



Food and Agriculture Organization
of the United Nations

Assessment and monitoring of land resources in FAO using Geospatial technology and methods: a focus on land cover.

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- Land Cover mapping and change detection
 - Land Cover standards, methodology and tools
 - Land Cover data applications
 - Crop monitoring
 - Land evaluation and planning
 - Data dissemination systems
 - Capacity building
 - SDG
-

Country Level

Satellite data

In Situ

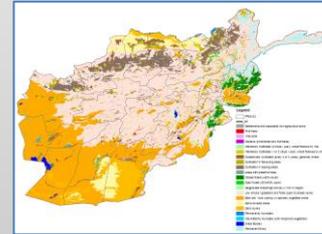
Aerial
photography



ISO
LCCS/LCML



National LC databases



Harmonization
and data fusion

Applications

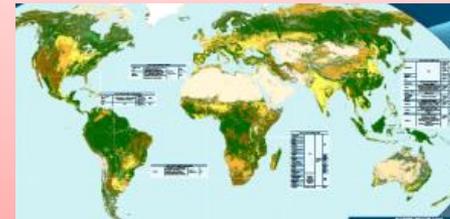


Global level

Web GIS



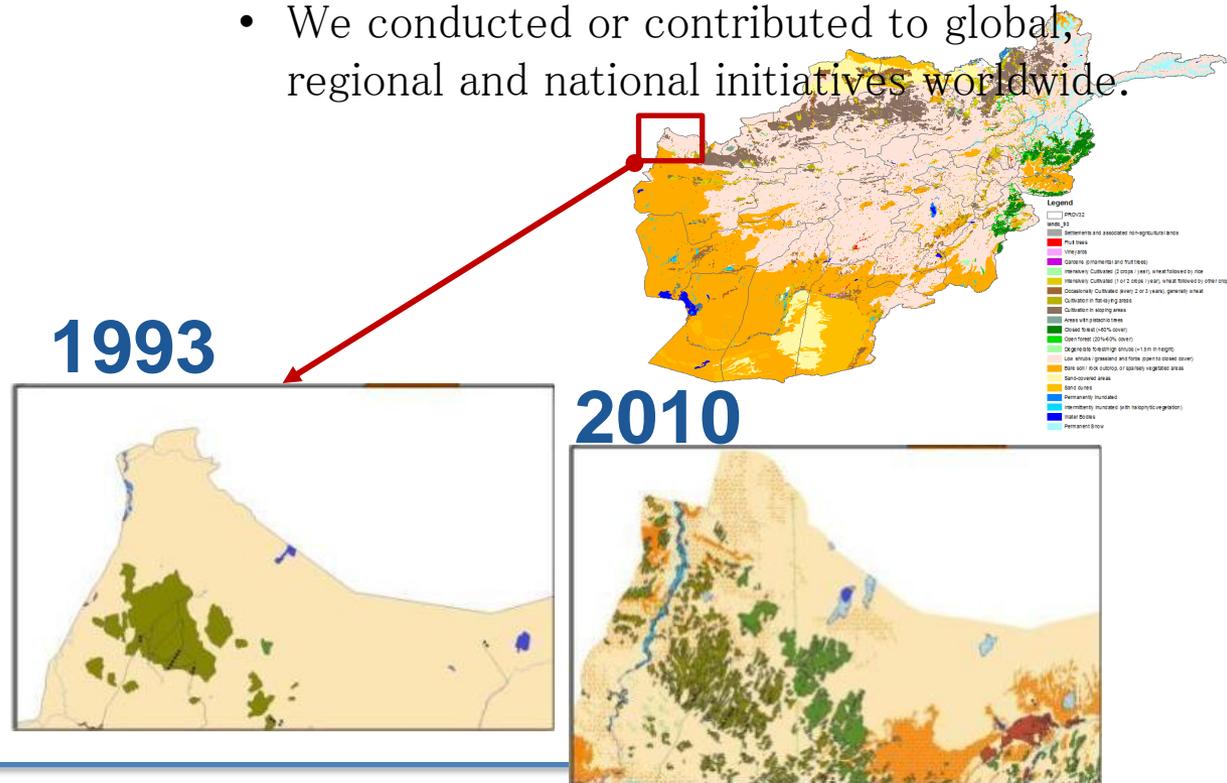
GLC- SHARE



Land Cover mapping and change detection

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- Data dissemination systems
- Capacity building
- SDG

- NRL and then DDN have a long significant experience in developing LC databases from EO sources.
- We conducted or contributed to global, regional and national initiatives worldwide.





