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Linkages between land use changes, desertification and human development in the Thar Desert Region of India

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ABSTRACT

Planning Commission of India has identified 15 Agro-eco regions (AEZs) for efficient resource management. Among the various regions, the Western Dry Region covers nine districts of the state of Rajasthan. Huge portion of Rajasthan is desiccated and houses the biggest Indian desert—the Thar Desert. The forest cover in all the nine districts of this zone has shown a declining trend owing to the land being diverted to cultivation. Besides forests, the area under other land uses is also being diverted to cultivation. This can have serious implications on sustainability of the livelihoods and extent of poverty of the people in this region. This in turn has implications on the health and other human development indicators. In this paper, the authors have used Markov Chain analysis to see the direction of change in the land use pattern in the districts covered under the Western Dry Region. The authors have also examined the linkages between various human development indicators of these districts in light of the changing land use pattern in the districts and suggested policy prescriptions for arresting desertification in state of Rajasthan.

1. Introduction

1.1. Desertification and development

Desertification is the persistent degradation of dryland ecosystems due to anthropogenic activities and variability in climate. Chapter 12 of Agenda 21, as approved by the United Nations Conference on Environment and Development (UNCED), defines desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities"(Fao, 1993). Currently, 41 percent of the landmass worldwide is prone to desertification and around two billion people are affected by desertification and degradation of land (Millennium Ecosystem Assessment, 2005). Land degradation occurs everywhere, but is defined as desertification when it occurs in the drylands. In drylands, scarcity of water limits the production of crops, forage, wood and other services that ecosystems provide to humans. Drylands, are therefore highly vulnerable to increases in climatic variability and anthropogenic pressures.

Common indicators of desertification include loss of biodiversity or declining habitat, loss of water-retention capacity, reduced soil fertility and increasing wind and water erosion (Gorse, 1985). The chief drivers of desertification include deforestation, over grazing, over cultivation, pressure of population, industrialization and poor land use practices. According to the (Millennium Ecosystem Assessment, 2005) report, nearly 10–20% of drylands are already degraded, and ongoing desertification threatens many of the world's ecosystems, including those inhabited by some of the poorest human populations. Therefore, desertification is one of the greatest environmental challenges today and a major barrier to meeting ecological and human needs especially in drylands. A large majority of dryland populations live in developing countries. Compared to the rest of the world, these populations lag far behind in terms of human well-being, per capita income and health parameters. Dryland populations are often marginalized and unable to play a role in decision making processes that affect their well-being, making them even more vulnerable. If no countermeasures are taken, desertification in drylands will continue to threaten future improvements in human well-being and possibly reverse any developmental gains in some regions.

Even though India shares only 2.4 percent of the world's total land area, it supports 17 percent & 15 percent of the world's human and livestock population respectively (Ministry of Agriculture,

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2013). These increasing pressures alone play a major role in promoting desertification. The increase in human and animal population increases the demand on natural resources leading to permanent loss of vegetation and plant species. This may also lead to the conversion of large areas into wastelands and to the frequent occurrence of natural disasters. Planning Commission of India has identified 15 Agro Climatic Zones for efficient resource management. Among the various regions, the Western Dry Region covers nine districts of the state of Rajasthan. These districts are (1) Bikaner (2) Jaisalmer (3) Barmer (4) Jodhpur (5) Churu (6) Nagaur (7) Sikar (8) Jhunjhunu and (9) Jalore. The Districts (1)–(5) formed the sub-zone of Arid Western Plain, districts (6)–(8) formed the sub-zone of Transitional Plain of Inland Drainage and the 9th district formed the sub-zone of Transitional Plain of Luni Basin. Fig. 1 shows the study area as shaded portion.

The huge portion of Rajasthan is desiccated and houses the biggest Indian desert—the Thar Desert. The forest cover in this region/zone is showing a declining trend owing to the land being diverted to cultivation. Besides forests, the area under other land uses is also being converted into arable lands. The capacity of these lands is limited. Pressures of human and livestock population have further compromised them (Planning Commission, 2002). This can have serious implications on sustainability of the livelihoods and extent of poverty of the people in these districts. This in turn has implications on the health and other human development indicators. Hence it is of importance to know the direction of change in the land use pattern in these districts. It would also be of relevance to study the performance of these districts in terms of various development indicators *vis a vis* various drivers of desertification existing in these districts. This paper describes the analysis of anthropogenic developmental activities in relation to degradation of natural ecosystems & depletion of resources.

