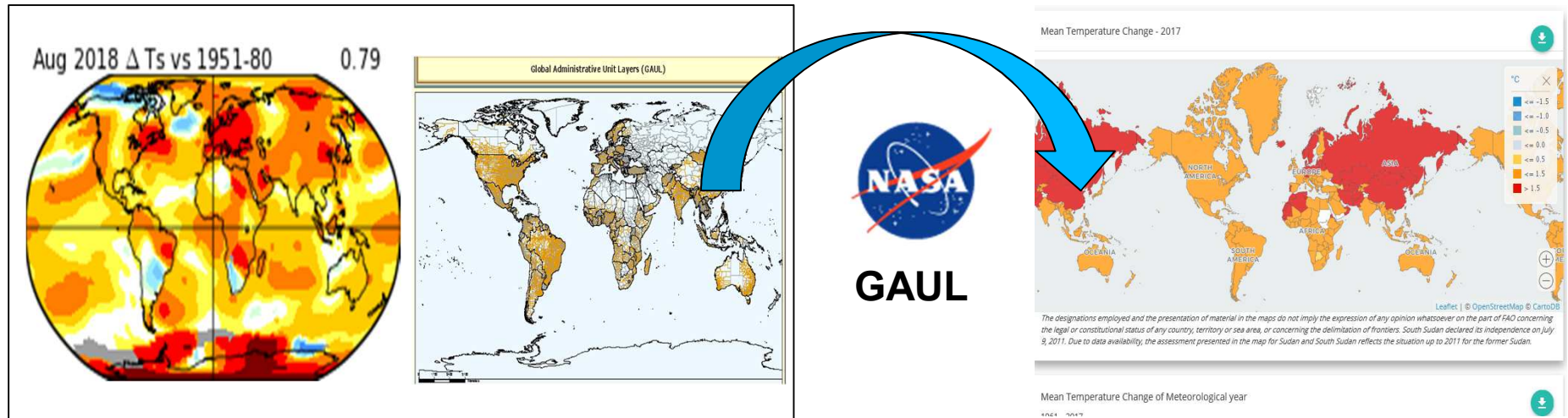
No global statistical data collection

Information available from network of met stations,  
geospatially distributed @ 50 km)



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# Temperature Change



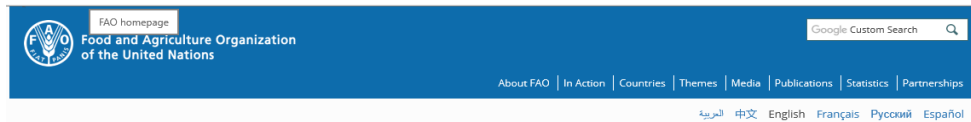
## PROCESS (with NASA-GISS):

- Use GAUL to aggregate from pixel to National Level
- Produce uncertainty indicators (ongoing)



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# FAOSTAT Climate Change Indicator: Temperature Change



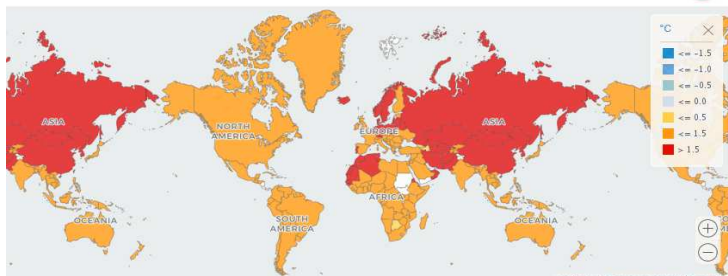
FAOSTAT



Temperature change

DOWNLOAD DATA | VISUALIZE DATA | METADATA

Mean Temperature Change - 2017



The designations employed and the presentation of material in the maps do not imply the expression of any opinion whatsoever on the part of FAO concerning the legal or constitutional status of any country, territory or sea area, or concerning the delimitation of frontiers. South Sudan declared its independence on July 9, 2011. Due to data availability, the assessment presented in the map for Sudan and South Sudan reflects the situation up to 2011 for the former Sudan.