Land cover and land use are key parameters for natural resources management. Land cover represents the baseline information for any management policy aimed at a sustainable use of natural resources.

In order to ensure long term availability of needed resources, initiatives for assessing and monitoring the environment are being developed within the frame of international agreements and conventions (UNFCCC, UNCCD, CBD Millennium Ecosystem Assessment).

Management practices need detailed, reliable and up-to-date information on the status of the land, most often obtained from land cover maps, as well as information on changes inland cover over time, depicting eventual trends in land conversions.

Developing countries are usually most affected by the lack of assessment data and monitoring tools, making their future management decisions more difficult.

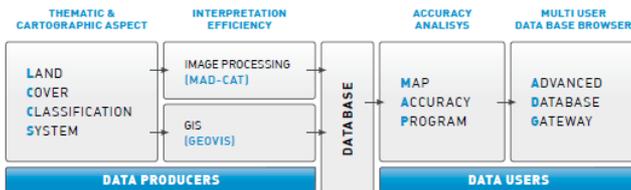


NATURAL RESOURCES MANAGEMENT AND ENVIRONMENT DEPARTMENT (NR)

TOOL BOX FOR LAND COVER ASSESSMENT

FAO is heavily involved in the development of tools for supporting countries in the assessment of land cover and monitoring it over time.

Starting from development of technical tools for land cover mapping and change assessment, to the standardization of procedures for land cover classification and analyses, FAO's work represents a significant contribution to the development of tools that provide essential land cover data needed for management purposes.



▲ The flow of products and data producers/users with inputs from FAO products.

Following is the list of components of the "GLCN tools set"

LAND COVER CLASSIFICATION SYSTEM (LCCS)



LCCS – A comprehensive, standardized a priori classification system that enables universal land cover classification to be used for effective management and land cover change assessment. Developed based on the experience gained from numerous United Nations, international and country mapping activities.

MAPPING DEVICE-CHANGE ANALYSIS TOOL (MAD-CAT)



MAD-CAT – A stand alone, interactive, and completely integrated environment for mapping land cover, detecting its changes over time, editing the land cover maps produced – so as to link them to land use information –, validating the results obtained and reporting through built-in statistics. MAD-CAT includes the innovative classification of satellite imagery using object-based approach, thus simplifying the procedure for land cover change analyses through comparison of objects across images of different dates.

GEOGRAPHICAL VECTOR INTERPRETATION SYSTEM (GeoVis)



GeoVis – features an extensive number of functionalities specifically designed to perform an efficient visual interpretation of remotely sensed images. Directly linked to LCCS, enables immediate assignment of polygons to specific land classes. It includes a module for estimating thematic mapping accuracy (MAP).

ADVANCED DATABASE GATEWAY (ADG)



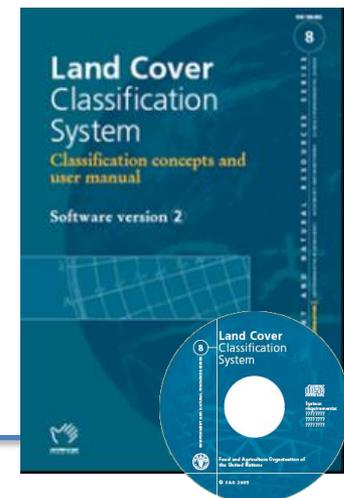
ADG – a cross-cutting interrogation software that allows the easy and fast recombination of land cover polygons according to the individual end-user requirements. Aggregated land cover classes can be generated not only by name, but also using the set of existing classifiers.





