Dynamics of Land Use Competition in India: Perceptions and Realities

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Abstract

Diversion of agricultural land to non-agricultural uses is an issue of public debate in every agrarian economy experiencing rapid urbanization and industrial development. However, the issue has become more complex and politicised in India due to widely varied perceptions about the extent of diversion of agricultural land and the causes and socio-economic consequences of loss of agricultural land. It is generally perceived that large-scale conversion of agricultural land to non-agricultural uses has occurred and the issue of acquisition of large tracts of fertile land by corporates and displacement of farmers, agricultural workers, and other rural communities has become a major political rather than socio-economic issue. We try to determine whether the perceptions are consistent with empirical evidence on land use competition and identify main drivers that contribute to loss of agricultural land.

The evidence shows that agricultural land conversion has become a serious issue in the country but the extent and intensity varies across different states. Between triennium ending (TE) 1991-92 and TE2011-12, net sown area in the country declined by about 1.8 million ha but it increased in some states, e.g. about 20 lakh ha in Rajasthan and 9.5 lakh ha in Gujarat. In contrast, Odisha lost over 17 lakh ha net sown area, Bihar (including Jharkhand) 12.4 lakh ha, Maharashtra (7.6 lakh ha), Tamil Nadu (7.1 lakh ha), Karnataka (3.1 lakh ha), Andhra Pradesh (2.7 lakh ha) and West Bengal (2.6 lakh ha). Contrary to general perception, Gujarat is the only state which has been able to add about 3 lakh ha to its total agricultural land during last two decades. Area under non-agricultural uses increased from 21.3 million ha in TE1991-92 to 26.3 million ha in TE2011-12 and almost all states witnessed an increase in area under non-agricultural uses. The empirical results revealed that urbanization, road infrastructure expansion and industrial development were the most important factors affecting agricultural land. Therefore, proper planning and management of land resources and appropriate policy framework are required to check conversion of agricultural land. Managing urbanization process and industrial as well as infrastructure expansion in a desired way that protects productive agricultural land and uses barren and unculturable wastelands (about 17.2 million ha) is very critical to country's prosperity and sustainability. Hence, restriction on conversion of agricultural land for non-agricultural uses (mainly for industrial estates) and proper planning and implementation of land use policies are needed. The recent and current trends in agriculture and non-agriculture land use should not be a cause for either panic or complacency. However, strategic planning that avoids land use conflict by identifying areas, mainly barren and unculturable wastelands, for non-agricultural activities such as urban and industrial expansion and protecting productive farm lands is necessary to address land use conflicts and co-existence of agriculture and other non-agricultural activities. The problem of small and fragmented farms underlines the need for revisiting tenancy laws so as to increase the effective farm size.

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Dynamics of Land Use Competition in India: Perceptions and Realities

1. Introduction

India has the second largest population in the world but scarce land resources. In 2011, India's population reached 121 crore, about 17 per cent of the world population while net sown area was about 140 million ha in 2012-13, about 0.12 ha per capita, and less than half of the world average of 0.23 ha (GoI, 2015). This problem of limited availability of land has been compounded by growth in population, urbanisation and diversion of productive agricultural land for non-agriculture purposes. During the last two decades, India's population has increased by about 18.4 crore, while the total agricultural land has decreased by about 3.2 million ha. According to the recent Land Use Statistics of the Ministry of Agriculture, Government of India, a total agricultural land of nearly 3.16 million ha (1.5 lakh ha per year) was lost to other sectors in the years between Triennium Ending (TE) 1991-92 and TE2012-13 (GoI, 2015). On the other hand, area under non-agricultural uses has increased by over five million ha (21.3 million ha to 26.4 million ha) during the same period. Taking into account the additional area added by reclamation and rehabilitation of culturable wastelands (about 2.4 million ha), it is estimated that a total net sown area of about 4 million ha (1.8 lakh ha per year) has been lost during last two decades. This loss of agricultural land is mainly due to rapid economic and industrial development, infrastructure expansion, rising population, urbanization, land degradation, etc.

India has been experiencing rapid urbanization over the last few decades, which accelerated during the last decade (GoI, 2011). In 1981, the proportion of urban population in the country was 23.4 percent, which marginally increased and reached 25.7 percent in 1991 and 27.8 per cent in 2001. However, between 2001 and 2011, the proportion of urban population increased from 27.8 per cent to 31.2 per cent (an increase of 3.4%, the highest ever during the last four decades).

In order to give a boost to manufacturing, increase exports and create employment opportunities, government announced Special Economic Zone (SEZ) policy in April 2000 and Special Economic Zones Act. 2005 was passed by the Parliament in 2005. After SEZ Act in 2005, 491 formal approvals have been granted for setting up of SEZs, out of which 352 have

been notified and are at various stages of operations. Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Tamil Nadu, Telangana and Uttar Pradesh account for the nearly 85 per cent of the SEZs approved so far. About 56,067 ha land has been acquired for formally approved SEZs in the country as on December 31, 2014 (GoI, 2015a). However, some concerns have been expressed about the land acquisition for SEZs. For example, the Comptroller and Auditor General Performance Audit Report on Special Economic Zones has categorically mentioned in the report that land appeared to be the most crucial and attractive component of the scheme as out of nearly 45,636 ha of land notified for SEZs, less than half of it (42.9%) has been utilized and remaining area is lying vacant in the processing area (GoI, 2015b). In addition, developers have also de-notified the land purchased for SEZs. For example, out of 39,246 ha of land notified in the six States, about 14 per cent was de-notified and diverted for commercial purposes in several cases.

High economic growth during the two decades has also spurred growth in rail, road and port traffic, necessitating further infrastructure improvements and therefore demand for more land. For example, total road length has increased by about 45 per cent, from about 3.37 million kms in 2001 to nearly 4.87 million km in 2012. More land is required for development of roads, railways, ports, airports, and other rural infrastructure but acquisition of land is becoming a major issue and needs to be addressed by the Centre as well as the States.

