GIS and Agriculture: The IARI perspective

In conversation with **Dr. V. K. Sehgal,** Professor and Principal Scientist (Agricultural Physics), Indian Agricultural Research Institute, New Delhi

What all comes under the purview of IARI?

The Indian Agricultural Research Institute (IARI) is India's premier national research institute for teaching, training, and extension services in agriculture, with a special focus on crop production. The institute is headquartered within a sprawling campus at New Delhi, and has eight regional stations spread across India. IARI's activities span 22 disciplines, including genetics and breeding, plant protection, soil science, agronomy, meteorology, food technology, engineering, environment sciences, water science and agro-economics. The institute has one of the best research facilities in the country, at par with foremost global institutions in the field.

One of the major contributions of IARI lies in developing desirable plant varieties through plant breeding projects, especially in rice and wheat crops (e.g.: Pusa Basmati, HD-2967), contributing significantly to the food security of the country. The institute has lead, early and often, in the fields of geomatics and remote sensing applications in India.

As early as 1969, we have used remote-sensing technology to

conduct field studies and map root-wilt disease of coconut using aerial multi-spectral imaging. Today, the institute boasts of state-of-art infrastructure, equipment and laboratories, among which is an X & L Band satellite ground station to receive direct-broadcast telemetry from a range of international satellites for remote sensing applications in the country.

Additionally, IARI deals with extension services that disseminate agricultural technology and new developments to farmers, thereby helping implement them in-field.

How is GIS facilitating the management?

Today, almost all agriculture projects are conducted in GIS environments, and are inseparable from the technology. At IARI, we use several GIS products, among which Esri is a notable platform. GIS processes disparate geospatial datasets, and generates unified maps to visualize data; this allows scientists and students to analyse spatially.

At IARI, we have been undertaking a project called ICAR-KRISHI. It is a centralized data management portal that has institutionalized GIS not just for visualization, but also for analytical applications.

GIS is also being used to develop advisories that are disseminated to farmers, fishermen, etc. Under the National Initiative on Climate Resilient Agriculture (NICRA), IARI is investing heavily to develop technology that can make the farmer resilient to variations of weather and climate. Remote sensing & GIS technologies are playing a major role in the vulnerability assessments of agriculture to climate change, monitoring of crop residue burning events across India, and analysing spatio-temporal patterns of climatic risk.

IARI is also attempting to improve agro-meteorological advisory services given to farmers. GIS and remote-sensing has been essential in developing live-updated crop condition maps for the whole of India, at a very high resolution. IARI is involved in a collaborative venture with the University of Nebraska, in association with the National Drought Mitigation Centre (USA). The venture aims to develop drought-monitoring indices for Indian agriculture, using GIS to combine ground-level and satellite data.

How is Esri India enabling you?

IARI stands among some of the oldest user-collaborators of Esri in India, and has been providing practical training in remote-sensing, GIS and GPS since 1984. Esri's solutions offer a process-oriented technology that allows sequential learning and efficient information delivery.

Most notably, Esri India addresses a major lacuna in Indian agriculture: many agricultural environments and sectors suffer from a situation where information exists, but is scattered; or, unavailable either on a unified platform, or for spatial visualization. Esri's GIS platform helps harvest, compile, analyse and generate new knowledge – this is indispensable for the improvement and modernisation of Indian agriculture. It is crucial as we move toward the goal of digital agriculture in India.

Currently what are the areas in which this platform is helping?

Esri's platform is a valuable aid for precision farming; plant phenomics; developing drought monitoring indices and new models for agricultural crop yield production; monitoring crop residue burning; watershed management; soil mapping, etc. The information generated by the platform aids national programmes and advisory projects. Classification and compilation of cropping data at several scales (district, block and village) is also done on this platform. The comprehensive inventory so generated is shared with the respective central and state departments for policymaking.

ICAR-KRISHI is another platform based on Esri technologies which combines the agricultural technology database with geo-spatial data, data generated through experiments, observational studies, publications, etc. Under KRISHI, analytical, experimental and visual data flows into a single database; it is accessible to IARI for coordinated and informed decision making. Significantly, the software was developed on an open-source platform, and then shifted to the IARI ArcGIS server. It is a long-term project with relevance for climate and sustainable management of natural resources.

How do you think the platform can be enhanced?

Esri's GIS and image processing platforms are components of an information system that holds relevance for an information-driven society. Agriculture cannot be aloof from this information revolution. It is important to recognize that the platforms aids a collaborative process; integrates diverse information; aids in information extraction; and, allows for repeated data iterations.

As agriculture is a function of local environment, soil, agronomic practices, resource availability and socio-economic conditions, the platform needs to be enhanced with newer functionalities to allow the capture of diverse information types in a user-friendly way. It should be able to integrate stand-alone dynamic agro models which can generate information at a range of scales – from the farmer's field to a farming region.

Esri's team in India could also help develop a formal/informal network of agricultural experts and researchers to bring the necessary platform changes or enhanced capabilities, as per the requirements of different agricultural applications. For example, flagship programs of the Government of India which deal with "Irrigation", "Soil Health", "Crop Insurance", etc. need specific GIS capabilities to make them user-friendly to stakeholders who use GIS from different levels of expertise. Such customized functionalities will go a long way in bringing the fruits of technology to grassroots, and develop examples that can then be applied by Esri in different parts of the world. Real-time benefits in agriculture can be maximised when GIS platforms are inter-linked comprehensively, and used by public, researchers and experts. ■