1.2. Western dry region: an overview

Rajasthan occupies 10 percent of the geographical area of India and is now the largest state in the country. The Aravalli ranges divide the state into two distinct regions. The region in the west of Aravalli, consisting of 11 districts, constitutes a part of the Great Indian Desert or the Thar Desert. Nine out of these eleven districts constitute the Western Dry Region. The average temperature of this region varies from 45 °C in May–June to 2 °C in December–January. The annual rainfall in this region is around 400 mm with very high year to year variation. The cropping intensity (ratio of net sown area to total cropped area) is higher in districts which receive higher rainfall. The average size of holdings in this region is higher than the state average of 2.78 ha in seven out of nine districts (Table 1).

The population in this region has been increasing at a rate faster than national average. According to 2011 Census, the percent decadal growth rate of the population of Rajasthan between 2001 and 2011 was 21.44 percent as compared to 17.64 percent for India. This has led to increased pressure on land for food security of the increasing population and fodder security for the livestock. Due to less rainfall, people in this region practice a crop and livestock based mixed farming system. Low and erratic rainfall coupled with highly erodible and nutrient poor soil cause great uncertainty in the production of foodgrains. Under such circumstances, livestock significantly supplements the household's economy in Thar. Livestock such as sheep, goat and camel can survive in arid environment and are superior in combating physiological stress caused by lesser intake of food and water. Livestock are utilized efficiently by the desert people. The hide is used in making water storage bags, milk, milk products and meat are used for local consumption, bones of dead animals are used for carving and during financial stress livestock are also sold to get money. Some of the districts of this region

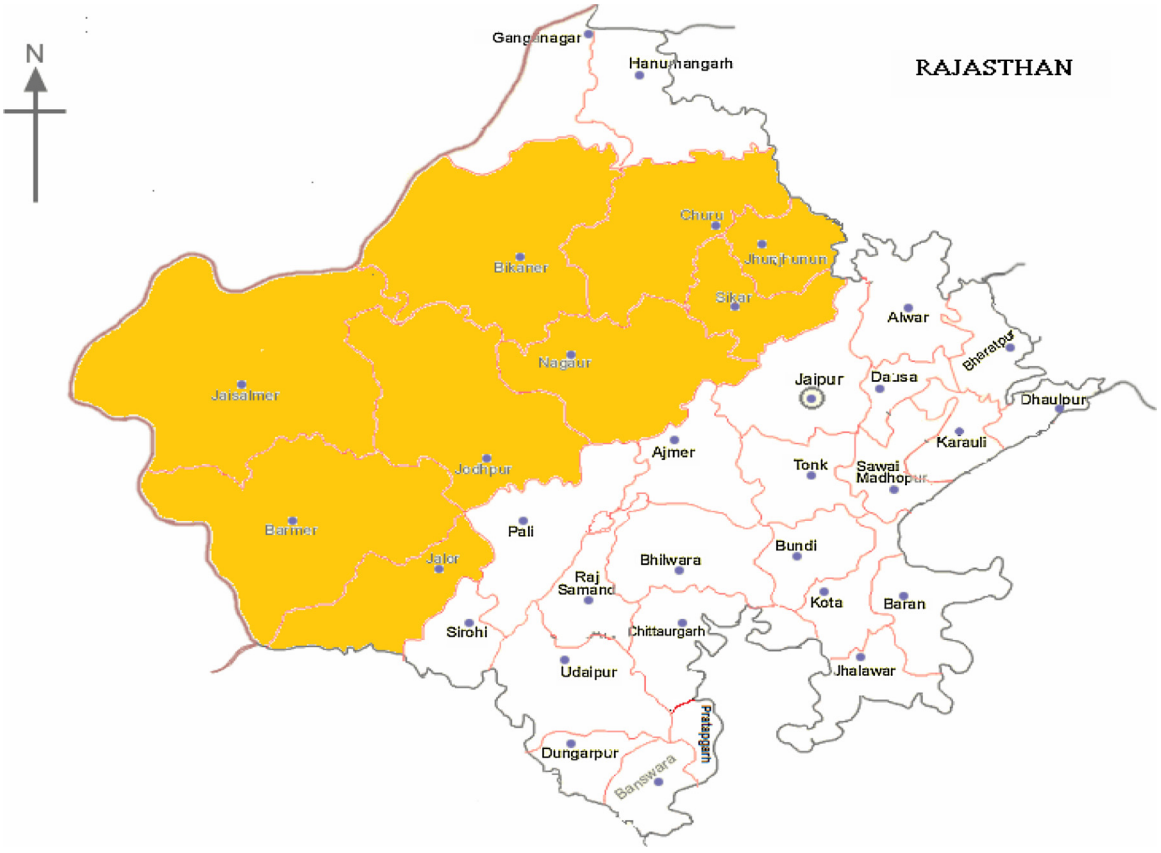

Fig. 1. The Western Dry Region.