LCCS / Land Cover Meta Language

- Land Cover mapping and change detection
 - Land Cover standards, methodology and tools
 - Land Cover data applications
 - Crop monitoring
 - Land evaluation and planning
 - Data dissemination systems
 - Capacity building
 - SDG
- LCCS allows the description, characterization, classification and comparison of most land cover features
 - Developed over the last 15 years
 - Suited for any scale, dates and sources
 - Recently became ISO standard (v3, LCML)
 - Referenced in INSPIRE
 - FAO is implementing and assisting with technical advice the production of standardized and harmonized land cover baseline.
 - Applied worldwide





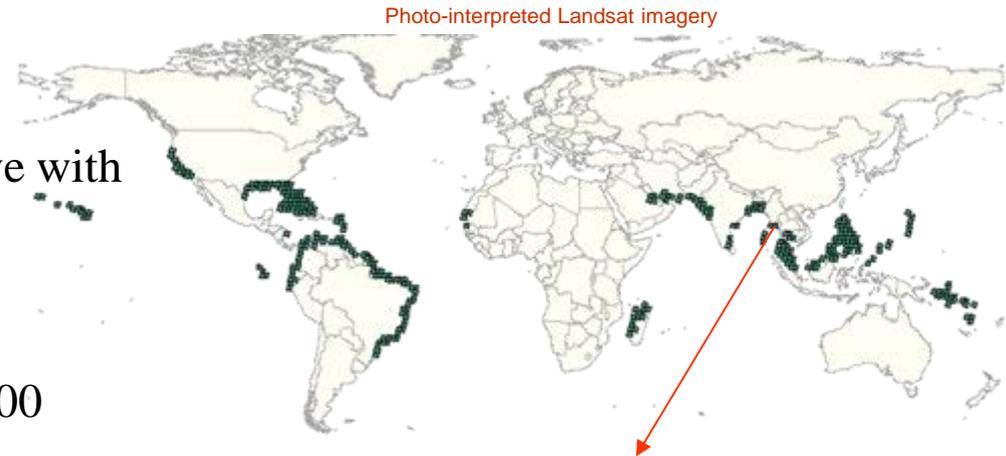
- Global land cover database;
- Methodology and datasets published in 2014;
- 11 major thematic land cover layers (FAO SEEA LCML legend);
- Resulted by a combination of “best available” high resolution national, regional and/or sub-national land cover databases;
- Produced with a resolution of 30 arc-second (~1x1 km). New release in 2016 at 300 meters
- Used to support monitoring of SDG land based indicators (e.g. 15.3, 15.4, 2.4



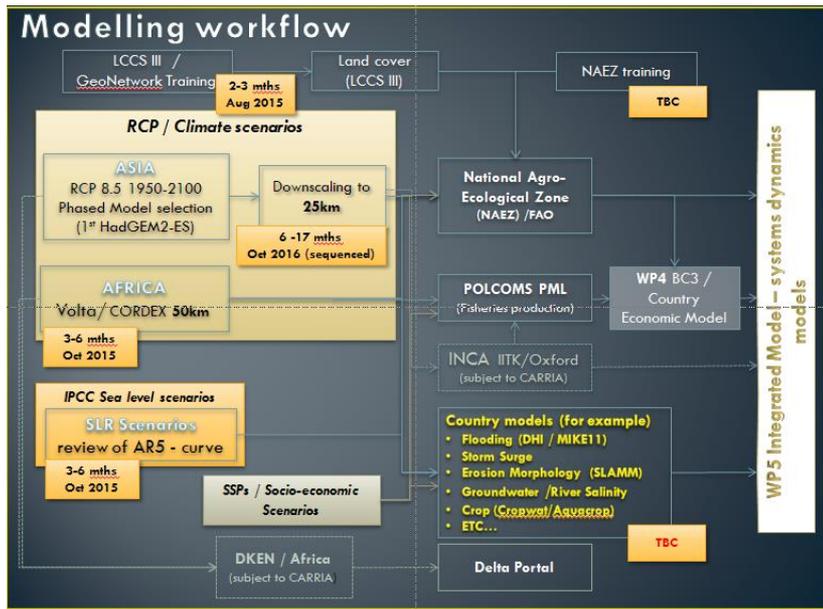


Fragile ecosystem mapping: mangroves

- The World Atlas of Mangroves provides an overview of the distribution of mangroves worldwide
- NRL has contributed to this initiative with methodology and toolbox
- 40 countries have been mapped
- Image interpretation of more than 400 Landsat scenes dated 2000-2003 at 1:250,000



“DECCMA: Deltas Vulnerability and Climate Change: Migration and Adaptation” examines the vulnerability, environmental stressors and hazards of a range of climate change and biophysically driven scenarios across the study deltas.