In addition to declining availability of agricultural land, farmland fragmentation, as a demographically-induced change in landholding structure, and declining farm size are other major problems of Indian agriculture. The average farm size has declined to 1.15 ha in 2010-11 as compared to 2.28 ha in 1970-71 (GoI, 2014a). The small and marginal holdings (below 2.00 ha) accounted for over 85 per cent in 2010-11 as against 69.9 in 1970-71 and the operated area at 44.6 per cent in 2010-11 compared with 20.9 per cent in 1970-71. The proportion of marginal holdings (<1.00 ha) increased from 51 per cent to 67.1 per cent during the last four decades. Agricultural land is fragmented in many states and the problem of land fragmentation has been identified a long time ago. The average number of parcels per holding has been declining but fragmentation is still a problem in many states. For example, the average number of parcels varied from about 1.2 in Punjab, Kerala, Gujarat

and many north-eastern states to 4.62 in Himachal Pradesh, 4.42 in Uttarakhand, 4.09 in Chhattisgarh, and 3.24 in Jammu & Kashmir, with national average of about 2.22. The average area per parcel in 2005-06 was 0.26 ha on marginal farms and 0.54 ha on small farms with national average of 0.59 ha. The empirical evidence shows that there is an inverse relationship between farm size and per hectare agricultural productivity in India. However, farm holdings below 0.8 ha do not generate enough income to keep a farm family out of poverty despite high productivity (Chand, et. al. 2011). Hence, there is a need to increase effective farm size to make it economically viable.

With increasing urbanization, industrialization with focus on *Make in India* and need for creation of infrastructure such as roads, railways, irrigation, there is no doubt that these developments will continue to have impact on the Indian economy. One of the consequences is that these initiatives require more land and there is a general fear that it might encroach upon agricultural land, particularly the fertile lands in the rural areas. Hence, the conflict between declining availability of agricultural land and population increase, as well as more requirement of land for industrial and infrastructure development has attracted special attention of political system, academics, industry, civil society and other stakeholders. However, the issue has become more complex and politicised due to widely varied perceptions about the extent of diversion of agricultural land and the causes and socio-economic consequences of loss of agricultural land. It is a common perception that large-scale diversion of agricultural land to non-agricultural uses has occurred and the issue of acquisition of large tracts of fertile lands by corporates and displacement of farmers, agricultural workers, and pastoralists has become a major political issue rather than socio-economic issue. Therefore, we try to determine whether the perceptions are consistent with empirical evidence on land use competition. This paper attempts to empirically address the following key questions:

i. How serious is the issue of diversion of agricultural land in the country?
ii. Is agriculture land rapidly declining due to increasing urbanization, infrastructure and industrial development, thereby threatening the national food security and economic viability of agriculture?
iii. Can industrial and infrastructure development as well as urbanisation continue without seriously affecting agricultural production?

2. Land Resources Status and Trends

Substantial changes in land use pattern have taken place during the last few decades, mainly driven by biophysical factors and human needs. In this section we analyse the changes in land use pattern at All India level during the last six decades and for states during the last two decades. The trends in land use pattern at all India level are presented in Table 1.

It is evident from the Table that during the last 60 years forest area in the country has increased by about 50 per cent, from 46.8 million ha in TE1952-53 to over 70 million ha in TE2011-12, while barren and unculturable land, and culturable waste land area has declined. The share of barren and unculturable wastelands has declined from 13.1 per cent of total reporting area in TE1952-53 to 5.6 per cent in TE2011-12, while current fallows has declined from 8.2 per cent to 4.2 per cent during the same period. In contrast, the area under non-agricultural uses has more than doubled from about 11.5 million ha to 26.3 million ha during the last six decades. Arable land, which increased during the seventies and eighties, witnessed a declining trend during the last two decades. Total arable land increased from about 181.8 million ha in TE1971-72 to 185.1 million ha in TE1991-92 but then declined to 183.6 million ha in TE2001-02 and reached about 182 million ha in TE2011-12. The net sown area also increased during the 1950s, 1960s, 1970s and 1980s, from about 120.5 million ha in TE1952-53 to 142.3 million ha in TE1991-92 but declined in the post-reforms period and reached 140.5 million ha in TE2011-12. Due to expansion in irrigation facilities, total cropped area increased from 134.3 million ha in early-50s to nearly 194 million ha in TE2011-12 and the cropping intensity increased from 111 per cent to 138 percent. During the period 1950-51 to 1991-92, area under agriculture (both net sown area and total cropped area) expanded significantly as the fallows were reduced and cultivable wastelands were brought under cultivation. However, we do not get the same trends during the last two decades. For example, between TE1991–92 to TE2011-12, net sown area declined by about 1.2 per cent from 142.3 million ha to 140.5 million ha and total arable land declined from about 185 million ha to 182 million ha during the same period. The share of fallow lands, which can be used for agriculture, increased from 7.9 per cent to 8.4 per cent either due to the lack of assured irrigation or problems of land degradation due to waterlogging, soil salinity, etc. The share of net irrigated area increased from 33.9 per cent

in early-90s to 45.3 per cent in TE2011-12, but cropping intensity increased from 128.9 per cent to 138 per cent. Permanent pastures and grazing lands, which are important source of livelihood for pastoralists and other marginalized communities, have declined by almost 9 per cent, from about 11.3 million ha to 10.3 million ha. Land used for non-agricultural purpose mainly for housing, industry and infrastructure has been growing substantially but occupies a relatively small (about 9% of total area) yet important share of land. The area under non-agricultural uses has increased from about 21.3 million ha in TE1991-92 to 26.3 million ha in TE2011-12 (23.3% increase).