The Temperature Change domain of the FAOSTAT Agri-Environmental Indicators section contains data on observed mean surface temperature changes by... Show More

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Bulk Downloads

All Data	753 KB
All Data Normalized	2.8 MB
All Area Groups	87 KB
Africa	168 KB
Americas	113 KB
Asia	152 KB
Europe	137 KB
Oceania	61 KB
Antarctic Region	10 KB

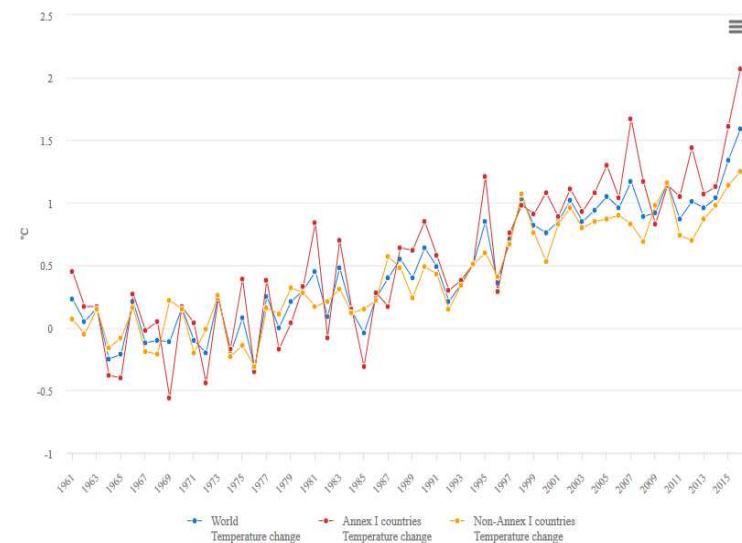
Last Update  
January 19, 2018

Related Documents:

- README\_Methodological\_Note
- Update history

Mean Temperature Change of Meteorological year

1961 - 2016



- Temp Change data for annual, seasonal and monthly means, 1961-2017
- 185 countries and territories



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## Conclusions

- GEO spatial-derived statistics are useful to address a number of relevant issues in agri-environment and climate change
- FAO produces and disseminates analytical estimates in support of national, regional and global evidence-based decision making
- Aim is to support, through methodological work as well as data, international reporting by member countries
- Focus on education/communication of results to non-specialized users is an important driver



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# Thank You !

Francesco N. Tubiello  
Senior Statistician  
Team Leader, Environment  
Statistics Division, FAO

