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Land resource inventory database:

A tool for improved farm resource management

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The article draws insights from monitoring and impact evaluation of Land Resource Inventory (LRI) based watershed planning process adopted to promote site-specific, scientific management of farm resources, enhance agricultural productivity in watersheds implemented under World Bank-aided Sujala-III project in Karnataka state. It examines comparative overview of LRI cards and soil health cards generated in different programmes. Further, it highlights the benefits of integration of the soil health card with LRI development process to prevent duplication in soil sampling and data generation efforts. Upscaling the LRI generation process to other rainfed areas of the country and promoting stakeholder capacity-building with timely accessibility of digitized LRI information for both farmers and extension workers will enable relevant guidance for efficient management of farm resources.

Keywords: Land resource inventory, Resource management, Soil health card, Watershed

LAND Resource Inventory (LRI) is a systematic survey and mapping process that provides detailed information about the morphological and physico-chemical characteristics of soils. The LRI database helps in preparing optimum land use plans for watershed management that help not only in restoring the ecological balance but also in improving the production on a sustainable basis. Meanwhile, the LRI data generated for micro-watersheds is not only helpful in watershed planning and implementation, but it also helps farmers to know about their land resources in detail. The LRI cards developed from LRI information in Sujala-III watersheds give specific details about the resources of each land parcel located in micro-watersheds. LRI helps farmers make informed farm decisions by providing detailed, site-specific information about their land and choose the best crops for their specific land conditions, soil health (nutrient), suitable and recommended site-specific conservation practices. LRI empowers farmers with the knowledge and required tools to make data-driven decisions, leading to improved farm productivity, sustainability, and profitability. Similar efforts of estimation of resources for better management of agricultural lands or soils were initiated by the government of India in past like Soil Health Card (SHC) scheme in 2015 across the country. However, the efforts were only restricted to the assessment of soil nutrient status and recommendation of required macro and micronutrients to farmers. Although the processes and purpose for generating soil nutrient and Land Resource Inventory (LRI) databases are different, they involved several similar activities. Therefore, coordinating the related schemes could streamline efforts, minimize data duplication, and reduce costs. In addition, a consolidated database would enable development agencies to make more informed decisions for sustainable land and resource management.

Development of site-specific LRI in Sujala-III watershed project

The concept of scientific planning of watersheds was mooted and its roots are based on the watershed common guidelines of 2006, which recommended a special effort needed to utilize GIS and remote sensing tools in planning, monitoring, and evaluation of the watershed programme. Further, in this direction, Watershed Development Department, Karnataka formulated World Bank-aided Sujala-III watershed project, implemented in 12 districts of Karnataka with a financial outlay of 514.4 crores during 2014–19. The main aim of the project was to provide scientific tools for future management of resources in the watershed areas. To accomplish this task, the Karnataka Watershed Development Department (WDD) in collaboration with the Department

of Horticulture (DoH) had planned to develop a database of resources for selected 12 sub-watersheds. To develop a comprehensive farm resource database, WDD collaborated with ICAR-National Bureau of Soil Survey and Land Use Planning and State Agricultural Universities to survey Land Resource Inventory (LRI).

LRI is an assessment of the status and changing conditions of soil, water, land use, land covers and related resources in a landscape at the field level at large scale. Inventory work starts with a soil profile study at a spatial resolution of 250 m × 250 m and later generated data was used to develop various layers of information on soil physical and chemical properties under sophisticated GIS modules. These information layers were overlaid on cadastral maps to draw the information for each land parcel designated with specific survey numbers. The data were available for both watershed and individual land parcels within the watersheds. The watershed level information/ database then given to Project Implementing Agencies (PIAs) for preparation of Detailed Project Reports (DPRs) and net planning for watershed implementation. Later, similar to soil health cards, an enriched and informed LRI card was brought out for each land parcel which contains the status of the soil nutrients, land capability, and crop suitability information. The card also carries site-specific land management information and this information remains valid for 25 years, except for soil nutrient status, which needs to be updated at three-year intervals. Further, the distribution of cards, information dissemination, awareness creation and training on the use of cards were conducted to farmers in watersheds.

LRI cards vs soil health cards: A comparative overview

The majority of Indian farmers use fertilizers injudiciously without testing soil requirements, which has a direct impact on the cost of production, soil health, and pollution of water bodies. To imbibe soil test-based nutrient application and better soil health management among farmers, a unique soil health card programme was launched on February 19, 2015. The scheme aimed to assess the soil nutrient status of every farm holding in the country. Soil health card provides information to farmers on the nutrient status of their soil along with recommendations on appropriate dosages of nutrients to be applied for improving soil health and fertility. Similarly, as described earlier, LRI cards were developed from the LRI database which also includes the soil nutrient analysis data and recommendations at each farm holding level in the watershed. Considering the information/data on soil nutrients and their utility, the data generated and provided in the LRI card are more comprehensive, as it provides information on the annual rainfall of the region, soil depth, soil texture, gravel content, soil erosion status, slope of the land, infiltration capacity of the soil, site-specific soil constraints affecting crop production, land suitability for different crops and their management options, soil nutrient status (*p*H, EC, OC, N, P_2O5, K_2O, S, Zn, B, Fe, Mn and Cu) for judicious use of fertilizers, along with fertiliser recommendations recently incorporated under REWARD project. In addition, information like contact details of Kisan call centre, horticulture helpline, Varuna mitra helpline, and agriculture marketing helpline numbers are available for enquiry on any agriculture related issues and guiding farmers to adopt scientific management practices. LRI cards serve as a valuable tool for addressing multidimensional land management issues at the farm level. Unlike soil health cards, which primarily focus on nutrient management, LRI cards provide a broader perspective, enabling farmers to tackle various aspects of land management comprehensively.

Table 1. Comparison of LRI card and soil health card

Major Parameters	LRI Card	Soil Health Card
Survey number-wise farmer details	✓	✓
Land surface and soil properties	✓	x
Soil nutrient status	✓	✓
Detailed fertilizer recommendation	✓	✓
Land suitability for different crops	✓	x
Soil limitations	✓	x
Land Management options	✓	x

LRI as improved database for crop, nutrient and farm resource planning

LRI alone is not a complete comprehensive solution for site-specific watershed planning. However, it is an enhanced database supporting site-specific crop, nutrient, and farm-level resource planning across watersheds. Integrating hydrological resource inventory and site-specific drainage line treatment measures, along with PRA, can further enhance decision-making and resource optimization for overall watershed planning. Hence, scaling up LRI across all rainfed micro-watersheds will help in farm-level resource and crop planning which further helps in better implementation of land development programmes.

SUMMARY

Considering the benefits of the card generated using the LRI database, integrating LRI data generation process with the existing soil health card scheme will help to eliminate duplication of efforts for separate soil sampling, soil health card generation and distribution. Further, updating nutrient status and fertilizer recommendation information every three years will align with the objectives of the SHC scheme and thus, comprehensive site-specific LRI information empower farmers for better crop planning and resource management at farm level. Meanwhile, dissemination and capacity building of farmers on the use of LRI cards and the availability of digitized LRI information to extension workers in line departments will ensure that farmers will receive timely and relevant guidance for effective crop, nutrient and resource management at individual farm level.

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