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Land Resource Cards: An Innovative Approach to Empower Farmers for Site-Specific Farm Resource Management

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ABSTRACT

The paper investigates an innovative extension approach of generation and distribution of Land Resource Cards, developed from Land Resource Inventory database, used for site-specific farm resource management in watersheds adopted under World Bank funded Sujala-III project. Extent of reach, satisfaction level and training status of Land Resource Cards in 12 model micro-watersheds located in different agro-climatic regions of Karnataka with a sample size of 720 farmers was assessed. The Land Resource Cards reached only 18 per cent of farmers while 22 per cent of farmers were trained for its utilization. However, 77 per cent were satisfied with the information provided and 23 per cent suggested for further improvement in cards for greater utility. The overall farmer's perception on capacity building on land resource cards revealed that they were very useful in farm-level resource management. Hence, need for replication of similar approach in all database driven watersheds to be implemented in the future with adoption of modifications is suggested.

INTRODUCTION

Land and water provides the principal basis for human livelihoods and well-being. Therefore, sustainable use of these natural resources is paramount importance for continuous food production and income generation to farming community. Improper and unscientific management of resources may cause further degradation and deterioration of natural resources. According to Intergovernmental Panel on Climate Change (IPCC) special report (2019) on land degradation highlights that soil erosion from agricultural fields is estimated to be currently 10 to 20 times to more than 100 times higher than the natural soil formation rate. Evidence to the same the soil loss rate in our country is about 1535 t km^{-2} yr^{-1} (Sharda & Ojasvi, 2016) and as a consequence of this the major rainfed crops suffer an annual production loss of 13.4 million tons due to water erosion alone with estimated loss of Rs. 205.32 billion (Sharda & Dogra, 2013) in monetary terms. Therefore, reducing and reversing land degradation at different spacial scales from individual farms to entire watershed will be cost effective and offer immediate and long-term benefits to the communities (IPCC, 2019). In this regard watershed is an ideal unit for management of natural resources for land use planning (Krishna, 1996; Lalitha et al., 2016). Over the years huge financial resources were invested in the watershed development programs, but most of conventional watersheds not given expected level of output in India (Lalitha et al., 2016; Hegde et al., 2018). The reasons attributes, lack of site-specific watershed planning and implementation (Lalitha et al., 2016), improper utilization of natural resources both at farm and watershed level (Hegde et al., 2018) and Inadequate management of conservation practices by the farmers due to poor knowledge

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and awareness (Oraon et al., 2020; Dupdal et al., 2021; Kumar et al., 2021) are some of them to be noted from various studies. Meanwhile, many suggested need for detailed site-specific land resources database to identify the inherent potentials, constraints and suitability for various land use options that suit to local conditions (Bandyopadhyay et al., 2009; Nain et al., 2012; Kumar et al., 2014; Ramamurthy et al., 2016; Bandyopadhyay et al., 2018; Hegde et al., 2018; Sharma et al., 2018; Oraon et al., 2020) and such interventions must easily understandable and manageable by farming community for decision-making at local level (Doubling Farmers' Income, 2018). Therefore to overcome all the above mentioned problems, a site-specific and scientific approach of watershed planning and implementation through generation of both watershed and farm-level database was adopted in recently implemented Sujala-III watersheds in Karnataka state. Under the project emphasis was given for development of Land Resource Inventory (LRI) database at micro-watershed level. The project approach also involves a new extension approach of preparation of Land Resource Cards emanated from the Land Resource Inventory (LRI) database and dissemination of knowledge through capacity building on utility of cards for site-specific farm level management was carried out at village level. The paper elaborates a detailed framework of new extension model and its reach and utility among farmers.