THREATENED DELTAS

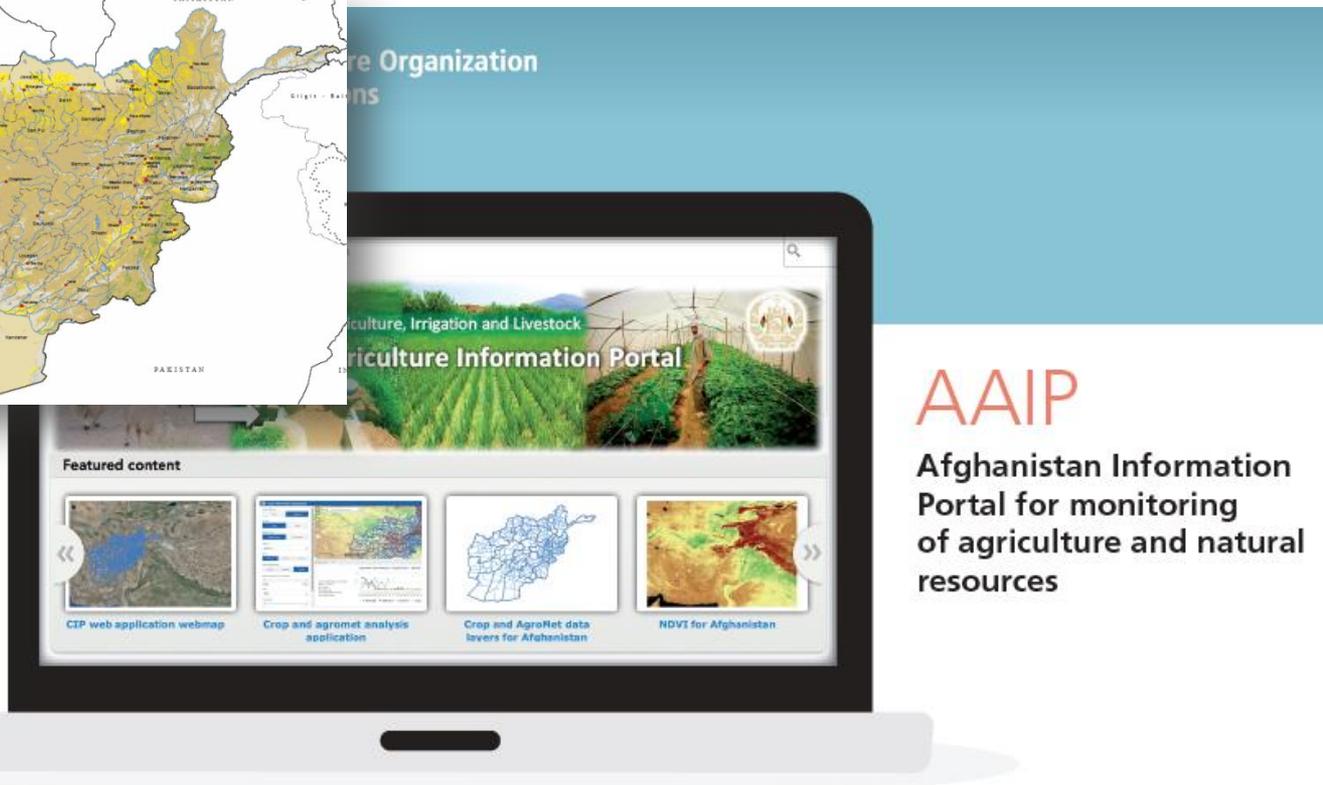
(Ericson et al (2006); IPCC AR4, 2007)



Population potentially displaced by current sea-level trends to 2050
(Extreme >1 million; high = 1 million-50,000; medium 50,000-5,000 people)
Global population in deltas is about 500 million people



Afghanistan Land Cover and crop monitoring Webapp



AAIP

Afghanistan Information Portal for monitoring of agriculture and natural resources

MAIN OBJECTIVES OF THE CROP PORTAL:

Sharing historical statistics and forecasts on crop yields and area.

1

Sharing historical and near real time agronomic, meteorological and hydrological data.

