

Quantification of agricultural land use during Kharif and Rabi season of Datia district, Madhya Pradesh, India

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Abstract: Land is an incredible resource of nature and optimum use of this resource should be in proper planned manner. In India major part of agricultural land remains fallow during different cropping practices due to various reasons. Datia is one of the district which is facing the problem of fallow land. In Datia district agricultural land covers 75.54 % and its utilization during seasons of Rabi and Kharif varies as mapped by Landsat ETM+ images (September 2016 and February 2017) with the help of geospatial technology. Agricultural land used during Kharif season is 39 % and during Rabi season is 84 % of total agricultural land. Thus a large area of agricultural land, a reusable resource is non-utilized which leads to loss of crop production. Lack of soil conservation facility & sowing of non-selected crops in western part, insufficient drain network & water logging in eastern part are the main reasons of this huge amount of fallow land. For maximum utilization of agricultural land and to increase the production during Kharif season, proper water management and modern agricultural technique plan should be prepared and implemented.

Keywords: Rabi Season, Kharif Season, Land use/ land cover, Fallow land

1. Introduction

Agriculture land is one of the most important land resources for food and fodder security of living beings. It is limited and cannot be exploited infinitely. Formation of agricultural land takes a very long time. As such its optimum use is must. Agricultural land resources well supported in association with water (naturally/ irrigation) leads to high production. In India at present, a small area of agricultural land is under irrigation facility and remaining is rainfed. Increase in water management system for agriculture use shows that in future production will increase (Seckler et al., 1999).

In Datia district agriculture is done during Kharif season (rain based) and Rabi (irrigation based), twice a year. Total agricultural land is 220965.5 ha out of total 293000 ha land of the district and there is a big gap in agricultural land utilization during Rabi & Kharif seasons. Main objective of this paper is to quantify the available land resources utilization during Rabi and Kharif seasons using remote sensing & GIS techniques to understand the lack of optimum utilization of agricultural land and its cause.

In this regards, recent studies have shown production forecasting of certain crops, crop yield modeling and crop stress detection using remotely sensed data. Historical aspects of agricultural growth, disparity and impact on farmers' income and employment have been studied by several scholars. Some recent studies include those of Sawant and Achuthan (1995), Bhalla and Singh (2001), Radhakrishna (2002) and Vaidyanathan (2010). Some studies also looked at the effect of agricultural technology

(irrigation pattern) on growth of crop output and its instability (Cummings and Ray, 1969; Hazell, 1982; Mahendradev, 1987; Deshpande, 1988; Vaidyanathan, 1992; Chand and Raju, 2009). Datia district is situated in northern part of Madhya Pradesh and is located between 78°12'36"E to 78°53'29"E longitude and 26°17'39"N to 25°24'51"N latitude and covers about 293000 ha area (Figure 1). Whole district is divided into four tahsils i.e. Datia, Bhandar, Indergarh & Seondh and are the main cities of Datia district. There are about 445 villages and total population is 786,375 (Census, 2011). The major crops of Rabi season are wheat, gram, pea & mustard and major Kharif crops are Groundnut, Jwar, Bazara, Maize & Sesame as per data from Agriculture Contingency Plan for District: Datia.

Yearly calendar is divided into three seasons (Summer, Monsoon and Winter) and the average rainfall is 793 mm. Rainfall is very erratic and irregular. The climate in these regions is characterized by complex climatic deficiencies as water scarcity for rainfed crops. The climate is semi-arid and dry sub-humid with a short (occasionally intense) wet season followed by long dry season. Rainfall is highly unreliable, both in time and space, with strong risks of dryspells at critical growth stages even during good rainfall years (Seraj 2009, Kumar & Rajpoot, 2013). Maximum temperature of this area reaches up to 48 °C in May and minimum temperature goes to 2 °C in January. The main occupation for livelihood of this area is agriculture.