METHODOLOGY

Firstly the efforts were made to elaborate the framework of new extension approach and its mechanism adopted under Sujala-III project for dissemination of farm level land resource information. Second, field survey conducted with semi-structured interview schedule to assess its extent of reach, satisfaction level and capacity building status with a sample of 720 farmers responses collected from 12 micro-watersheds, three each from Raipalli, Bedawatti, Lingapurahalla and Harve sub-watersheds in Bidar, Koppal, Tumakur and Chamarajanagar districts of Karnataka, respectively. A stratified random sampling technique was used for sampling purpose. The selection criterion picks one micro-watershed from upper, middle and lower reaches (strata) of the each sub-watershed. Within the micro-watershed, 60 respondents were drawn, 20 each from upper, middle and lower reaches.

RESULTS AND DISCUSSION

Land resource cards and its generation process

Land Resource Card (LRC) is an information guide generated for each land parcel at farm level developed from LRI database of micro-watersheds which provide site-specific and location specific crop choices, soil and water conservation measures, nutrition status of soil, soil limitations and their management information to guide farmers for sustainable management of resources. The cards are a result of an extensive investigation by consortia of partners involving 14 research institutions (LRI partners) under Sujala-III project. Initially the LRI partners mapped various characteristics to determine the profile of the soil, socio-economic and bio-physical properties of watersheds, rainfall situation of region, suitable economically potential crops of the locality and among others through field survey. Further, consortia of partners developed a LRI database for preparing optimum land use plans for the micro-watersheds through generation of LRI Atlas maps, treatment plans and hydrology atlas using GIS, GPS and Remote sensing techniques. This database of each micro-watershed helps Project Implementing Agencies (PIAs) like State Agriculture line Departments for further site-specific scientific Detailed Project Report (DPR) preparation and implementation of watershed interventions as per plans at both micro-watershed and farm level. Later an innovative product, LRC was brought out for each land parcel within the micro-watershed using LRI database. Specifically cards contain micro-level LRI information which remains valid for 25 years, except soil nutrient status, which needs to be updated at every three years interval. Meanwhile all this database information was made available in an interactive web portal (https://www.sujala3lri.karnataka.gov.in/) for stakeholder's utility by Watershed Development Department, Government of Karnataka. The project generated Land Resource database for 2531 Micro-watersheds covers area of 12.66 lakh ha during 2013-19.

To disseminate the database information generated in the Sujala-III watersheds, the LRI partner Institutes were generated LRC for all the land parcels located in the micro-watershed. The generated information was transferred to LRI Extension Managers employed at each *Raitha Samparka Kendras* (*RSK*s), called Farmer Contact Centers, located in respective micro-watershed. They laminated LRC for further distribution among farmers in micro-watersheds. Approximately each card preparation (after received database from LRI Partners) with color printing and lamination cost was Rs. 12. Once the cards were generated, the next step was card distribution to farmers at village level and they were trained on the scientific and site-specific land resource details and its proper utilization for sustainable management of soil and water resources at farm level.

The comprehensive database generated through the LRI covering all the land holdings in a watershed area will help in the preparation of individual farm level information through LRCs. It helps the farmers in identifying site-specific soil constraints affecting crop production, gives land-use option based on suitability of different crops and their management options, potentiality of soil for cultivation of cereals, pulses, major vegetable crops, horticulture plantation, forestry and other uses, soil nutrient status (Available pH, EC, OC, N, P_2O_5, K_2O, S, Zn, B, Fe, Mn and Cu) for judicious use of fertilizers and additional information like Kissan Call Centre number, Horticulture helpline, Varuna mitra helpline, and Agriculture marketing helpline numbers for enquiry on any agriculture related issues. Thus highlighted the cards to enrich the knowledge of farmers and empower to take best farm management decisions pertaining to his/her land. Further, the Land Resource Cards with detailed information provided in cards to overcome some of the knowledge constraints faced by farmers reported by Ghaswa (2019) & Kaur et al., (2020) in use of Soil Health Cards (SHC) in which latter provide only information on nutritional status of soil.

LRI card distribution status in Sujala-III micro-watersheds

The micro-watershed wise Land Resource Card distribution status was analysed and the results are presented in Figure 1.

