ISPRS-GEOGLAM-ISRS International Workshop on

'Earth Observations (EO) for Agricultural Monitoring'

<u>Draft Recommendations</u>

ISPRS-GEOGLAM-ISRS international workshop on 'Earth Observations (EO) for Agricultural Monitoring', jointly hosted by MNCFC, IARI & ISRS-Delhi Chapter, was held at IARI, New Delhi during February 18-20, 2019. The purpose of the workshop was to commemorate **50 Years of Remote Sensing in India**.

It comprised of three plenary sessions of fifteen presentations and seven technical sessions, with oral presentations, one industry session and a poster session. In addition, there were two evening lectures by eminent scientist / policy maker.

These presentations addressed the evolution of remote sensing over the last fifty years in various applications to agriculture in India. Presentations, also, included updates on major international initiatives including GEOGLAM and Asia-Rice and contributions of different major national organizations. There were many contributary technical presentations on the use of EO data for: Crop area, yield, condition and agricultural drought assessment, monitoring horticultural systems, detection of pest - disease infestation and in the crop insurance schemes. There were also presentations on the derivation of bio-geophysical parameters. It was noted that there has been significant progress in the application of EO data for real-time applications related to multiple in-season crop and hazard impact assessment.

However, in order for the technology to be useful at the farm-level and on a sustained basis to support operational decision-support systems there are some pre-requisites:

Providing crop insurance at the farm-scale remains a large challenge.

- Space technology needs to be applied to enable easy and timely pay-outs for crop insurance and agricultural drought.
- Farm-scale crop stress detection, identifying causal factors (abiotic or biotic nature), quantification and suggesting remedies for precision management using combination of UAV and high-resolution space-borne remote sensing need to be emphasized.

In order to sustain current operational systems and make progress on new and emerging challenges, **commitment to continuity of the availability of EO data both in optical and microwave** has to be ensured.

- The small field size and complex cropping systems in India requires the use of high spatial resolution data. Space system operators are suggested to provide science quality, high resolution multispectral (< 2m) at 3-4 days interval. A constellation approach may be considered for such satellites. For maximum societal benefit, including information at the farm level, these data should free and openly available.
- A number of regions of India have persistent cloud cover during the growing season. For such regions multi-polarisation synthetic aperture radar data holds considerable promise. Space system operators are advised to provide high resolution microwave systems designed for Indian agricultural applications.

- For ease of use, harmonized interoperable products of surface reflectance, temperature, gamma_0 etc. should be made available to users from multi-sensor data.

Research towards reducing the uncertainty of crop yield estimation and improving agriculture at the farm-scale using an ensemble of approaches is recommended.

- Collaborative research studies should be undertaken to understand the feedback of agricultural practices to climate, which would lead to definition of advanced sensors
- Advanced remote sensing observations such hyperspectral sensors can be applied to farm-scale digital soil health, abiotic-biotic stress discrimination and quantification
- Remote sensing technology should be used to provide solutions for farmer 'income-centric' rather than 'production-centric' for doubling farmers' income
- Short-term and long-term farmers' risk assessment, management and forecasting are essential to reduce crop loss
- Increased resource-use efficiency (water, nutrients) at farm-scale should be targeted
- Adequate real-time databases are essential for monitoring extreme weather events and crop loss assessment
- Use of advance techniques like Machine Learning and Artificial Intelligence may be explained for Crop Area & Yield Assessment and stress detection and early warning.

For **improved large-scale agricultural drought early warning** in the short-term and high-resolution drought vulnerability assessment in the

long-term. Operational products on PASM, MAI, river water storage, ground water availability index should be targeted from GEO-LEO platform observations.

It is noted that India has made tremendous progress in the agricultural applications using EO data and considering its rich experience in establishing operational systems applicable to diverse agricultural conditions, it is recommended that it should **play leadership role in regional/global initiatives such as GEOGLAM and Asia-Rice**. The GEOGLAM Joint Experiment for Crop Assessment and Monitoring **(JECAM)** provides a framework for the scientific evaluation of products available from different GEO-LEO missions for different geographical areas through multi-disciplinary working groups. From these evaluation studies, the development of standard products and best practices documents targeting sensing systems would be of considerable use. Given the depth of experience in agricultural remote sensing, the Indian agricultural remote sensing community can make an important **contribution in the area of capacity building at the international level**, which will be mutually beneficial.

Considering the rich scientific content of the presentations made at the plenary sessions, it is recommended to **bring out a publication of this, in the form of a book**, for wider dissemination among the global community of professionals engaged in global agricultural monitoring.