



A GIS-based methodological framework to characterize the Resource Management Domain (RMD): A case study of Mewat district, Haryana, India



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ABSTRACT

Resource Management Domains (RMD) represent a way to characterize land units, based on biophysical and socioeconomic characteristics. This concept has been applied to delineate and characterize sustainable land units for agricultural use in the Mewat District of Haryana, India. A GIS-based framework was conceptualized to characterize RMD and appropriate biophysical and socioeconomic parameters were identified based on local conditions and expert opinion. The biophysical characteristics of the region were represented by soil (soil erosion and fertility) and groundwater (groundwater quality, potential and vulnerability) parameters. Population density, landholding, cropping pattern, irrigation source, fertilizer type, sprinkler density, tubewell type and tractor density were considered for socioeconomic characterization. Each of these parameters was modelled and mapped using well established methods. The biophysical and socioeconomic parameters were integrated using a multivariate clustering method. The integration modelling results in the delineation of the region into seven RMDs, which were validated with two focus group discussions (FGD) in each of the RMD's. The correlation between the RMD modelling results and the FGD was found to be more than 90% in five RMDs and 65% and 39% in the remaining two RMDs respectively. The result was also validated with feedback from the local administrative authorities. The study charts a sound basis for policy makers for taking the necessary steps to address location-specific differential agricultural needs in any region.

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1. Introduction

Agriculture is facing a serious challenge of resource degradation (soil, water, forests etc.) in India which has been further aggravated with the increasing variability in climatic parameters (Mall et al., 2006; NAPCC, 2008; Solomon et al., 2007; Suryavanshi et al., 2012). The past efforts of improving crop yields based on high fertilizer use, more water demand and consumption have been identified as one of the key factors for increasing resource degradation in agriculture (Abrol et al., 2012; Khan and Hanjra, 2009; Rodell et al., 2009; Sehgal and Abrol, 1994; Singh, 2000). Thus a need for managing the natural resource base along with sustaining agriculture

has been identified to provide a way through land based solutions. Most of the initial concepts (land systems, agroecological units, and major land resource units) were based on biophysical parameters only (Abichandani and Sen, 1977; Christian and Stewart, 1968; Faroda and Joshi, 1999). The lack of socioeconomic parameters, that reflects the resource use pattern by the farmers in a region, has been identified as one of the limitations in these initial concepts. Thus, a new focus has been laid on the integration of biophysical and socioeconomic parameters to characterize land units for better resource management and sustainable agricultural production. Resource Management Domain, a conceptual framework involves the integration of biophysical and socioeconomic parameters (Babu and Reidhead, 2000; Dumanski and Craswell, 1998; Eswaran et al., 2000; Kam et al., 2006; Ram and Joshi, 2010). The RMD takes into consideration the biophysical, environmental, socioeconomic and institutional factors for the efficient use and management of