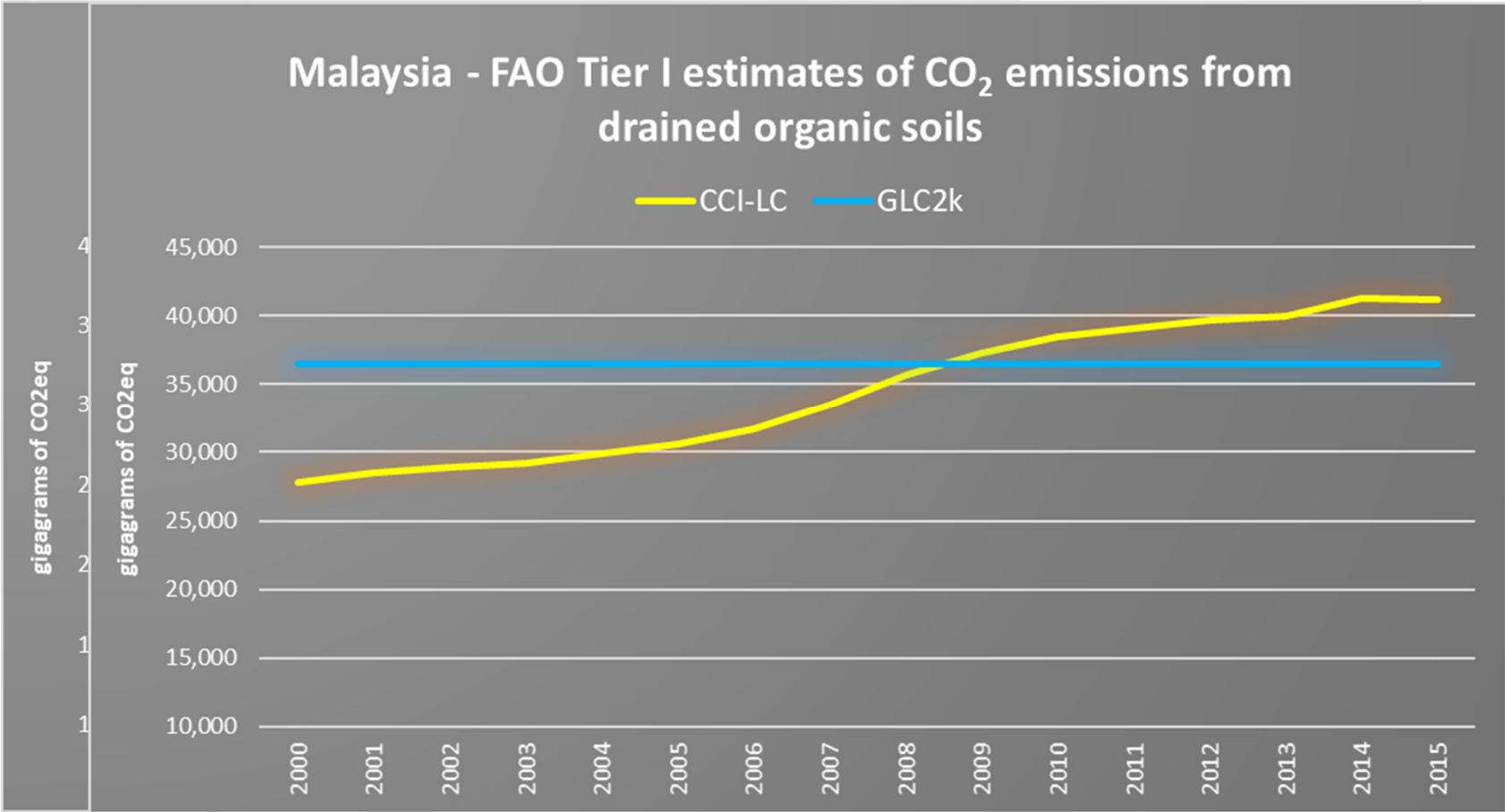
[francesco.tubiello@fao.org](mailto:francesco.tubiello@fao.org)

