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APCAS/24/5.2

ASIA AND PACIFIC COMMISSION ON AGRICULTURAL STATISTICS

AGENDA ITEM 5.2 Report of Side Event: Country Experiences in EO Data

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AGENDA ITEM 5.2

Report of Side Event: Country Experiences in EO Data

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Background – Summary of Presentations

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Lead Ministry/Agency	Ministry/Department of Agriculture (China, Japan, Republic of Korea, Thailand); National Statistics Office (Bhutan, Indonesia, Mongolia); both (US)
Policy mandate	Parliamentary mandates, statistics acts
Legislative mandate (if any)	Parliamentary mandates, statistics acts, privacy acts, national security, aviation security
Stakeholders involved	Ministries/Departments of Agriculture, National Statistics Offices, Environment/Geographic Ministries, National Defense, Aviation authorities, Privacy Commissions/Legislators, Academia,
Interagency collaborations	See above
Privacy legislation	Privacy of individuals/firms: In situ data; cloud storage/computing
Privacy considerations	farmer identification/confidential information); cloud storage/computing where in situ data is stored/used

Background – Summary of Presentations

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Satellite imagery source(s)	Open Data: Landsat - USGS (United States Geological Survey); Sentinel - ESA (European Space Agency); Modis Commercial Data: Planet, World View-3, GeoEye-1 National Data: GF series satellite, Beijing-2 satellite
Type of imagery used (optical, SAR, etc.; including satellite system)	Optical sensor (passive sensor, same sun-synchronous orbit, and Multispectral Instrument (MSI)); Synthetic Aperture Radar (SAR) sensor (active sensor)
Ancillary data	Digital Elevation Model (DEM), natural forest boundaries, weather data (temperature, precipitation), soil moisture, National, District and subdistrict boundary, cadastral plot boundary, Ground control points (GCP) for image registration
Data processing (infrastructure on-site or cloud-based)	On-site IT infrastructure (6) Cloud-based storage processing and computing(1)

Background – Summary of Presentations

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Area covered by EO data analysis (national/sub-national)	National area covered for agricultural area estimation
Crops covered	Rice/paddy, wheat, corn, soybeans taro, oil palm, rubber, rapeseed, casava, pineapple
Statistics produced (ex. Crop type mapping, area estimation)	Crop identification/crop type mapping, crop cultivated area, crop yield, Area Estimation of Paddy Growth Phase (Phenology)

- Cost-efficiency – optimize/reduce sampling for crop surveys
- Improved accuracy and frequency of crop statistics
- Open access to medium and high resolution EO data:
 - Landsat (NASA/USGS), Modis (NASA), Sentinel (ESA)
- Government-Academic partnerships – already widely implemented
- Inter-governmental partnerships (USA-India NISAR satellite)
- Opportunity to cross-check their data accuracy for the beginner countries.
Governments can use these data to manage crop schedules and growth schedules
- UN System networks:
 - UN joint task force on EO Data
 - UN Big Data Hubs: EO data (China), AI/Data Science (Indonesia)
 - Geospatial taskforces: IAEG-SDGs

Challenges in advancing EO data for agriculture statistics

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- Scarcity of high-quality in-situ data
 - Privacy issues with in-situ data – limited data sharing
- Frequent cloud cover in tropical regions
- Lack of accurate detection of mixed crops and multiple cycles
- High costs for high resolution satellite (HRS), hyper spectrum imaging (HSI), and some SAR data (e.g., L-band) for crop's penetration

Challenges in advancing EO data for agriculture statistics

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- In establishing a new EO-agriculture statistics programme
 - Lack of technical/GIS capacity and know-how
 - Limited use of EO-based statistics as official statistics
 - Limited crops covered
 - High cost of processed imagery
 - Very high-resolution images are required to capture smaller agriculture plots, especially areas with adverse terrain like mountain slopes, leading to high data acquisition cost
 - Some countries don't have an approved statistical act
 - Agriculture policymakers have limited awareness of EO technology

- Develop/share advanced algorithms for crop type mapping
- Integrate optical and SAR data on crop monitoring and yield estimation
- Use of red edge bands and of thermal bands in general
- Development of national EO data cubes
- Utilize cloud storage and cloud computing
- Utilize time-series of datasets (e.g., satellite and meteorological datasets) for crop yield estimation
- AI for crop classification and create land parcel

In establishing a new EO-agriculture statistics programme

- North-south and south-south cooperation and technical assistance

- Collecting **complete plot boundary** preferred to competing approaches to georeferencing plot locations in large-scale household surveys.
 - **Georeferencing the complete set of plot corners is a second-best strategy**, can approximate full plot boundaries and can in turn train models with comparable performance.
 - **If only a single GPS point** can be collected, that location should be **near the plot centroid** rather than at the plot corner.
- **No plot observations should be excluded** from model training based on a minimum plot area threshold.
- **Inclusion of weather** is generally beneficial to model performance.
- **CNNs** can provide performance gains over Random forest models, especially at larger sample sizes (>1,000 fields) and in systems with “larger” fields. Further developing the other advanced of AI for better results on crop classification.
- Crop growth model should adopt for yield estimation.

Recommendations for consideration by the Commission

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- Recommends launching an awareness program to promote the use of EO technologies for agriculture management for countries who are new to EO data
- Recommends identifying common standards on applications of EO for developing standard spatial data for statistics

Recommendations for consideration by the Commission

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The Commission,

Recognizes the best practices identified through APCAS members experiences and FAO field tests in utilizing earth observation (EO) data, along with proven methods developed by the UN Committee of Experts on Big Data (UNCEBD) and the UN Committee of Experts on Food Security, Agricultural, and Rural Statistics (UNCEAG). The commission encourages APCAS members to consider adopting these practices, including georeferencing plot boundaries and centroids in agricultural surveys and censuses.

Recommendations for consideration by the Commission

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Recommends that the FAO continues to provide technical assistance to member countries in specific applications of EO, such as mapping field boundaries to improve survey operations, mapping mixed crops, crop yield modeling, and assessing disaster impacts on crops. Additionally, the Commission recommends that the FAO should support the assessment of countries geospatial capacity and maturity.

Encourages members to leverage international capacity-building initiatives, including those led by the Task Team on Earth Observations for Agricultural Statistics jointly established under the UNCEBD and UNCEAG.

Thank you for your attention!