Table 1: Trends in Land Use Pattern[2] in India: 1950-51 to 2011-12

(thousand hectares)

Category	***TE1952-53***	***TE1971-72***	***TE1991-92***	***TE2001-02***	***TE2011-12***
Reporting Area	287643	303929	304933	305113	305854
Forests	46842 (16.3)	63832 (21.0)	67658 (22.2)	69576 (22.8)	70005 (22.9)
Not Available for Cultivation	***49144 (17.1)***	***45244 (14.9)***	***40806 (13.4)***	***41232 (13.5)***	***43477 (14.2)***
Area under non-agricultural uses	*11456 (4.0)*	*16439 (5.4)*	*21314 (7.0)*	*23755 (7.8)*	*26282 (8.6)*
Barren and unculturable land	*37688 (13.1)*	*28805 (9.5)*	*19492 (6.4)*	*17477 (5.7)*	*17195 (5.6)*
Other uncultivated land excluding fallow land	***43306 (15.1)***	***34352 (11.3)***	***30161 (9.9)***	***27847 (9.1)***	***26252 (8.6)***
Permanent pastures & other grazing lands	*7967 (2.8)*	*13071 (4.3)*	*11336 (3.7)*	*10678 (3.5)*	*10312 (3.4)*
Land under Miscellaneous tree crops & groves (not included in net area sown)	*11822 (4.1)*	*4366 (1.4)*	*3792 (1.2)*	*3537 (1.2)*	*3195 (1.0)*
Culturable waste land	*23517 (8.2)*	*16915 (5.6)*	*15032 (4.9)*	*13631 (4.5)*	*12744 (4.2)*
Fallow Lands	***27822 (9.7)***	***20741 (6.8)***	***24028 (7.9)***	***25414 (8.3)***	***25610 (8.4)***
Fallow lands other than current fallows	*15360*	*8878 (2.9)*	*9959 (3.3)*	*10356 (3.4)*	*10609 (3.5)*

[2] *Please see Annexure I for concepts and definitions of Land Use Statistics*

Category	***TE1952-53***	***TE1971-72***	***TE1991-92***	***TE2001-02***	***TE2011-12***
	(5.3)				
Current fallows	*12462 (4.3)*	*11863 (3.9)*	*14069 (4.6)*	*15058 (4.9)*	*15001 (4.9)*
Net Sown Area	***120529 (41.9)***	***139760 (46.0)***	***142280 (46.7)***	***141044 (46.2)***	***140511 (45.9)***
Total Cropped Area	***134267 (46.7)***	***164414 (54.1)***	***183417 (60.1)***	***187250 (61.4)***	***193854 (63.4)***
Area Sown more than Once	13738 (4.8)	24654 (8.1)	41137 (13.5)	46206 (15.1)	53343 (17.4)
Arable Land	***183690 (63.9)***	***181782 (59.8)***	***185133 (60.7)***	***183627 (60.2)***	***182060 (59.5)***
Cultivated Land	132991 (46.2)	151623 (49.9)	156349 (51.3)	156102 (51.2)	155512 (50.8)
Net Irrigated Area[3]	21008 (17.4)	30949 (22.1)	48197 (33.9)	56557 (40.1)	63559 (45.3)
Gross Irrigated Area[4]	23016 (17.1)	37866 (23.0)	63578 (34.7)	77924 (41.6)	88415 (45.6)
Cropping Intensity (%)	***111.4***	***117.6***	***128.9***	***132.8***	***138.0***

Figures in parentheses show percent to Reporting Area
Source: MoA (2014); Computed by Author.

In order to understand the magnitude, and direction of land-use changes at the state level, we evaluated land-use trends in selected states during the 1991-2011 and the results are discussed in the following sub-section.

2.1. Expansion of Area under Non-Agricultural Uses

The loss of farm lands to other uses is an unavoidable phenomenon during economic development, population growth and urbanization periods (Tan et. al., 2009). In the 1990s, the average annual growth rate of GDP (at 2004-05 constant prices) in the country was about 5.73 per cent, which increased to 7.69 per cent during the next decade (CSO, 2014). The higher economic growth stimulated the demand for land for non-agricultural uses from two aspects. Firstly, higher economic growth led to the increase in housing requirements,

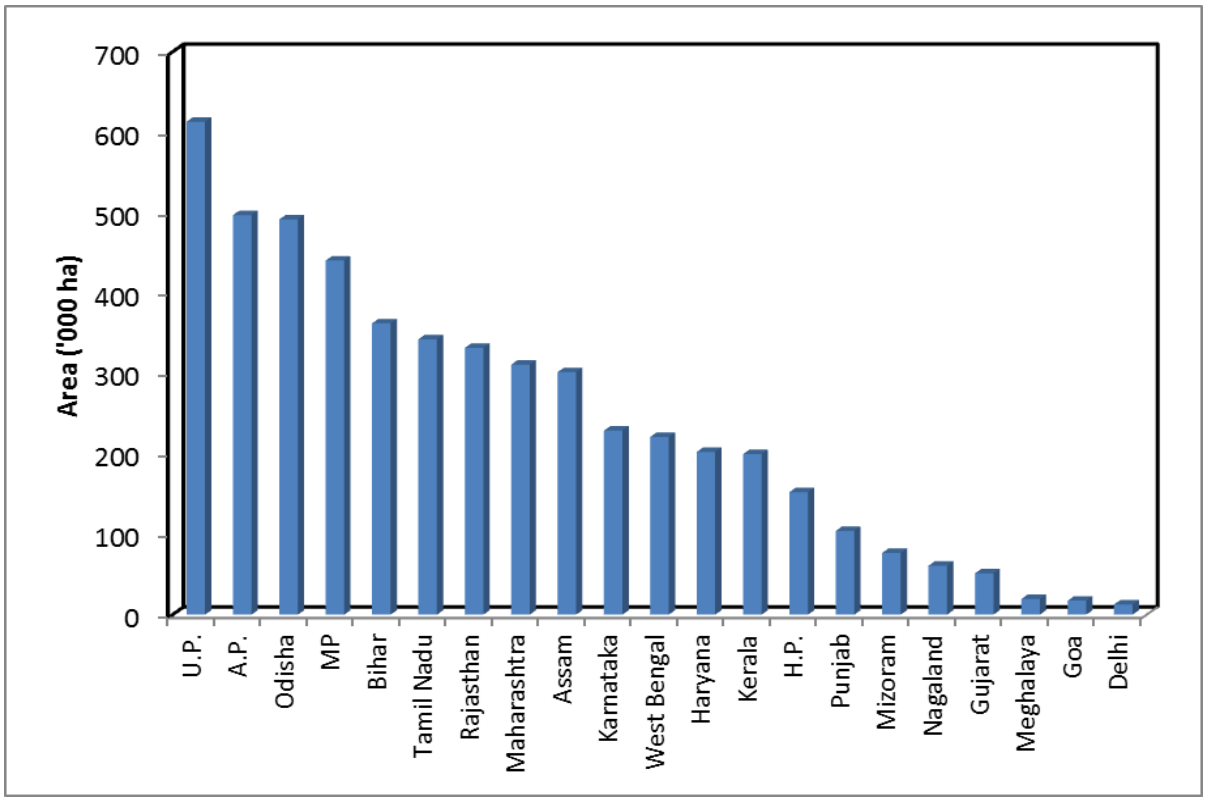
[3] *Figures in parentheses show % of Net Irrigated Area over Net Sown Area*

