2ND SESSION: EARTH OBSERVATION AND SPACE INTEGRATED APPLICATIONS FOR SUSTAINABLE DEVELOPMENT

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“Earth observation and integrated applications for disaster risk management and sustainable development”

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FLOOD IMPACT IN PAKISTAN 2022-23

1. Collection of ancillary data
   - National land cover (2021), field data
   - Crop calendar 2021
   - Population (WorldPop 2020)
   - Administrative boundary (GAUL 2015)

2. Area of interest (provinces, districts)

3. Flood extent preparation
   - Sentinel 1 Radar (10m) and Sentinel 2 optical (10m)
   - JRC permanent waterbody (30 m)
   - National river data

4. Preparation of agricultural mask

5. Preparation of crop type mask

6. Overlay and zonal statistics
   - Flood extent by provinces, districts
   - Inundated agriculture land by provinces, districts
   - Inundated crops by provinces, districts
   - Population exposed by provinces, districts

6. Flood cropland

6. Flooded wheat

FLOODS IN LIBYA 2023

2. Dams

5. Reservoir

Water extent

10. Irrigation

Exposure

Category 1

Extraction\collection
Geolocation
Field form
Field visit

Category 2

Storage
Geolocation
Field form
Field visit

Category 3

Transportation
Sampling
Field form
Field visit

Category 4

Distribution\irrigation
Sampling
Field form
Field visit
Assessing agriculture drought severity and its impacts on both irrigated and rainfed agriculture using Condition Vegetation Index (VCI) in Afghanistan from 2021 to 2023.
FAO – GENERAL OVERVIEW

- Founded in 1945, FAO leads international efforts to defeat hunger and improve nutrition and food security.
- FAO is providing technical support in > 130 countries among 195 Member Nations.
- HQ is located in Rome, Italy.
- Consist of 5 regional offices, 11 sub-regional offices, 6 liaison offices and 7 partnership & liaisons offices.
- Article 1 of the convention - Functions of the Organization
  The Organization shall collect, analyse, interpret and disseminate information relating to nutrition, food and agriculture. In this Constitution, the term "agriculture" and its derivatives include fisheries, marine products, forestry and primary forestry products.
- FAO supports development plans, strategies and decision-making processes in member states through the transformation to MORE efficient, inclusive, resilient and sustainable agri-food systems for better production, better nutrition, a better environment, and a better life, leaving no one behind.
- FAO is the custodian UN agency for 21 SDG indicators and is a contributing agency for a further 5. In this capacity, FAO is supporting countries’ efforts in monitoring the 2030 Agenda.

https://www.fao.org/home/en
FAO – GENERAL OVERVIEW
GEOSPATIAL UNIT (NSL)

- FAO's Geospatial Unit: providing geospatial data, information, & services
- Supporting food security and monitoring natural resource use
- Proposing policy-relevant solutions through remote sensing

Our Contributions

- Define standards and indicators for regular monitoring
- Conduct qualitative and quantitative assessment of natural resources
- Develop methodologies and tools for governments and institutions

Impact

- Supports development plans, growth strategies, and decision-making processes
- Key issues addressed: land cover mapping, crop monitoring, disaster risk reduction, food security mapping, spatial planning, and environmental sustainability

Applying technological advances

- Object-Based Image Analysis
- Multi-temporal
- Optical, RADAR and LiDAR
- LCML - LCHML
- Cloud computing (SEPAL – GEE)
- Machine-learning/AI
- UAS
- Internet of Things
- Integration with local knowledge and field data
- etc....
DIVERSITY OF DATA INPUT AND APPLICATIONS

Diverse satellite imagery and sensors are used to assess and monitor natural resources and agriculture.

- **MODIS** (250 m spatial resolution)
- **Landsat** (30 m spatial resolution)
- **Sentinel 2** (10 m spatial resolution)
- **SPOT 6/7** (6 m spatial resolution)
- And many others... NICFI, Planet, Worldview, MAXAR etc.

**Ex. of applications**
- **Land degradation in Angola**
- **Land cover in Uruguay**
- **Crop mapping in Libya**
- **Woodfuel in Bangladesh**
- **Infrastructure**
- **Greenhouses**

**Challenges:** compromise between temporal, spatial & spectral resolutions with available imagery (cost/size/cloud etc.)
GEOSPATIAL PLATFORMS

- Global Information and Early Warning System on Food and Agriculture (GIEWS)
- National Forest Monitoring (NFM)
- Remote sensing for water productivity (WAPOR)
- Globally Important Agricultural Heritage Systems (GIAHS)
- Modelling System for Agricultural Impacts of Climate Change (MOSAICC)
- Agricultural Stress Index System (ASIS)
- Global Land Cover Network (GLCN)
- Global Agro-Ecological Zones (GAEZ)
- Global information system on water resources and agricultural water management (AQUASTAT)
- Land cover legend registry (LCLR)
- The Hand-in-Hand (HIH) Initiative (HiHi).
- Emergency data Hub (DIEM).