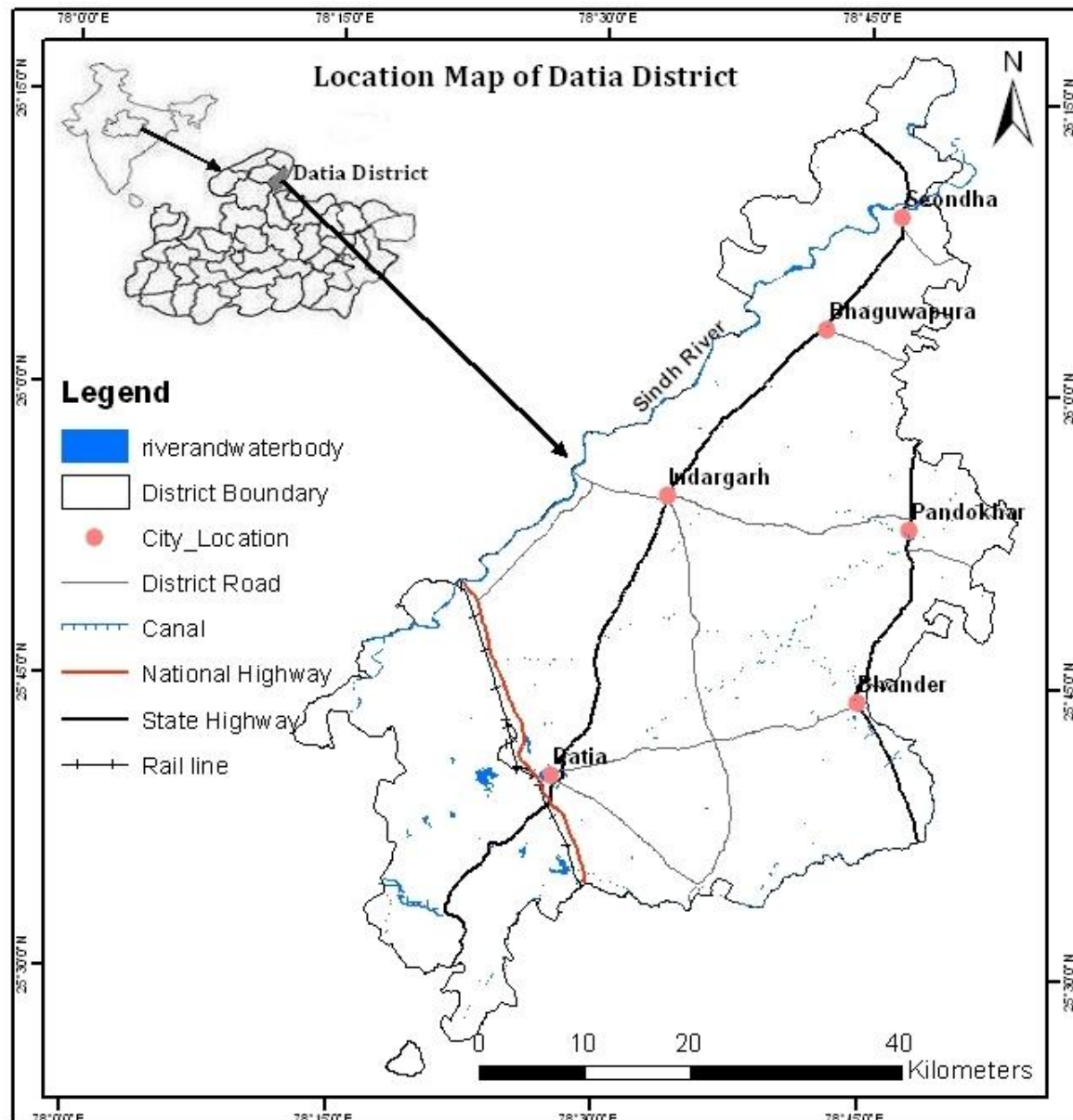


Figure 1: Location map of Datia district, M.P.

2. Materials and methodology

For the quantification of utilization of agricultural area, land use / land cover map is prepared using digitally enhanced and geo-referenced satellite imagery of Landsat ETM+ (September 2016 and February 2017). For preparation of district boundary, block boundary and location of human habitations; SOI toposheets (1:50,000) have been used. Quantification of land use/ land cover and agriculture land use for cropping in Rabi and Kharif season, visual interpretation and digital classification technique (hybrid raster classification) is used and area calculation is done using ERDAS. After the preparation of both land use/ land cover and area calculation during Rabi and Kharif seasons maps are prepared on Arc Map.