[4] *Figures in parentheses show % of Gross Irrigated Area over Gross Cropped Area*

transportation infrastructure, and industrial development. Secondly, with the high economic growth, share of urban population rapidly rose during the last decade.

At the All India level, the area under non-agricultural uses has increased by 2.36 lakh hectares per year (646 ha per day) between TE1991-92 and TE2011-12. Disaggregated analysis shows the similar trends in majority of the States (Figure 1). The states with high rate of addition to area under non-agricultural uses (more than three lakh hectares) are Uttar Pradesh, Andhra Pradesh, Odisha, Madhya Pradesh, Bihar, Tamil Nadu, Rajasthan, Maharashtra and Assam. Even States like Haryana (2.02 lakh ha) and Punjab (1.04 lakh ha), which are predominantly agrarian states, also witnessed an increase in area under non-agricultural uses. Among other states, the increase in area ranged from 13 thousand ha in Delhi to 2.29 lakh ha in Karnataka.

Figure 1: Changes in Area Put to Non-agricultural Uses in Major States of India between TE1991-92 and TE2011-12:



Source: GoI (2014 & 2015c)

In order to examine changes in area under non-agricultural uses during two different sub-periods (1990s and 2000s), trends in land put to non-agricultural uses were computed and results are presented in Table 2. It is evident from the Table that total area under non-

agricultural uses expanded by 23.3 per cent between TE1991-92and TE2011-12 and the annual increase was about 1.1 per cent. However, the rate of area expansion was not identical during two sub-periods and among different States. The non-agricultural area increased faster during the 2000s compared with 1990s. The area under non-agricultural uses was about 21.3 million ha in TE1991-92 and it increased to about 23.8 million ha in TE2001-02 (net addition of 2.42 million ha during 1990s) and reached nearly 26.3 million ha in TE2011-12 (2.53 million ha during 2000s). Area under non-agricultural uses has increased in most of the states during both periods. Bihar, Andhra Pradesh and Assam had an addition of more than 1.5 lakh ha to non-agricultural use during the 1990s and the number of states having more than 1.5 lakh ha addition to non-agricultural uses increased to seven (Uttar Pradesh, Odisha, Madhya Pradesh, West Bengal, Tamil Nadu, Andhra Pradesh and Rajasthan) during the last decade.

Table 2: Classification of States according to Changes in Area under Non-agricultural Uses between TE1991-92 and TE2011-12

Change in Area	***Between TE1991-92 and TE2001-02***	***Between TE2001-02 and TE2011-12***
Increase in Area ('000 ha)	***All India (2421),*** Bihar (322), Andhra Pradesh (315), Assam (163), Madhya Pradesh (144), Karnataka (125), Maharashtra (125), Meghalaya (125), Nagaland (125), Punjab (125), Sikkim (125), Himachal Pradesh (115), Uttar Pradesh (111), Haryana (92), Kerala (82), Manipur (82), Mizoram (82), Odisha (82), Rajasthan (82), Tamil Nadu (82), Goa (17), and Gujarat (14)	***All India (2527),*** Uttar Pradesh (368), Odisha (292), Madhya Pradesh (225), West Bengal (223), Tamil Nadu (190), Andhra Pradesh (182), Rajasthan (177), Assam (139), Kerala (118), Haryana (110), Karnataka (104), Punjab (90), Maharashtra (83), Uttarakhand (65), Bihar (57), Himachal Pradesh (37), Gujarat (37), Chhattisgarh (26), Nagaland (23), Arunachal Pradesh (21), Meghalaya (17), and Jharkhand (5)
Decline in Area ('000 ha)	West Bengal (-2), Jammu & Kashmir (-4), Arunachal Pradesh (-24)	Jammu & Kashmir (-3), Mizoram (-35), Sikkim (-41)

Source: GoI (2014 & 2105c); Computed by Author.

The rate of non-agricultural land expansion also varied among different states. For example, Himachal Pradesh recorded the highest increase (138.3%) in area under non-agricultural uses between 1991 and 2011. Other States, which witnessed a significant increase in area

under non-agricultural uses, included Odisha (70.3%), Haryana (65.4%), Kerala (63.5%), Punjab (31.4%), Uttar Pradesh (including Uttarakhand) and Maharashtra (29.5%). The number of States having higher increase in area under non-agricultural uses than the All-India average increased from six (Andhra Pradesh, Haryana, Himachal Pradesh, Kerala, Maharashtra, and Odisha) in 1990s to 12 (Bihar including Jharkhand Haryana, Himachal Pradesh, Kerala, Madhya Pradesh including Chhattisgarh, Odisha, Punjab, Rajasthan, Uttar Pradesh including Uttarakhand and West Bengal) in 2000s. During the last decade, Haryana and Punjab, two major agrarian States, experienced more than 25 per cent increase in area under non-agricultural uses, which is a cause of concern.