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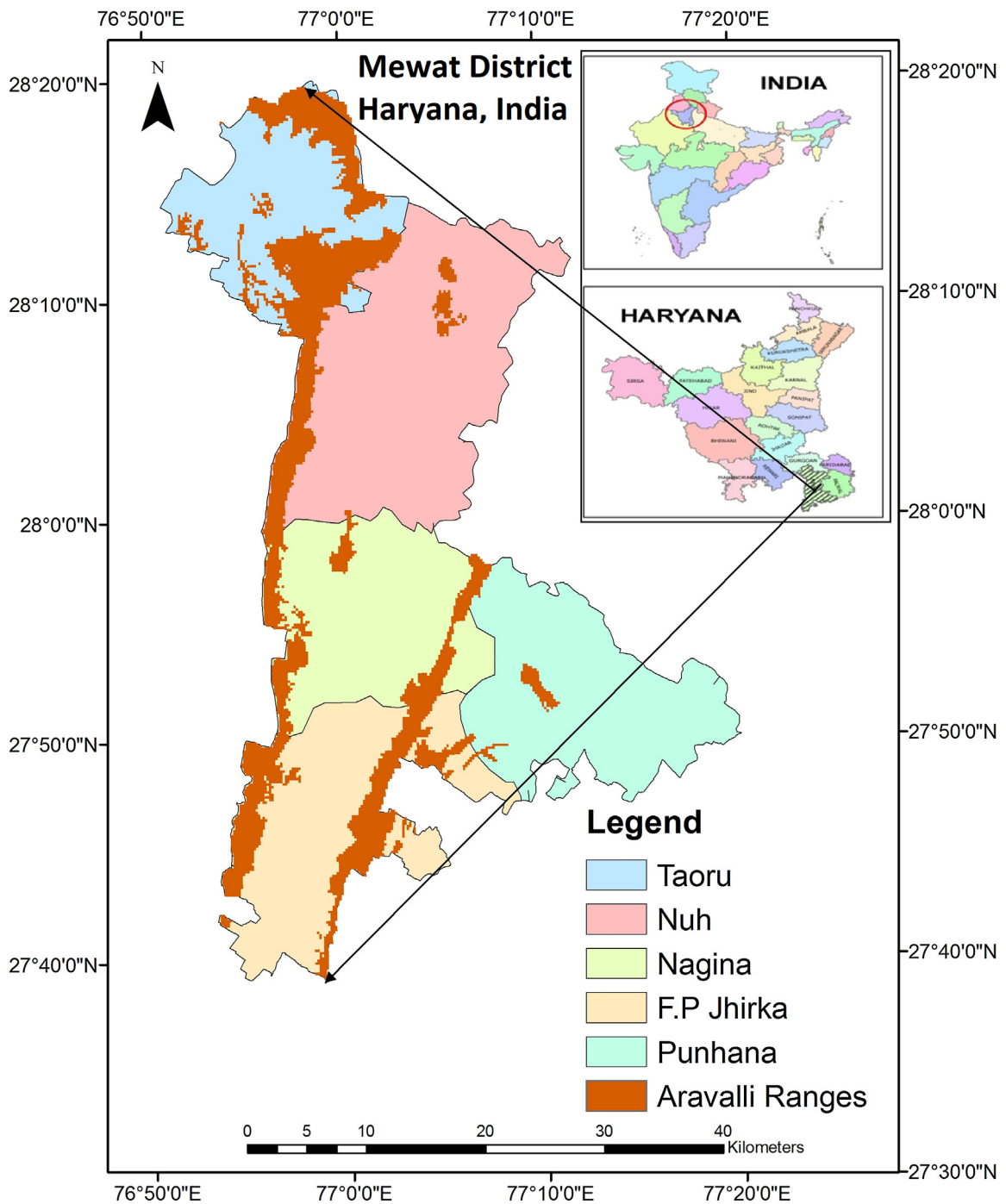


Fig. 1. Mewat district, Haryana, India.

land and other natural resources (Dumanski and Craswell, 1998; Mennis and Hultgren, 2006; Ochola and Kerkides, 2004). RMD, in its simplest form, is a unit of land that has similar management requirements for the same kind of land use and by extension, would need similar research and development initiatives. Compared to other methods, RMDs are somewhat intangible: they are defined by resource issues and common underlying socioeconomic parameters, and do not have the conventionally set geographic or administrative boundaries (Babu and Reidhead, 2000). Unlike biophysical characterization, RMD recognizes the key role of human decision-making and activities, and their economic and environmental consequences (Baja et al., 2002; Kam et al., 2006; Saroinsong et al., 2007; Koohafkan et al., 1998). The RMD concept thus pro-

vides a sound basis for decision making at all levels as a physical framework for research and development, policy, and as a unit for technology refinement and transfer (Howlett, 1998; Sai, 1998; Kam et al., 2006; Koohafkan et al., 1998; Ram and Joshi, 2010; Craswell and Latham, 1998; Wijnhoud, 2007). Although the concept of the RMD has been well accepted by different researchers across the globe, however a structured methodology to characterize RMD is missing in the available literature.

The present study has used the concept of the RMD for identifying homogenous land units having similar constraints and needs in the Mewat District of Haryana, India. A GIS-based framework was developed to characterize RMD in the region that was later

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