<http://www.fao.org/economic/ess/environment/en/>



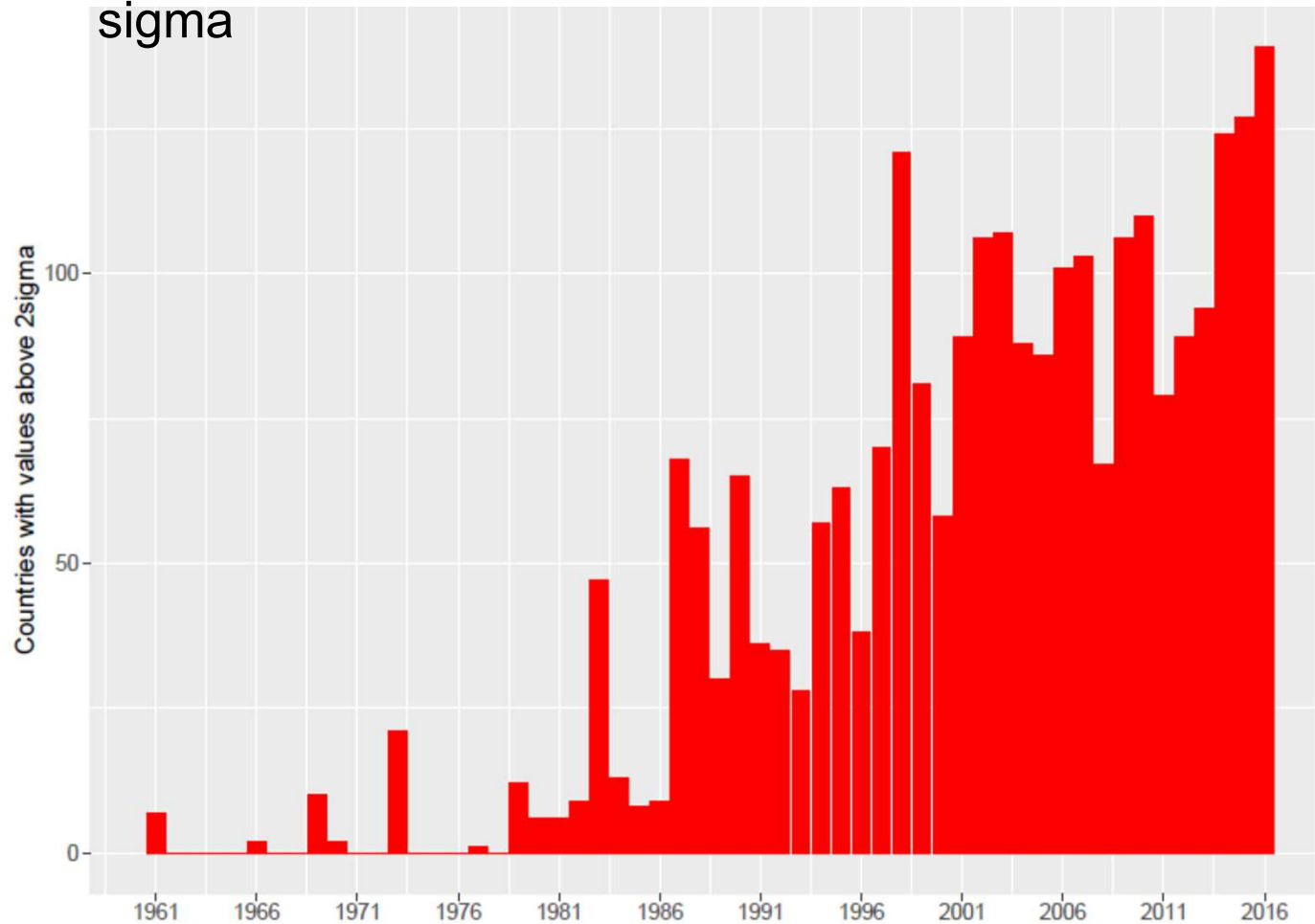
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# GHG from drained organic soils