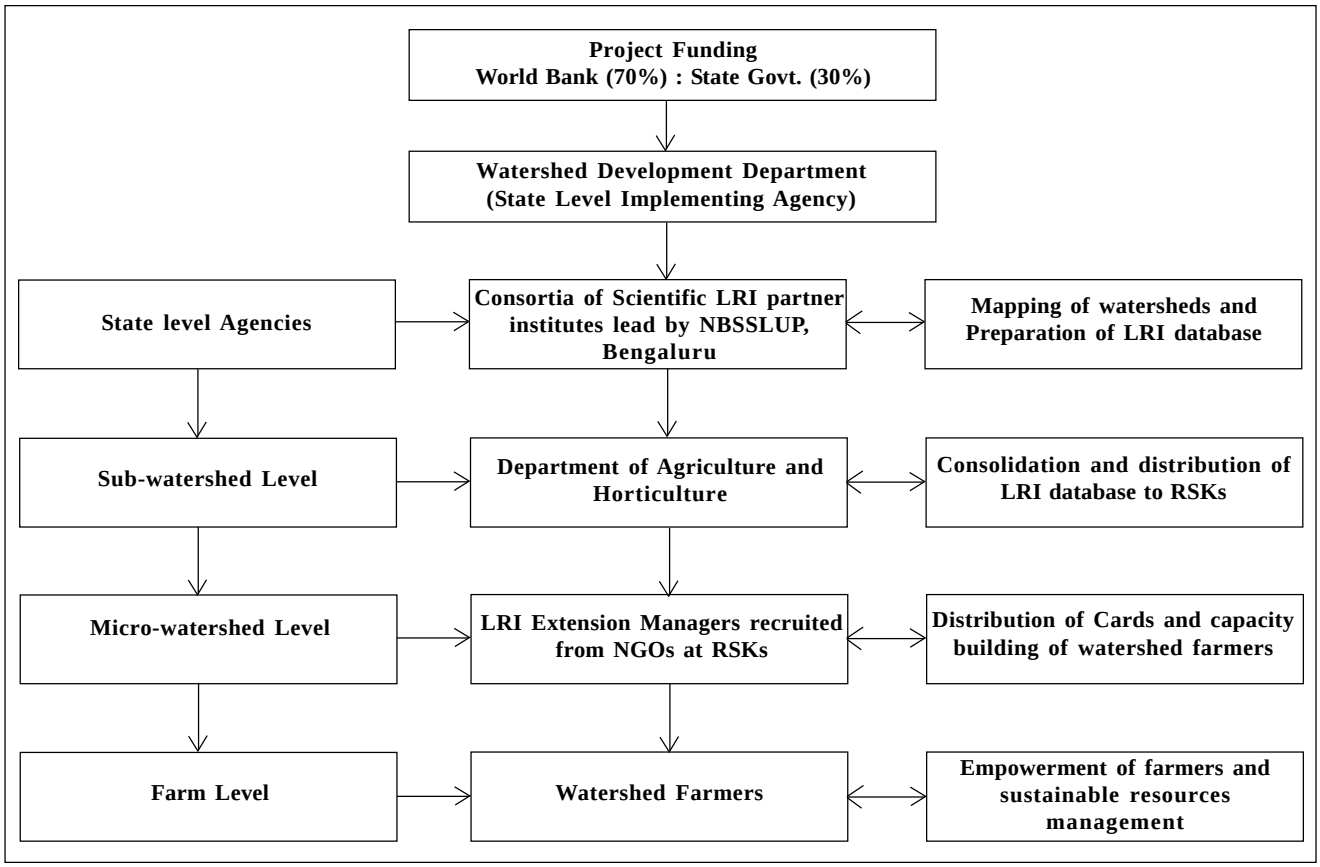

Figure 1. Innovative approach adopted for creation of awareness on utility of LRC for site-specific farm-level planning among farmers