3. Results and discussion

Land use/ Land cover of Datia district is prepared using satellite data (Figure 2). Total area of Datia district is about 293000 ha and major Land use/ land cover classification area is given in table 1 and presented in figure 3. Land use/cover classification clearly shows that agricultural land cover about 75.54 % of total area of district. Forest covers 9.45 % a small part and it is characterized by scattered scanty vegetation mainly bushes and medium size trees. Built-up land is scattered in small clusters of four major towns (Datia, Bhandar, Seondha and Indergarh) and villages. It covers 2.06 % area. Waste land covers 4.82 % area and water bodies 3.76 % area. Agricultural land is most precious natural resources which supports livelihood mainly of rural masses.

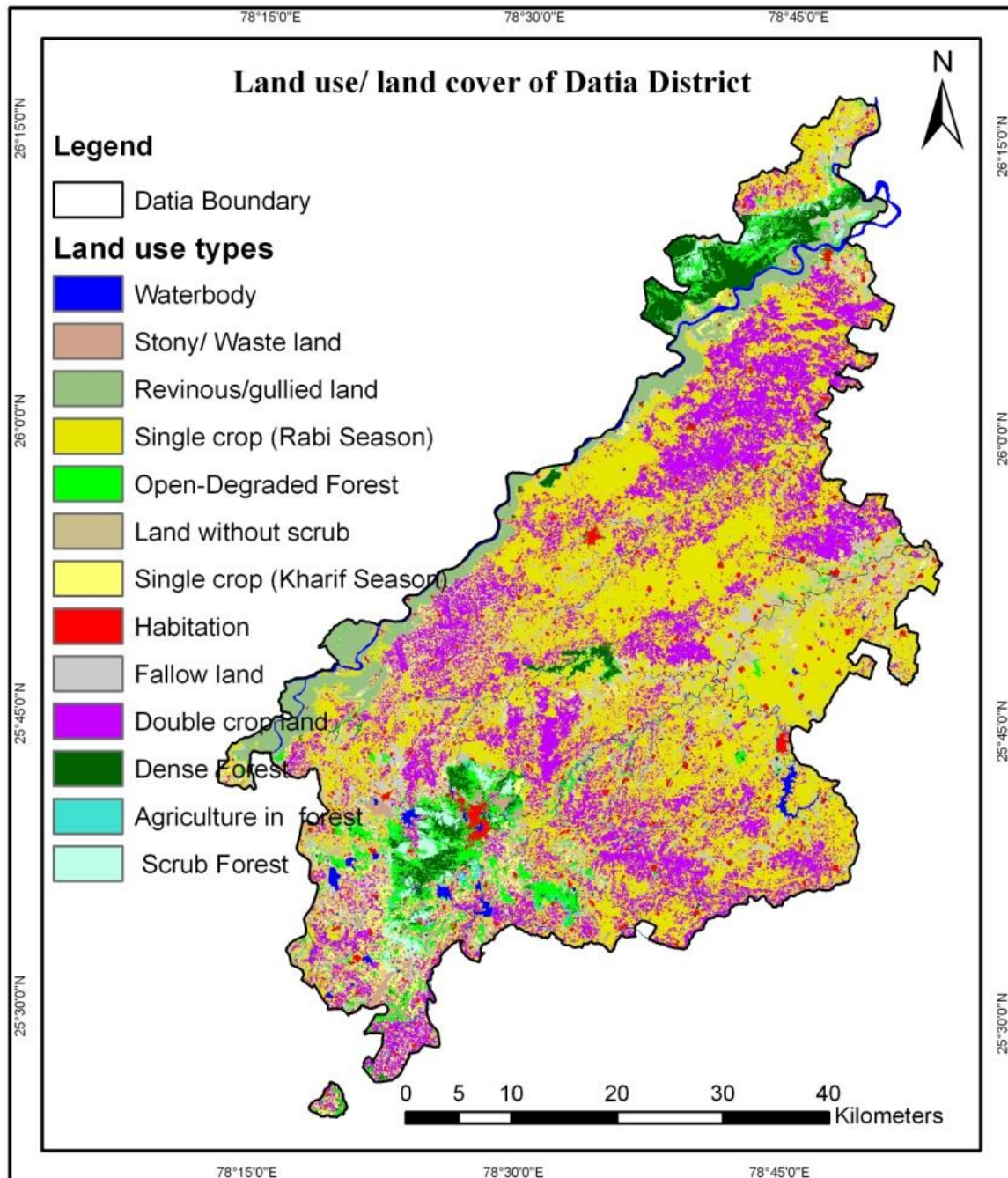


Figure 2: Land use/ land cover map of Datia district, M.P.

Table 1: Major land use classes of Datia district, M.P.

Sr No	Land use classes	Area (ha)	% Area
1	Agricultural land	220965.5	75.5
2	Land without scrub	11738.3	4.00
3	Forest	27927.52	9.5
4	Buil-up area	6039.9	2.1
5	Agriculture in forest	756.18	0.3
6	Waste land	14120.62	4.8
7	Waterbody	10984.6	3.7

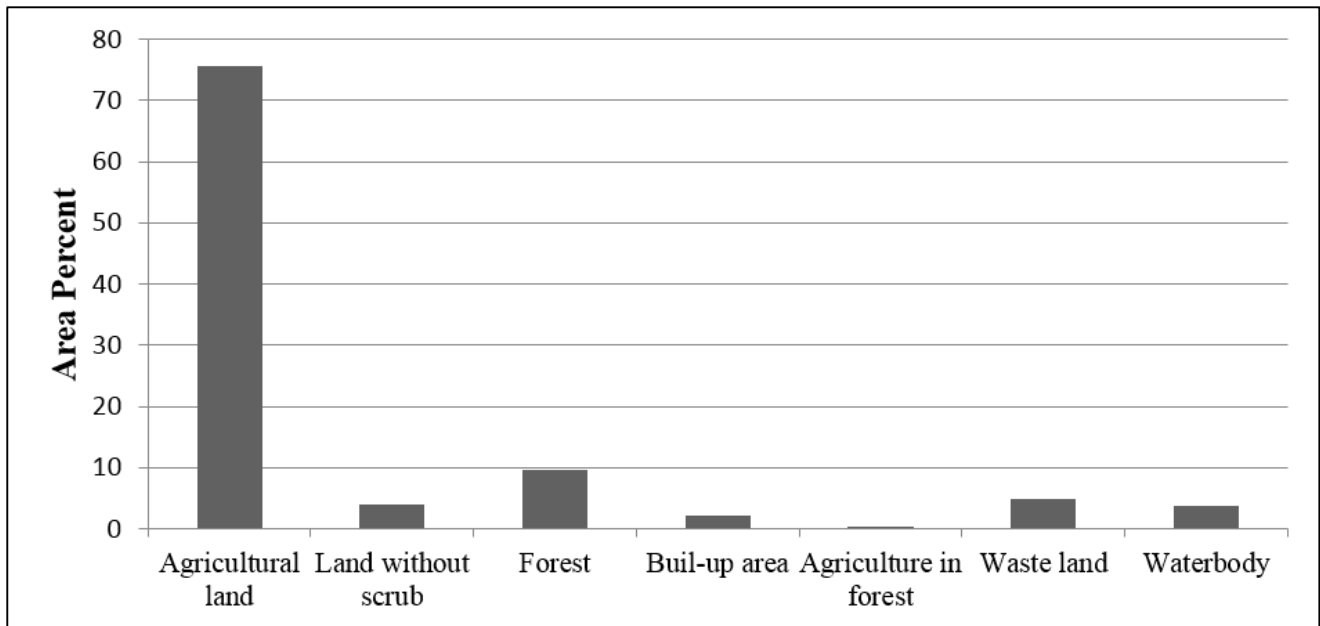


Figure 3: Land use of both seasons (Rabi & Kharif) of Datia District, M.P.

