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A System of Geomorphological Mapping for Western Rajasthan with Relevance for Agricultural Land Use

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Abstract: A geomorphological map of arid western Rajasthan has been prepared using a recently developed classification system for national mapping in India at 1:50,000 scale. The mapping involved digital interpretation of the false colour composite (FCC) of images of 2005-06 from LISS-III scanner in the Indian Remote Sensing Satellite (IRS), followed by field verification of the mapped units and analysis of sediments from key sites. It resulted in the generation of three-tier mapped information on the origin, processes and landform units, as well as other digital database on landform characteristics. To find out the agricultural use of the landforms, a land use map of the same area for 2005-06 was draped on the derived map of landforms, using GIS. Area statistics for all the maps was generated for each of the four agro-climatic zones in western Rajasthan. The mapping reveal that landforms of aeolian origin cover the maximum area (~79%), which dominantly consist of sand dunes (~50%). Landforms of fluvial origin have been masked over large area by the aeolian features, leaving only 13% area as visible. Croplands occur on all the major landforms, but irrigated croplands occur dominantly on older alluvial plains. Sand dunes and sandy plains are dominantly under un-irrigated croplands, and partly under irrigated croplands, which may increase the risk of sand mobility. These and other results have been discussed in the paper.

Key words: Geomorphology, mapping, agricultural land use, western Rajasthan, ACZ, GIS.

Geomorphology, the scientific study of landforms and processes, is not limited to an understanding of the landscapes of earth and other planets. It has a larger goal of being useful to the societal needs, and thereby to a range of sub-disciplines of geography (both physical and socio-cultural) as well as to various other earth-science disciplines, like pedology, geology, hydrology, plant ecology, etc. One of the ways by which it caters to the needs of the above disciplines and sub-disciplines is through mapping of the observed and interpreted land features at different scales. Recognizing this responsible role, geomorphological research, since its beginning in the early 19th Century, has emphasized on preparation of sketches and maps of the landscapes and landforms as a fundamental means of visualization and analysis of the Earth's surface features (Dykes, 2008). A geomorphological map can act as a preliminary tool for land management and landscape risk management, as well as for providing baseline data to other applied sectors of environmental research such as landscape ecology, forestry, soil science, etc. (Cooke and Doornkamp, 1990; Dramis *et al.*, 2011). Despite having such a potentially useful role for different scientific disciplines, no universally acceptable system of mapping is still available, especially because of the vast difference in the landscape properties across the globe, and also because of the vastly different user perceptions and needs.

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A Brief History of the Mapping Concept

Throughout the 19th century and early 20th century, the study of landforms was dominated by a static description of physiography, which involved carefully drawn diagrams, sketches and excellent illustrations of geomorphological processes. For example, while explaining the force of water in the carving of the Grand Canyon, Powell (1875) prepared several sketches and maps of the area. Gilbert (1877) used numerous sketches and maps to explain his idea of dynamic equilibrium in landscape in a study of the Henry Mountains, Utah, while Davis (1899) used maps and diagrams to introduce his concept of 'Geographical Cycle'. Since then geomorphological maps have remained an essential graphical component of the inventories of a landscape, depicting landforms as well as surface and subsurface materials. In the early 20th Century and until