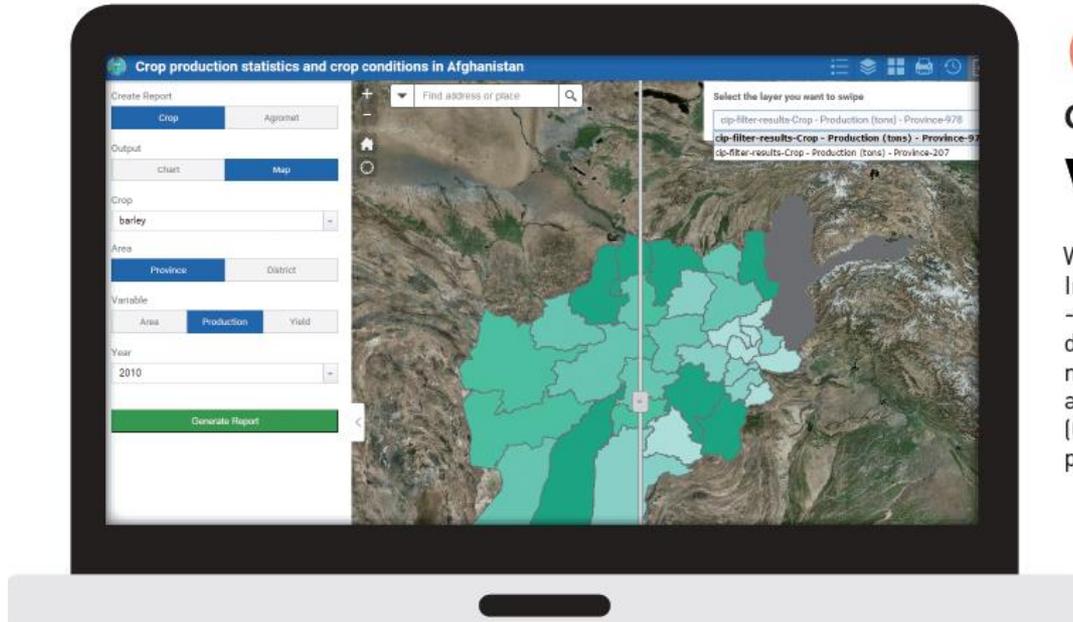
2

Monitoring crop conditions during main growing stages to detect stresses affecting future crop results.

3

GIS interface for the mapping of crop production information natural resources, infrastructure and vegetation indexes from remote sensing.

4



CIP Crop Information Portal web app

Whitin the Afghanistan Agriculture Information Portal (AAIP) - that allows for data sharing and development of web application for monitoring purposes in agriculture - a web app has been developed (CIP) to monitor selected crop production and agro-met data.

Available Layers

Operational layers:
Crop and Agrometeorology

Ancillary layers:
Administrative boundaries,
Land cover, Irrigation
Watersheds, NDVI, Villages

Next coming:
Road network and Market price



Crops info

Type:
Barley, Maize, Rice, Wheat

Area: Country, Province, District
Period: 2009 - 2014

Query mode:
Single crop, Comparison among crops
or Comparison among areas (swipe)



Agromet info

Data aggregation:
Annual, Monthly, 10 Day

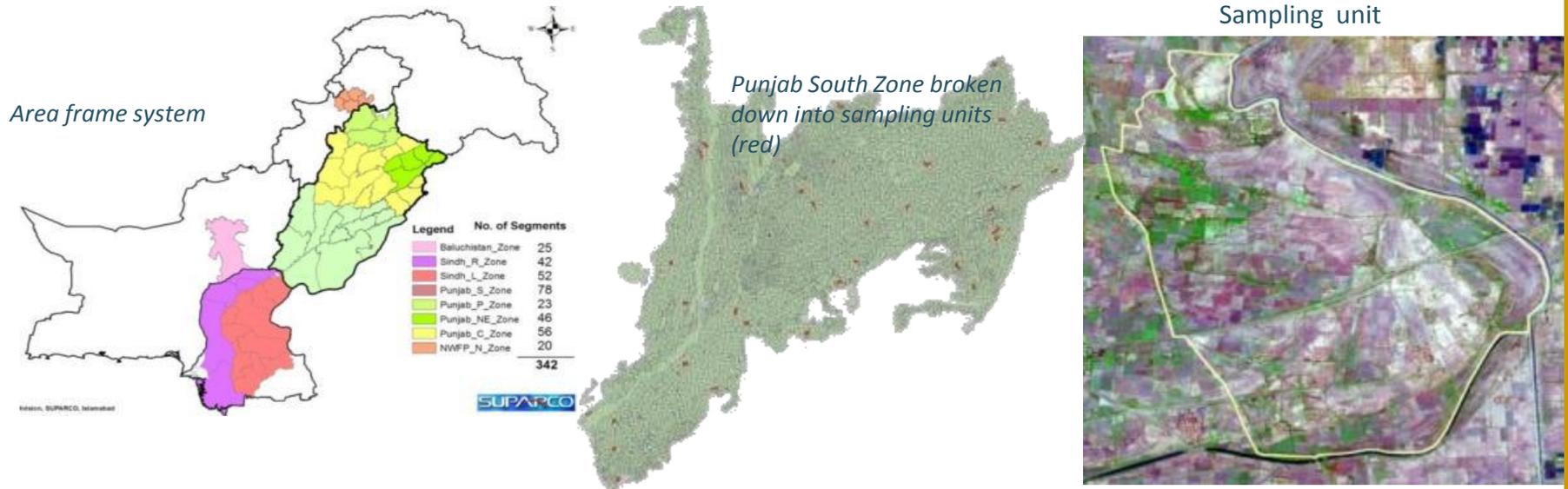
Area: Country, Province, District
Period: 2009 - 2015