# Communicating Climate Change Indicators:

Number of countries with temperature anomalies  $> 2$  sigma

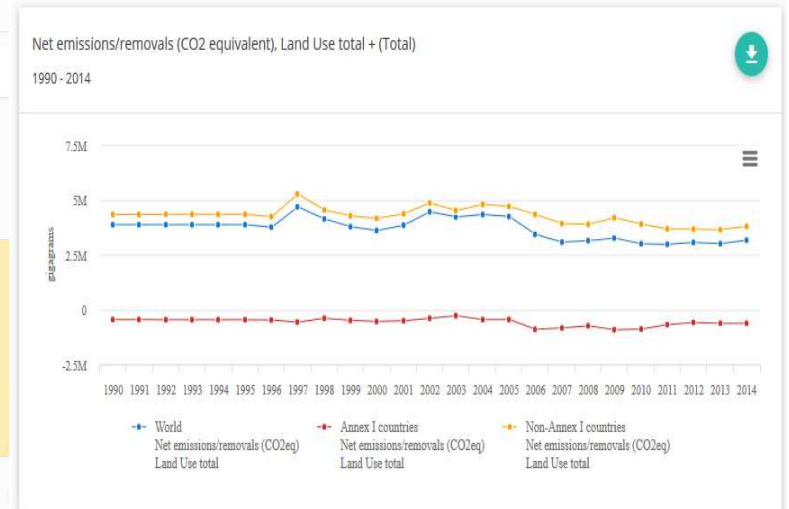
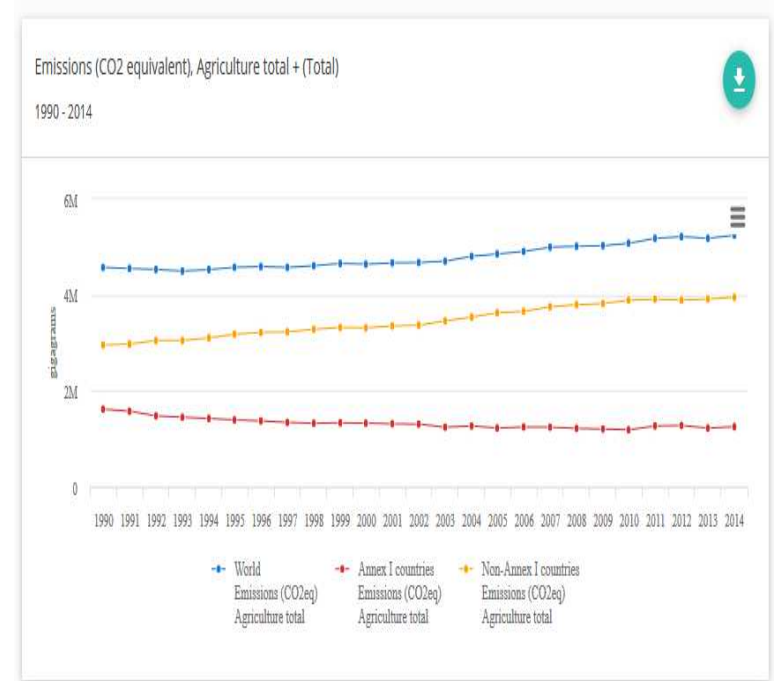
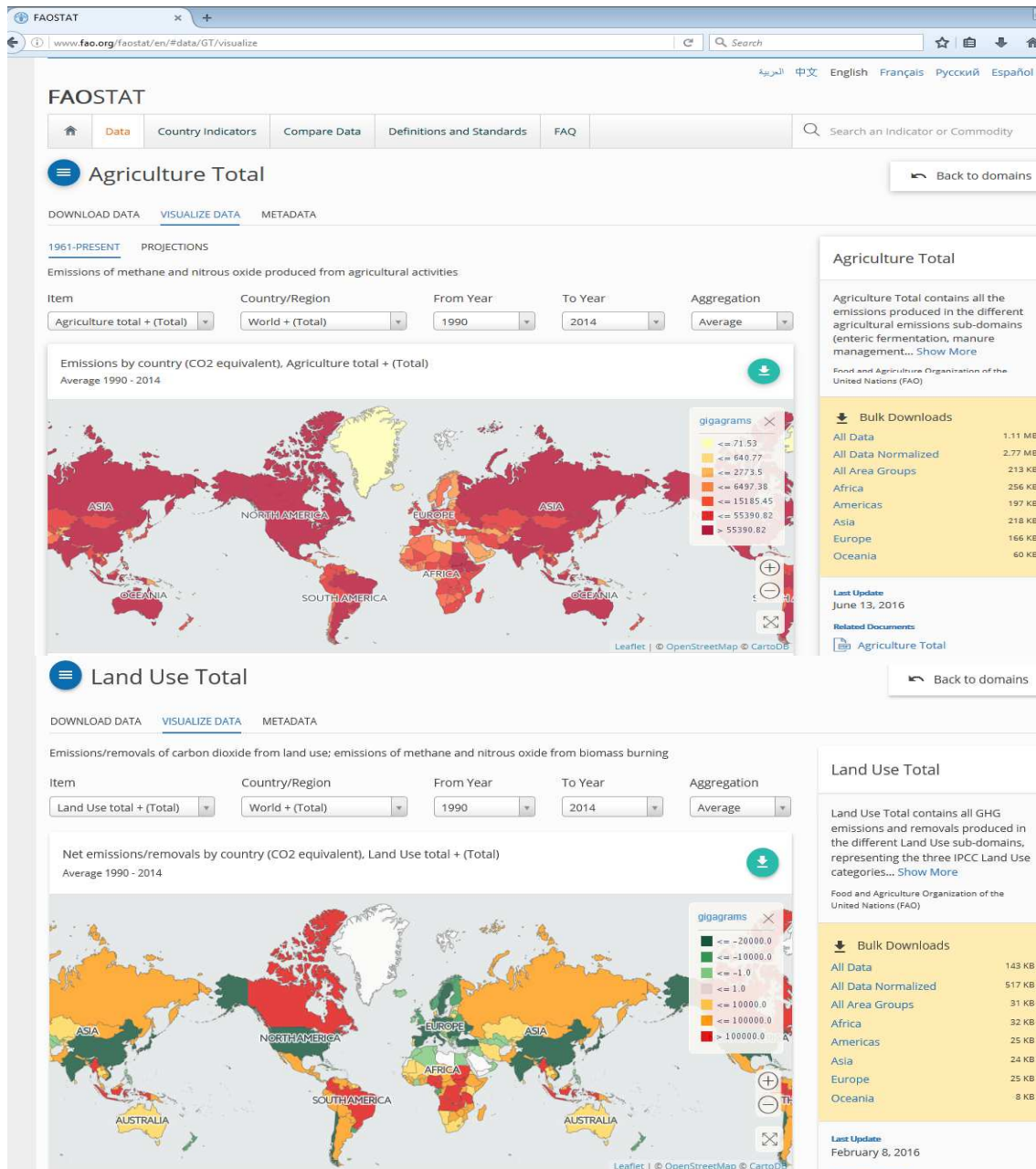