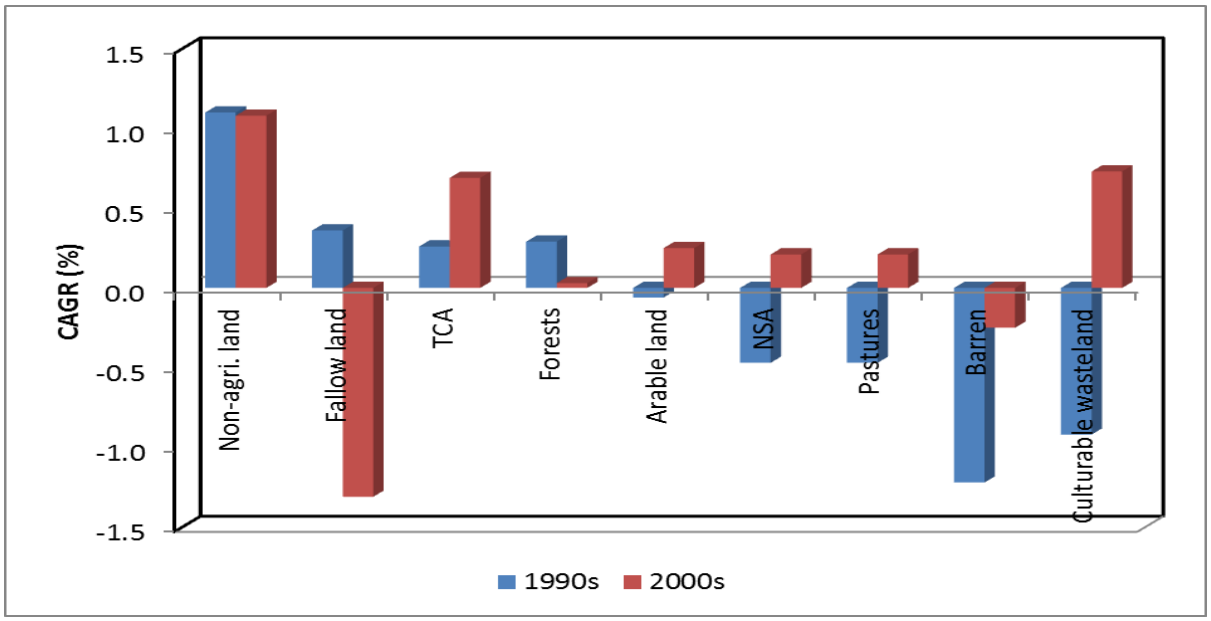
Annual compound growth rates in area under non-agricultural uses were estimated for 1990s and 2000s and results are presented in Table 3. Among all land use categories, the area under non-agricultural uses registered the highest growth rate at the all India level (about 1.1 per cent per annum) during last two decades (Figure 2). Growth rates computed for different states revealed that the area under non-agricultural uses showed an increasing trend in eight states and declining trend in six states. The annual growth rate was the highest for Himachal Pradesh (5.03%), followed by Odisha (2.31%) and Kerala (2.22%) during the 1990s while in 2000s, Uttarakhand had the highest growth rate (4.98%), followed by Odisha (3.09%) and Kerala (2.78%). Punjab, which witnessed a negative growth rate (-1.24%) during the nineties, showed a significant positive growth rate (1.86%). The compound annual growth rate in area under non-agricultural uses varied from less than one per cent in states like Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Jammu & Kashmir, Jharkhand, Karnataka, Maharashtra, and Tamil Nadu to 5.33 per cent in Uttarakhand, Odisha (3.58%), Himachal Pradesh (3.94 %), Kerala (2.76%), Punjab (2.68%), West Bengal (1.81%), Haryana (1.50%), Madhya Pradesh (1.66%), Rajasthan (1.32%), Uttar Pradesh (1.35%) with all India average of 1.23 per cent during 1991-2011. These results indicate that there has been a continuous increase in area under non-agricultural uses in all the states. Pandey and Seto (2015) also reported the similar results.

2.2. Declining Availability of Agricultural Land

Agriculture plays an important role in providing rural livelihood, ensuring food self-sufficiency and inclusive economic development. India is one of the most land scarce

country in the word, with average per capita availability of arable land being 0.15 ha in 2011, down from 0.22 ha in 1991. About 46 per cent of total land area (305.8 million ha) is used for crop production. In spite of a growing population and increased demand for agricultural products, the net sown area in the country has not increased during the last 3-4 decades. On contrary, net sown area has declined during the last two decades. In fact, over 3 million ha of productive arable land has been lost to other sectors in the country. There was about 1.7 per cent decline in the agricultural land over the last twenty years. In TE1991-92, total arable land in the country was 185.1 million ha, that declined to about 183.6 million ha by TE2001-02 and then to about 182 million ha in TE2011-12. While new technologies, including irrigation, high yielding varieties, better management practices, etc. have led to an increase of crop production in the country. However, in a country like India, which is already experiencing high pressure on its productive agricultural land resources, a decline in the availability of agricultural land could have serious implications for maintaining food self-sufficiency, as well as in ensuring household food security and rural livelihoods. In order to understand trends in availability of agricultural land, we have analysed the data available from Land Use Statistics for the last two decades and the results are presented in Table 4.