Results indicate that about 60 per cent of the farmers of Chikkamageri-3 micro-watershed in Bedawatti sub-watershed received Land Resource Cards, which is the highest percentage among all 12 micro-watersheds studied. This followed by Ryavanaki-1 micro-watershed (52%). However, Bedawatti-6, Huliyapura, Raipalli-2 and Kharanjikhurd micro-watersheds reported 10-20 per cent distribution. Further, in Kunchamanahalli-1, Sagade and Harve-1, Kalyanpura, Lingapurahalla and Babulgaon-2 micro-watersheds received less than 10 per cent Land Resource Cards (Figure 2). Meanwhile, the overall reach of the cards to the farmers was 18 per cent and it was lower when project was about to complete in December, 2019. The reason for lower card reach among watershed farmers is mainly due to distribution of cards at the middle of the project and also higher LRI Extension Manager to farmer's ratio.

Satisfaction of farmers on information provided in land resource cards

The satisfaction on the information provided in the cards as perceived by the farmers who received LRCs was documented in twelve micro-watersheds. The satisfaction level on information provided in cards ranged between 60 to 100 per cent (Table 1). The percentage of satisfied farmers was more than the unsatisfied farmers in all the micro-watersheds. The reason expressed by the satisfied farmers were documented in open ended questions, which revealed that cards helped farmers in identifying site-specific soil constraints affecting crop production, also helped to understand constraints/limitations affect land productivity and gave crops suitable to their soil condition and other suitable conservation measures to be adopted at farm level to manage land for better income. Thus a LRC provided an adequate knowledge and awareness among farmers to overcome constraints faced by farmers due inadequate knowledge about scientific conservation practices and land or soil limitations as reported by some studies (Kumar et al., 2021; Dupdal et al., 2021). The fraction of farmers who dissatisfied with the Land Resource Card information cite lack understanding due to illiteracy and prejudice in accepting new farming techniques and moving away from traditional practices, particularly older age farmers. Hiwarkar et al., (2014) also observed a positive correlation between illiteracy and old age on low awareness about knowledge on soil and water conservation practices even after capacity building. The reasons also depicted by Kumar et al., (2021) on personality traits like age and education are associated positively significant with constraints like knowledge and awareness on conservation practices.

Land resource card training status in Sujala-III micro-watersheds

The capacity building of famers through trainings on LRCs was crucial for the dissemination and influence for adoption of the LRI based scientific watershed management activities. Understanding the information provided and how to use to derive maximum benefit from the LRCs needed a timely training to the