SEPAL CLOUD COMPUTING PLATFORM

- SEPAL is a cloud platform for accessing, processing and analyzing geospatial data for land monitoring.
- SEPAL is free and open: anyone can register for access to the following features
- All you need is an Internet connection to access SEPAL website

https://sepal.io/
LAND COVER AND THE SDGS

Land resources play a vital role in tackling climate change, securing biodiversity and maintaining crucial ecosystem services, while ensuring resilient livelihoods and food security.

Assessing land-cover and land-use is essential and critical and one of the fourteenth fundamental data theme under UN-GGIM.

Contributes to all SDGs its cross-sectoral nature as well as other international goals and initiatives including UNFCCC, ISOTC211 AG13, UNFCCC, UNCCD, UNCEEA and others.

It is an important baseline information in national reporting to international reporting, land suitability, assessment, monitoring of various sectors (agriculture, forestry, fishery, energy, emergency) and many others.

HIGH INCONSISTENCIES BETWEEN GLOBAL LAND COVER

Comparison between global land cover datasets ~2015

Cropland agreement map. Cropland agreement map. Pixel-level results from six high-resolution cropland maps

Definitions of Cropland

Summary of the cropland definitions

Number of layers depicting cropland

https://www.nature.com/article
Some examples of forest definitions:

**Burkina Faso:** area > 0.5 ha, height of trees > 5 m and tree cover > 10%, […] Land with an essentially agricultural or urban vocation is excluded.

**Côte d'Ivoire:** area > 0.1 ha, tree cover > 30%, height > 5 m, […], excluding plant formations resulting from agricultural activities.

**Costa Rica:** height of trees > 5 m and tree cover > 70%.

**Limitation:**
- Fixed number of land cover classes
- Classes are too general
- Missing information
- Different terms used for same concepts (**Synonymy**).
- Different understanding of homonymous concepts (**Polysemy**)

**Ambiguities** in the definition and comparison of different land classes.
SETTING COMMON RULES: FAO LAND COVER LEGEND REGISTRY

- It is an online library established and maintained by FAO for accessing existing land cover legend, legend class, datasets and related reference documents.

Web portal Interface

Link: An International Library for Land Cover Legends: The Land Cover Legend Registry, library, documentation
INTEGRATION OF LEGENDS WITH SEPAL

Bangladesh land cover
INSTITUTIONAL COLLABORATION & PARTNERSHIPS

BANGLADESH

- Multiple institutions (13)
- Different sectors
- Diverse objectives
- Different programs/projects
- Different approaches
- National and international reporting
- National and local planning

WEST AFRICA

- Regional & international organizations: ECOWAS, CILS, AGRYHMET, OSS, FAO, NASA SERVIR
- 17 countries: Benin, Burkina Faso, Cape Verde, Côte D'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, and Togo.
- Area: 8 million square kilometers.
- Ecological belts: region can be sub-divided based on climate and vegetation characteristics into 5 ecological belts including Guineo-Congolian, Guinean, Sudanian, Sahelian and Saharan belts


**SDG 15.3.1: Case studies & Trainings**

**Case study: Land restoration in Refugee camps in Cox’s Bazar, Bangladesh**

- After massive Rohingya influx in August 2017, restoration activities started in September 2018.

**Case study: Peatland degradation and restoration in Indonesia**


**SEPAL SDG 15.3.1 based on the GPG v2 (UNCCD).**

- Multiple sensors (MODIS, Landsat 4, 5, 7, 8 and Sentinel 2).
- Suitable vegetation index (NDVI/EVI/MSVI).
- Suitable land cover ecological functional units.
- In-country land cover data including reclassification.
- etc.
GLOBAL AGRO_ECOLOGICAL ZONING

GAEZ v4 Web-platform

https://gaez.fao.org/

Model documentation

Video

User guide

Brochure

User cases

Hand-in-Hand Geospatial platform

AGROMAPS

ECOCROP

Food and Agriculture Organization of the United Nations

https://gaez.fao.org/
MONITORING GREEN CITIES INDICATORS & NATURE BASED SOLUTIONS

**Data (Tier 1)**
- Administrative Units
- Satellite Imagery
- Population data
- Land Cover
- [...]

**Tools and platform**
- Desktop based/stand alone (Arc/QGIS, ERDAS Imagine, Snap, [...])
- Server based (Geonode, [...])
- Cloud based (SEPAL, GEE, Google Colab, [...])

**Methods**
- Delineating into degree of urbanization (degurba) classes
- Generation of national level land cover
- Preparing population data
- Deriving Green Cities indicators
CHALLENGES

Need capacities to use standards for EO data interoperability, consistency, transparency and accuracy
To establish sustainable frameworks, plans and programs
To benefit from the diversity of satellite data and technologies
And provide data availability and accessibility in timely manner and collaboratively
For adoptable and adaptable solutions
THANK YOU

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Geospatial Unit: https://www.fao.org/geospatial/en/