Figure 2: Compound Annual Growth Rates (%) in Various Land Use Classes in India during the 1990s and 2000s



Source: GoI (2014)

Table 3: Trends in Compound Annual Growth Rates (CAGR) of Area under Non-agricultural Uses in India: 1991-2011

CAGR	1990s	2000s
≥ National Average	***India (1.09),*** Karnataka (1.15), Bihar (1.62), Assam (1.77), Maharashtra (2.07), Haryana (2.16), Kerala (2.22), Odisha (2.31), Himachal Pradesh (5.03)	***India (1.08),*** Uttarakhand (4.98), Rajasthan (1.10), Madhya Pradesh (1.34), Uttar Pradesh (1.35), West Bengal (1.59), Haryana (1.60), Assam (1.70), Punjab (1.86), Kerala (2.78), Odisha (3.09)
≤ National Average	Gujarat (0.17), West Bengal (0.24), Uttar Pradesh (0.53), Rajasthan (0.64), Madhya Pradesh (0.69), Tamil Nadu (0.82), Andhra Pradesh (1.02)	Himachal Pradesh (0.06), Gujarat (0.36), Bihar (0.39), Andhra Pradesh (0.55), Maharashtra (0.63), Karnataka (0.78), Tamil Nadu (0.82), Chhattisgarh (0.82), Jharkhand (0.09)
Negative	Punjab (-1.24)	Jammu & Kashmir (-0.26)

Source: GoI (2007, 2014, and 2015c); Computed by Author.

As is evident from the Table 4, over the last 20 years, the availability of agricultural land has been declining at the rate of about 1.7 per cent per year. The data shows that between TE1991-92 and TE2011-12, the net sown area decreased by 1.26 per cent (i.e. from 142.3 million ha to 140.5 million ha) which represents an annual average decline by about 0.6 per cent. In case of total arable land, the land area declined from about 185 million ha in TE1991-92 to about 182.1 million ha in TE2011-12, a decline of about 1.7 per cent. However, total cropped area in the country witnessed an increasing trend during this period. For example, total cropped area increased from 183.4 million ha in TE1991-92 to 187.2 million ha in TE2001-02 and reached about 194.9 million ha in TE2011-12, an increase of about 5.4 per cent between 1991 and 2011. The rate of increase in total cropped area was higher (3.53%) during the 2000s compared with 1990s (2.1%) mainly due to increase in area under irrigation. The net irrigated area increased from about 48.2 million ha in TE1991-92 to about 63.6 million ha in TE2011-12, an increase of about 24.2 per cent. The gross irrigated area increased from about 63.6 million ha to 88.4 million ha during the same period. The enhanced coverage of irrigation has led to increase in cropping intensity from 128.9 per cent in early-1990s to 138 per cent in TE2011-12. It is however puzzling to note that gross irrigated area increased by over 25 million ha between TE1991-92 and TE2011-12 but total cropped area increased by only 10.4 million ha.

Table 4: Trends in Net Sown Area, Total Cropped Area, Arable Land, Net Irrigated Area and Gross Irrigated Area in India: 1991-2011

Category	*TE1991-92*	*TE2001-02*	*TE2011-12*	*Change (%) 2011-12 over 1991-92*
Net Sown Area (million ha)	142.28	141.04	140.51	-1.26
Total Cropped Area (million ha)	183.42	187.25	193.85	5.38
Arable Land (million ha)	185.13	183.63	182.06	-1.69
Net Irrigated Area (million ha)	48.20	56.56	63.60	24.2
Gross Irrigated Area (million ha)	63.58	77.92	88.41	28.1
Cropping Intensity (%)	128.9	132.8	138.0	9.1
Culturable Wastelands (million ha)	15.03	13.63	12.74	-17.96
Fallow Lands (million ha)	24.03	25.41	25.61	6.18

Source: MoA (2014); Data compilation by Authors.

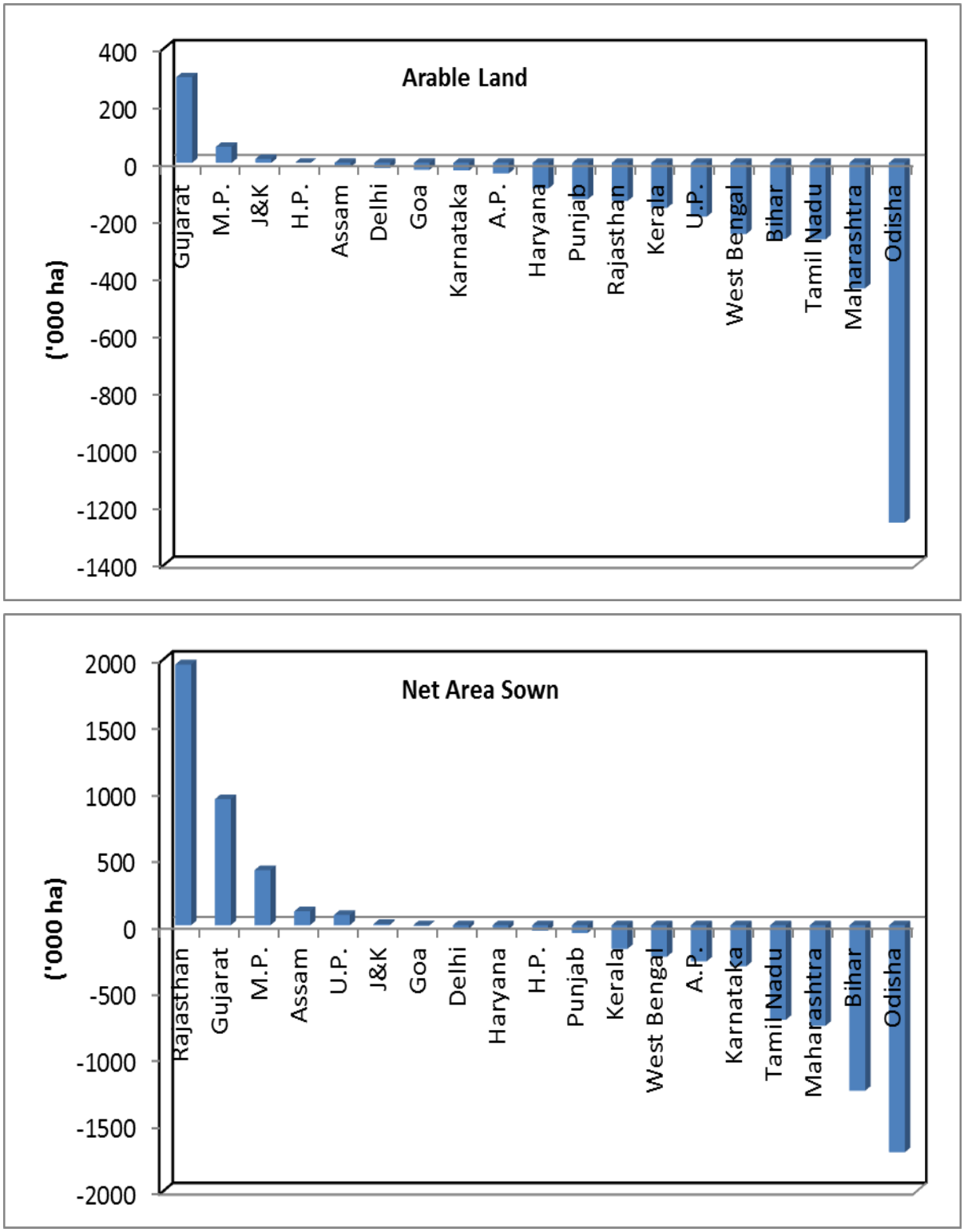
The productive agricultural lands have become degraded as a result of number of factors such as soil salinity and waterlogging, unsustainable use of land and water resources, water and wind erosion, soil pollution, etc. Degraded cultivated lands mainly due to unsustainable use have frequently been left fallow. It is evident from the Table that area under fallow land has increased from about 24 million ha in TE1991-92 to 25.6 million ha in TE2011-12. This equates to about 18 per cent of present cultivated land. On the other hand, area under culturable wastelands has declined by about 18 per cent, from about 15 million ha in TE1991-92 to 12.7 million ha in TE2011-12. It has been estimated that nearly 32.5 million ha area has been lost to water and wind erosion in the country (ICAR, 2010). As per ICAR estimates, about 114 million ha area is under degraded and wastelands in the country. In view of these emerging trends in land use pattern, improving the use and access to the land is critically important. Since scope for bringing additional land under agriculture is limited, increased agricultural productivity per unit area and reclamation of degraded lands should contribute towards increased agricultural production in the country.