Land use during Rabi and Kharif season and agricultural land utilization for cropping of Rabi, Kharif and double cropping is given in table 2 and presented in figure 4, 5, 6 & 7. Comparative utilization of agricultural land during Kharif and Rabi is shown in figure 8. Out of total of agricultural land, during Kharif season sown area is 39 % and fallow land is 61 % while during Rabi season is 84 % and fallow land is 16 %. This indicates that in the area during both cropping seasons agricultural land use has a big gap. Total of both season un-utilized agricultural land resource amounts to about 69 %. This is a huge amount of un-utilized land resource leading to overall lower agricultural production than expected. Land under double cropping of both cropping season is 31 % (Figure 8).

Topographically district area is drained from west to east. Western part has higher slope and rain water retention is minimum and in the east, area is almost plain with highly fertile alluvium and water is filled in agricultural fields along with erratic distribution of rain causing both drought and water logging condition causing non utilization of major percent of agricultural land. Lack of optimum use of agricultural land resource demand is proper rain water harvesting, removal of water logging problem in eastern part, sowing of selected crops & implementation of soil conservation plan in western part for maximum utilization of agricultural land resource as double cropping pattern. A proper plan of irrigation and drain network should be developed and applied to increase the production (Singh et al., 2006).

Table 2: Agriculture Land use classes of Datia district

Sl No		Area (ha) Rabi Season	Area (ha) Kharif Season	Major Crops
1.	Single crop	116114.00	17206.30	Black Gram, Groundnut & Sesame in Kharif
2.	Double	68341.70	68341.70	
3.	Fallow land	36509.80	135417.5	Wheat, Gram, Pea & Mustard in Rabi
4.	Total	220965.50	220965.50	