Query mode:
Single factor or Composite



Pakistan Land Cover and crop monitoring

- The Area frame approach is used for crop acreage and yield estimation.
- Good quality land cover data improves stratification, reduces sample size and allocation, and produces more accurate estimates.
- NRL/DDN is collaborating with SUPARCO in developing a national LCCS based LC database and applying the AF methodology in Pakistan at the provincial Crop Reporting Services of Punjab and Sindh

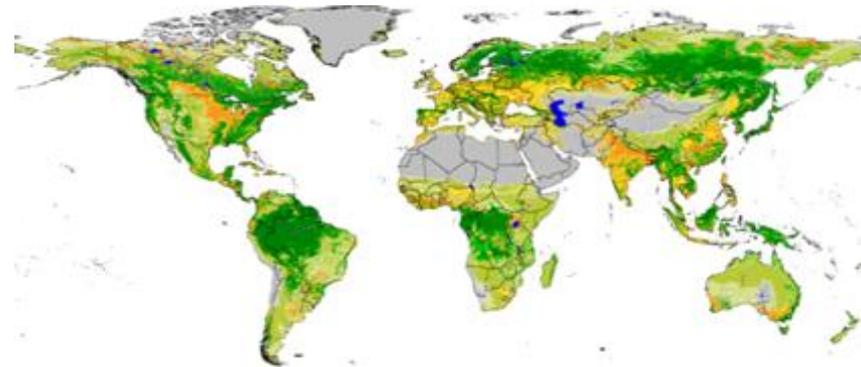


- DDN is involved in programmes on global systems to monitor and assess production as an important decision making tool:
 - provide **timely information on crop production and yield** in a standardized and regular fashion at the regional to global level.
 - provide **estimates as early as possible** during the growing season(s) and update the estimates periodically through the season until harvest.
- Examples are **GEOGLAM** and **SIGMA** combining in-situ information, weather and satellite data in a convergence of evidence approach to estimate production and yield.
- **Sentinel-2 for agricultural monitoring** (Sen2-Agri) provide new opportunities for monitoring of agricultural systems





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 - **Land evaluation and planning**
 - Data dissemination systems
 - Capacity building
 - SDG
- The Agro-Ecological Zones (AEZ) process is the main system for **assessing agricultural resources and potential**
 - Can be applied at global, regional and national levels for better planning, management and monitoring of land resources
 - FAO involved in methodology development since 1978
 - Used as SO-2 indicator (area with improved agricultural productivity and crop suitability)