The trends in agricultural land use vary among different States. The changes in net sown area and arable land were analysed for major States during the last two decades and the results are presented in Figure 3 and Table 5.

Conversion of prime agricultural land to non-agricultural uses has become a matter of serious concern in the country during the last two decade, and about 3 million ha of arable land has been lost during TE1991-92 to TE2011-12 in the country (Table 4). However, it is interesting to note that some states have been able to bring additional land under agriculture. For example, in Gujarat, total arable land increased by about 3 lakh hectares during TE1991-2011 (Figure 2). Other states which recorded an increase in arable land included Madhya Pradesh (56,000 ha), and Jammu & Kashmir (14,000 ha). On the other hand, Odisha lost about 1.2 million ha of agricultural land and Maharashtra lost about 4.37 lakh ha. Other states, which registered a decline in agricultural land (>1 lakh ha), included Tamil Nadu, Bihar, West Bengal, Kerala, Rajasthan and Punjab.

In case of net sown area, Rajasthan added nearly 2 million ha to net sown area while Gujarat increased net sown area by about 9.5 lakh ha during 1991-2011 (Figure 2). Other states which witnessed increase in net sown area during the last two decades are Madhya Pradesh (4.15 lakh ha), Nagaland (1.79 lakh ha), Manipur (1.76 lakh ha), Assam (1.05 lakh ha), Uttar Pradesh (77,000 ha), and Jammu & Kashmir (9,000 ha). All other states have lost prime agricultural land during post-reforms period. The highest loss in net sown area was recorded in Odisha (17.1 lakh ha), followed by Bihar (12.4 lakh ha), Maharashtra (7.57 lakh ha), Tamil Nadu (7.12 lakh ha), Karnataka (3.1 lakh ha), Andhra Pradesh (2.73 lakh ha) and West Bengal (2.63 lakh ha). The trends in loss of agricultural land differed during two sub-periods of 1990s and 2000s. The loss of net sown area to other uses was estimated to be about 10.44 lakh ha between TE1991-92 and TE2001-02, 5.43 lakh ha between TE2001-02 and TE2011-12 (Table 5). In total, an estimated 1.59 million ha of prime farmland was converted to non-agricultural uses during the 20-year period 1991-2011. This translates into an average annual loss of over 75,000 ha of productive land.

Figure 3: Changes in Total Arable Land and Net Sown Area in Major States in India between TE1991-92 and TE2011-12



Source: MoA (2014 and 2015c)

Disaggregated analysis at the state level shows mixed trends. Nine States witnessed a fall in net sown area ranging from about 10 thousand ha in Haryana to 5.78 lakh ha in Maharashtra during the nineties. Other states which lost croplands included Odisha (4.04 lakh ha), Karnataka (3.66 lakh ha), Bihar (3.62 lakh ha), Tamil Nadu (3.42 lakh ha) and Andhra Pradesh (3.41 lakh ha). However, some states increased net sown area, e.g. Uttar Pradesh increased net sown area by 3.49 lakh ha, Madhya Pradesh (2.81 lakh ha), Rajasthan (2.22 lakh ha), Gujarat (1.46 lakh ha), West Bengal (89,000 ha), Punjab (30,000 ha), Jammu & Kashmir (15,000 ha).