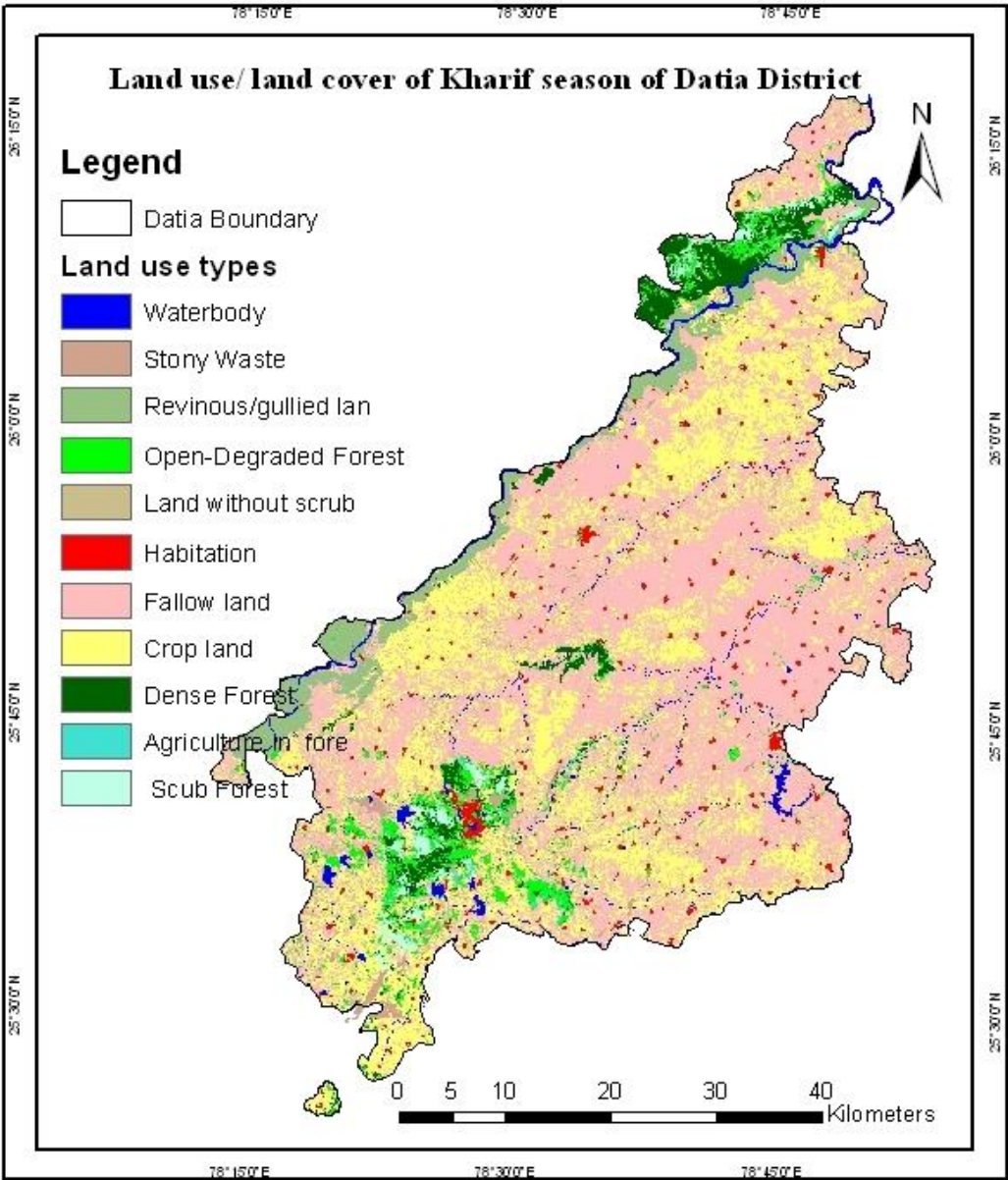


Figure 4: Land use map of Kharif season of Datia district

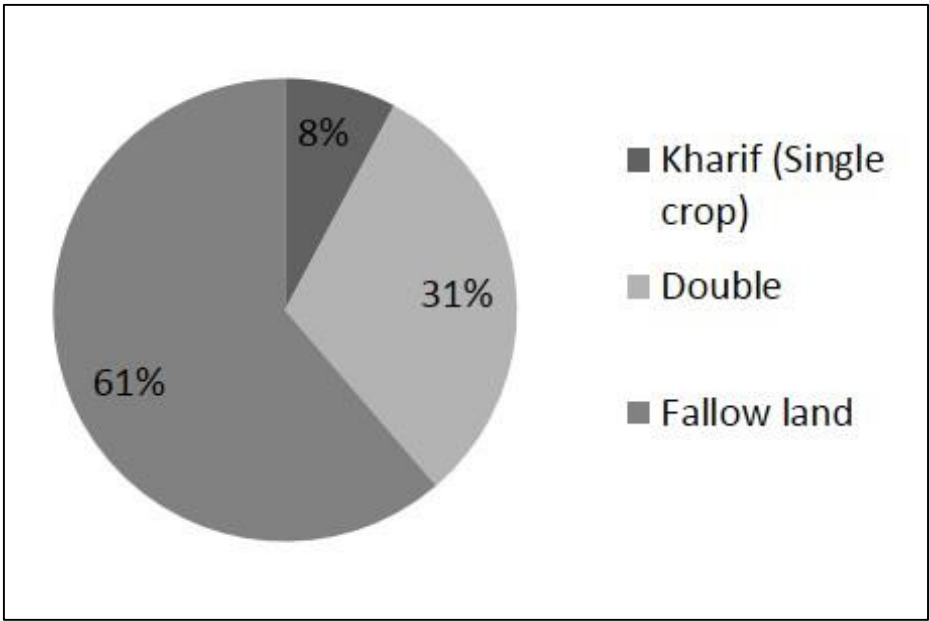


Figure 5: Crop land during Kharif season

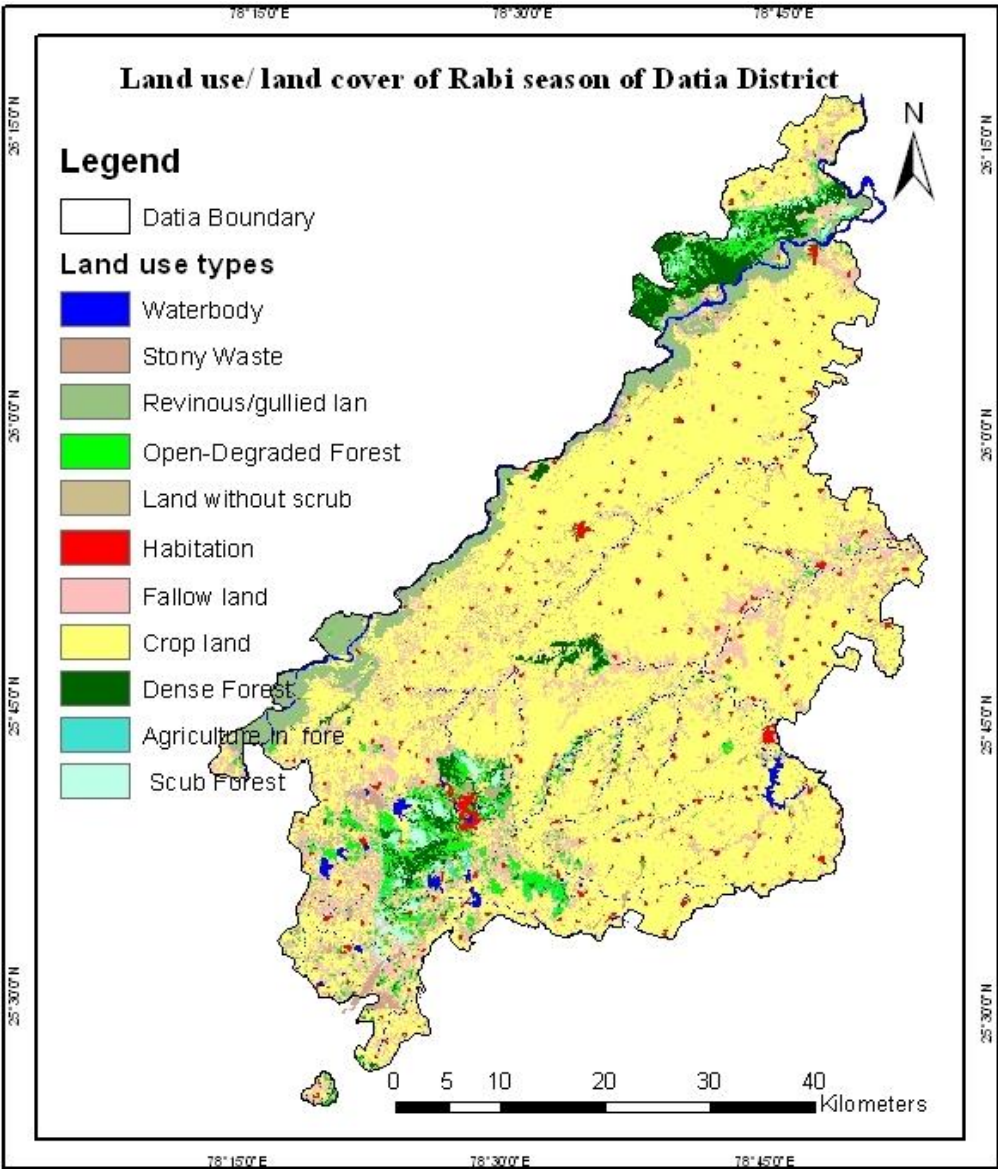


Figure 6: Land use map of Rabi season of Datia district

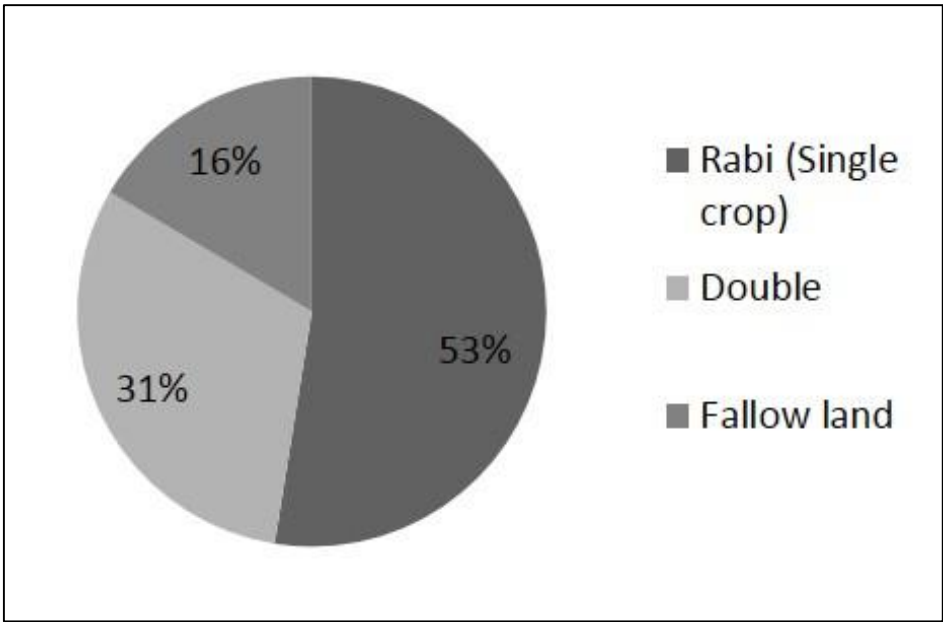