[MOVIE of > 3-sigma anomalies, 1961-2016](#)



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# FAOSTAT Emissions Database



# FAOSTAT Analytical Environment Statistics

## Global default estimates

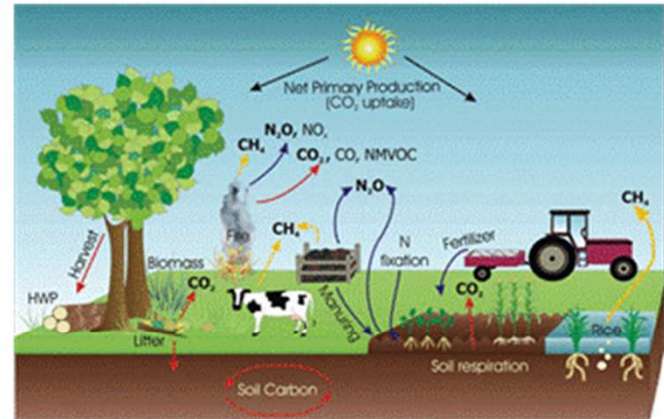


& geospatial data

+

SDG Methods

IPCC 2006 Guidelines



=



<http://www.fao.org/faostat/en/#data>

# Integration geospatial to statistical standards and processes



Perspectives on EO for the SDGs

- The Role of Geospatial Information and Earth Observations in the SDGs: A Policy Perspective
- Earth Observation for Ecosystem Accounting
- Forging Close Collaboration Between EO Scientists and Official Statisticians – An Australian Case Study
- Monitoring the 2030 Agenda in Mexico: Institutional Coordination and the Integration of Information
- Perspectives from a Custodian Agency for Agriculture, Forestry and Fisheries
- The 'Urban' SDG and the Role for Satellite Earth Observations
- EO4SDG: Earth Observations in Service of the 2030 Agenda for

## Perspectives from a Custodian Agency for Agriculture, Forestry and Fisheries

Food and agriculture lie at the heart of the 2030 Agenda, with closely related development outcomes that range from ending poverty and hunger to maintaining and protecting the natural resource base, and responding to climate vulnerability and change. As a result, FAO was chosen as the Custodian Agency of 21 SDG indicators, with responsibilities for the methodological development, the provision of technical assistance and the collection and dissemination of data for monitoring progress towards a number of targets under Goal 2 'Zero hunger', Goal 5 'Gender equality', Goal 6 'Clean water and sanitation', Goal 12 'Responsible consumption', Goal 14 'Life below water' and Goal 15 'Life on land.' Data collected from countries and new sources will allow monitoring annual progress at a sub-regional, regional and global level and will provide the evidence base for the planned follow-up and review processes in the context of the SDG High Level Political Forum.