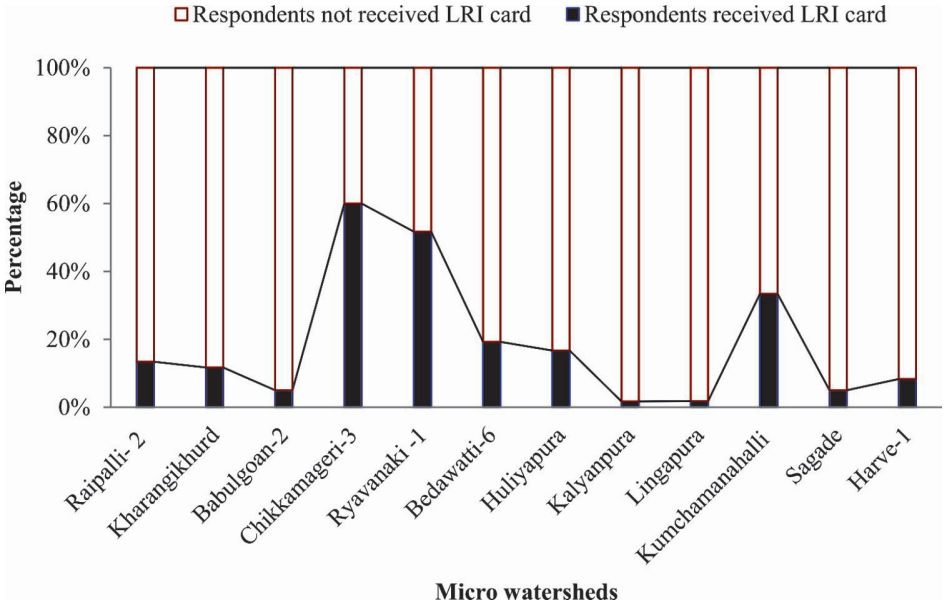

Figure 2. Micro-watershed wise percentage of Land Resource Cards distribution among farmers

Table 1. Micro-watershed wise farmer's satisfaction on information provided in land resource cards

Sub-watershed	Micro-watershed	Satisfied farmers (%)	Unsatisfied farmers (%)
Raipalli sub-watershed, Bidar	Raipalli 2	87.5	12.5
	Kharangikhurd	85.7	14.3
	Babulgoan-2	66.7	33.3
	Total/Average (n_1=18)	83.3	16.7
Bedawatti sub-watershed, Koppal	Chikkamageri-3	75.0	25.0
	Ryavanaki -1	74.2	25.8
	Bedawatti-6	60.0	40.0
	Total/Average (n_2=92)	70.7	29.3
Lingapurahalla sub-watershed, Tumkur	Huliyapura	90.0	10.0
	Kalyanpura	100.0	0.0
	Lingapura	100.0	0.0
	Total/Average (n_3=14)	92.9	7.1
Harve sub-watershed, Chamarajnagar	Kumchamanahalli	90.0	10.0
	Sagade	66.7	33.3
	Harve-1	80.0	20.0
	Total/Average (n_4=28)	85.7	14.3
	Overall (n=152)	83.15	16.85

Table 2.

Sub-watershed	Micro-watershed	Farmers received training (%)
Raipalli sub-watershed, Bidar	Raipalli 2	13.3
	Kharangikhurd	10.0
	Babulgoan-2	5.0
	Total/Average (n_1=180)	9.4
Bedawatti sub-watershed, Koppal	Chikkamageri-3	53.3
	Ryavanaki -1	51.7
	Bedawatti-6	40.0
	Total/Average (n_2=180)	48.3
Lingapurahalla sub-watershed,Tumkur	Huliyapura	26.7
	Kalyanpura	5.0
	Lingapura	8.3
	Total/Average (n_3=180)	13.3
Harve sub-watershed, Chamarajnagar	Kumchamanahalli	38.3
	Sagade	8.3
	Harve-1	11.7
	Total/Average (n_4=180)	19.4
	Overall (n=720)	22.6

farmers. The results revealed that the number of farmers received training in all three micro-watersheds of Bedawatti sub-watersheds was approximately 50 per cent of the total number of respondents surveyed (Table 2). In other micro watersheds of the Raipalli, Lingapurahalla and Harve sub-watersheds the percentage of farmers received LRI trainings was less than 20 per cent and the percentage of farmers not trained is higher i.e. >80 per cent. The lower distribution (reach) and training on Land Resource Cards is due to generation and distribution of cards to farmers was conceptualised in the middle of the project, which gives less time and scope for its distribution and training among farmers.

CONCLUSION

The study revealed that Land Resource Cards generated using LRI database will be useful for farmers for scientific farm-level planning using information provided in the cards. However, lower reach of cards among farmers was observed. The study recommends that LRC distribution and training to be conducted before

implementation of the project to create awareness and mobilize farmers to accept the LRI based recommendations at the early stage of the watershed projects. Further, this innovative generation and dissemination model of LRC generation need to be scaled up at state and national level and generated database to be linked to Nation Farmers Database for its greater utility and to realize self-reliance among farmers for sustainable rainfed agriculture. Further long-term impact study of Land Resource Cards and its site-specific database on knowledge, attitude and utility among in watershed farmers need to be taken up.

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