Figure 7: Crop land during Rabi season

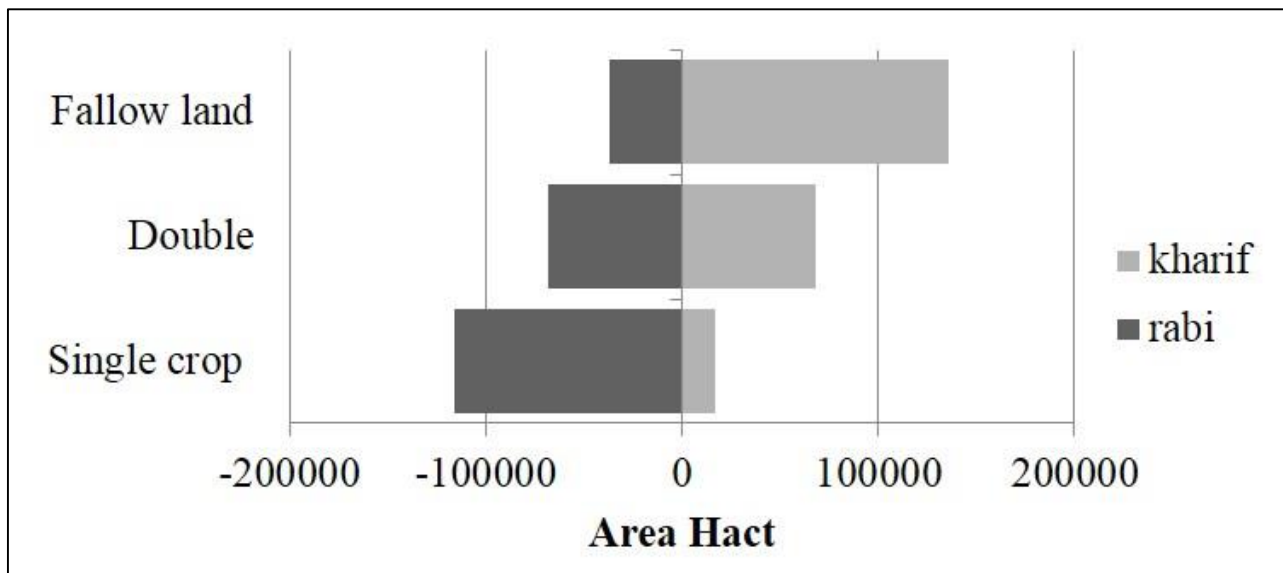


Figure 8: Pyramid of Agricultural land of Datia district, M.P.

Conclusion

Agricultural land is to be utilized to its full extent during Kharif and Rabi season. In Datia district utilization of agricultural land during Kharif season is 39 % and in Rabi about 84 %. Major part of agricultural land resource during Kharif season remains un-utilized. For maximum use of agricultural land and increased production from agricultural land during Kharif season, proper water management and modern agricultural technique plan be prepared and implemented.

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