### 5.1 Tracking progress towards sustainable development

Earth observations (EO) can provide a significant contribution to the measurement of many of the SDG indicators under FAO custodianship. In

- indicator 2.3.1: volume of production per labour unit by classes of farming/pastoral/ forestry enterprise size;

- indicator 2.3.2: average income of small-scale food producers, by sex and indigenous status.

Target 2.4 focuses on the sustainable increase of agricultural productivity:

- indicator 2.4.1: proportion of agricultural area under productive and sustainable agriculture, which entails maintaining agriculture's ecosystems function, by improving land and soil quality and strengthening its capacity for adaptation to climate change, including improved resilience to extreme events and disasters.

Monitoring this target involves measuring the economic, social and environmental dimensions of agricultural sustainability with appropriate sub-indicators.

The official global indicators selected to measure progress against targets 2.3 and 2.4 require a common data collection framework, able to gather timely and relevant environmental, economic and social information at the farm level, with the possibility of capturing disparities between small- and large-scale food producers.

In order to better meet these requirements and more generally the need to improve the quality, consistency and timeliness of national and sub-

consistent data framework across sub-national, national and global scales. MONTHS:

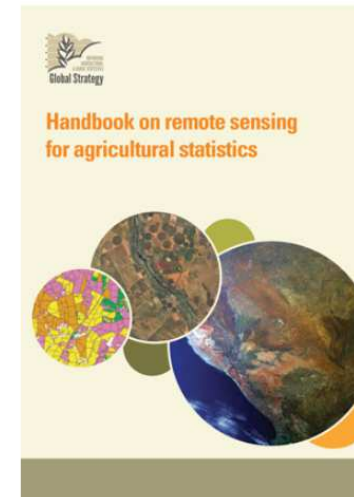


Figure 4: FAO and Global Strategy guidelines on applying remote sensing information to improve crop statistics.

### Article Contributors

Pietro Gennari, Francesco N Tubiello and Giulia Conchedda (Food and Agriculture Organization of the United Nations)

### Further Information

FAO, Office of the Chief Statistician: [chief-statistician@fao.org](mailto:chief-statistician@fao.org)

Open Foris tools: [www.openforis.org](http://www.openforis.org)



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# FAOSTAT Agri-Environmental Indicators

**Livestock Patterns**

The Livestock Patterns domain of the FAOSTAT Agri-Environmental Indicators contains data on livestock numbers, shares of major livestock species and... [Show More](#)

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All Data	940 KB
All Data Normalized	2.86 MB
All Area Groups	152 KB
Africa	202 KB
Americas	167 KB
Asia	190 KB
Europe	143 KB
Oceania	44 KB

**Last Update**  
July 6, 2017

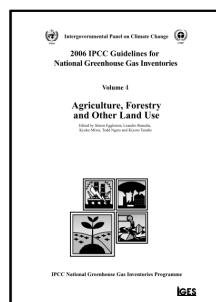
**Related Documents**

[README\\_Methodological\\_Note](#)

[Definitions and standa...](#)

[Metadata](#)

• Air and Climate	% Ag. NH3	1980-2009
• Energy	Bioenergy, Ag. Use	1971-2009
• Soil	% C, degrad., erosion	1991 & 2008
• Water	% ag. withdrawals	1961-2010
• <b>Fertilizers</b>	Kg/ha of cropland	2002-2016
• <b>Pesticides</b>	Kg/ha of cropland	1990-2016
• <b>Livestock Patterns</b>	% LSU	1961-2016
• <b>Land Use</b>	Share of land area	1961-2016
• <b>Land Cover</b>	ha	1990-2016
• <b>Climate Change</b>	GHG, Temp Change	1961-2017



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