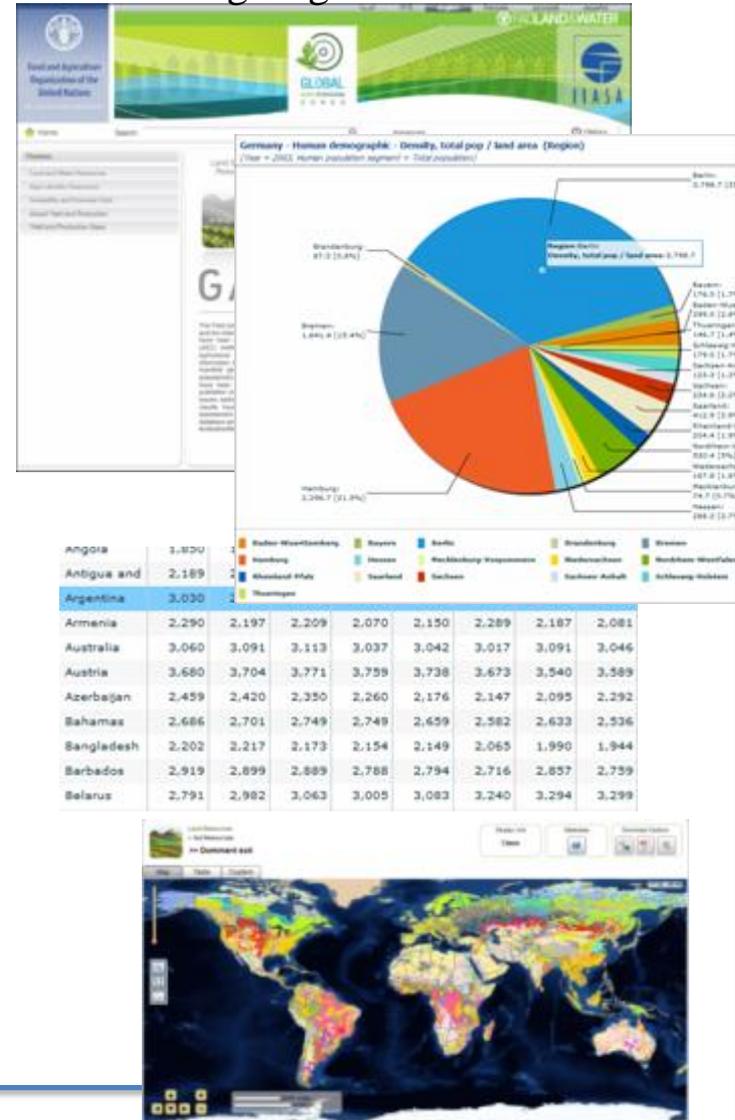




Global Agro Ecological Zones (GAEZ)

www.fao.org/nr/gaez

- In 2012, FAO and International Institute for Applied Systems Analysis (IIASA) launched the **Global Agro-Ecological Zoning Data portal**
- It provides online **28 terabytes of geospatial and tabular** information and **reporting** on agricultural resources and potential
- Global, regional, national and sub-national
- Brief summary of content:
 - 5 thematic areas
 - > 300,000 global datasets at mainly 5 arc-minutes (order of tenth terabytes)
 - yield and production gap analysis
 - Historical 1961–2000, 30 year average (1961–1990) and
 - Future (2020, 2050s 2080)





- The **AEZ framework** for crop potential assessment can be applied at national scale through the **Land Resources Information Management System (LRIMS)**
- Tool helping
 - **conduct the assessment** of land suitability, potential attainable yields and potential crop production, and
 - **model land responses** to agricultural policies at national scale according to the AEZ methodology. Specified management assumptions and input levels, both for rain-fed and irrigated conditions are evaluated
- It employs detailed **spatial biophysical and socio-economic datasets**.





- Awareness workshops, training resources and sessions
 - Regional awareness workshops by FAO staff on land cover mapping methodology, standards and tools
 - National on-the-job trainings to support national mapping programmes
 - Project coordination and backstopping

Sudan



Uruguay



Nepal



Pakistan



Framework for Monitoring and Reporting on SDG Target 15.3

Indicator 15.3.1
Proportion of land
that is degraded over
total land area



Sub-Indicators
UNCCD (CBD, UNFCCC)
Reporting Mechanisms



**Data from
multiple sources**
FAO, GEF and other
Reporting Mechanisms

**Official Statistics
and Earth Observation**



**Land Use and
Management Practices**



**Surveys, Sampling and
Citizen Sourcing**





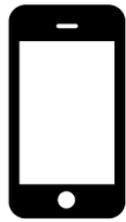
Global Importance Agricultural Heritage Systems

Agricultural Heritage Systems can be found all over the world. Characteristically, these systems are rich in agricultural biodiversity and associated wildlife, and are important resources of indigenous knowledge and culture.

36 Identified - 91 Potential

Geo-tagging app to support acknowledgement and recognition of farmers rights on the land

Farmers



Geo-tagging:

- Name
- Photo
- X,Y
- Land Cover
- Land Use
- Crop species



Web GIS:

Information sharing and outreach





Thank you