Table 5: Classification of States according to Changes in Net Sown Area between TE1991-92 and TE2011-12

Change in Net Sown Area	***Between TE1991-92 and TE2001-02***	***Between TE2001-02 and TE2011-12***
Increase in Net Sown Area ('000 ha)	U.P. (349), M.P. (281), Rajasthan (222), Gujarat (146), West Bengal (89), Punjab (30), J&K (15)	Rajasthan (1740), Gujarat (803), M.P. (348), Andhra Pradesh (68), Karnataka (56)
Decline in Net Sown Area ('000 ha)	Maharashtra (-578), Odisha (-404), Karnataka (-366), Bihar (-362), Tamil Nadu (-342), Andhra Pradesh (-341), Kerala (-30), Himachal Pradesh (-28), Haryana (-10), ***India (-1044)***	Odisha (-1304), Maharashtra (-179), Tamil Nadu (-369), Bihar (-335), West Bengal (-325), UP (-217), Kerala (-148), Punjab (-88), Haryana (-21), Himachal Pradesh (-13), J&K (-5), Jharkhand (-505), Chhattisgarh (-96), Uttarakhand (-48), ***India (-543)***

Source: MoA (2007, 2014 & 2015c); Computed by Author.

However, in the next decade, only five states, namely, Rajasthan (17.4 lakh ha), Gujarat (8.03 lakh ha), Madhya Pradesh (3.48 lakh ha), Andhra Pradesh (68,000 ha), and Karnataka (56,000 ha), witnessed an increase in net sown area while all other states lost croplands. About 17.4 lakh ha of additional net sown area was brought under cultivation in Rajasthan, followed by Gujarat (8.03 lakh ha) and Madhya Pradesh (3.48 lakh ha). All other states lost net sown area. The number of states losing net sown area increased from nine in the 1990s to 14 in 2000s. Odisha lost over 13 lakh ha of cropland to non-agricultural sector. Other states that lost more than one lakh ha of net sown area included Tamil Nadu (3.69 lakh ha), Bihar (3.35 lakh ha), West Bengal (3.25 lakh ha), Uttar Pradesh (2.17 lakh ha), Maharashtra

(1.79 lakh ha), and Kerala (1.48 lakh ha). Even states like Punjab (88,000 ha) and Haryana (21,000 ha) also lost net sown area during the last decade.

The classification of states according to changes in total arable/agricultural land is given in Table 6. It is evident from the table that all major states except Andhra Pradesh, Karnataka and few north-eastern states lost arable land during the 1990s. However, during the next decade, Gujarat was the only major state which brought over 3 lakh ha additional area under agriculture. Odisha lost substantial amount of agricultural land during both periods. These trends clearly show that agricultural land is under pressure from other sectors.

Table 6: Classification of States according to Changes in Total Agricultural Land between TE1991-92 and TE2011-12

Change in Net Sown Area	***Between TE1991-92 and TE2001-02***	***Between TE2001-02 and TE2011-12***
Increase in Net Sown Area ('000 ha)	Manipur (55.1), Madhya Pradesh (33.2), Nagaland (31.8), Karnataka (23.5), Jammu & Kashmir (3.6)	Gujarat (305), Jharkhand (47.3), Andhra Pradesh (44.0), Uttarakhand (31.8), Himachal Pradesh (14.4), Jammu & Kashmir (10.2), Goa (0.1)
Decline in Net Sown Area ('000 ha)	Odisha (-618.7), Bihar (-302.5), Tamil Nadu (-128.4), Uttar Pradesh (-85.1), Andhra Pradesh (-81), Kerala (-60.7), Rajasthan (-48.8), Punjab (-45), Maharashtra (-31.6), West Bengal (-14.4), Himachal Pradesh (-14.1), Delhi (-13.9), Haryana (-12.8), Gujarat (-6.4), Assam (-4), ***India (1413.7)***	Odisha (-635.4), Maharashtra (-405.7), Uttar Pradesh (-237.2), West Bengal (-233.3), Tamil Nadu (-138.4), Kerala (-96.2), Rajasthan (-84.4), Punjab (-81.6), Haryana (-77.1), Bihar (-53.1), Karnataka (-50.2), Chhattisgarh (-41.6), Assam (-11.3), Madhya Pradesh (-11.2), Delhi (-4.3), ***India (1457.9)***

Source: MoA (2007, 2014 & 2015c); Computed by Author.

The changes in cropping intensity vis-à-vis irrigation intensity during two time periods, TE1991-92 and TE2011-12 have also been analysed and results are presented in Table 7. West Bengal, Bihar, Gujarat and Andhra Pradesh have significantly increased the irrigation intensity during the last two decades, but have registered a negligible or no change in cropping intensity. In Kerala, although there was a positive change in irrigation intensity, the cropping intensity declined. In Odisha and Tamil Nadu, both cropping intensity and irrigation intensity witnessed a declining trend. In Karnataka, despite decline in irrigation intensity,

cropping intensity increased. In about half of the states, irrigation intensity increased at a higher pace compared with cropping intensity. These trends suggest that many states made investment in irrigation but have failed in proper utilisation of irrigated areas for crop production. Therefore, efforts are needed to improve water use efficiency through better management practices and technologies and bridge the gap between irrigational potential created and potential utilised.

Table 7: Changes in Cropping Intensity (%) and Irrigation Intensity (%) in Selected States in India: 1991-92 to 2011-

State	Cropping Intensity (TCA/NSA)		Change in Cropping Intensity	Irrigation Intensity (GIA/NIA)		Change in Irrigation Intensity
	TE1991-92	*TE2011-12*		*TE1991-92*	*TE2011-12*	
Andhra Pradesh	119.6	126.2	6.7	125.3	137.4	12.1
Assam	140.8	147.5	6.6	100.0	107.0	7.0
Bihar	134.2	134.2	0.0	127.0	152.6	25.5
Gujarat	113.2	117.9	4.6	119.6	132.6	13.0
Haryana	160.5	182.8	22.3	162.0	185.9	23.9
H.P.	168.8	176.2	7.4	173.5	177.0	3.5
J&K	146.8	155.7	8.9	143.5	150.3	6.8
Karnataka	114.0	123.1	9.0	123.0	121.2	-1.7
Kerala	134.7	128.9	-5.8	117.2	121.3	4.1
Madhya Pradesh	119.4	139.5	20.2	102.8	105.9	3.1
Maharashtra	114.4	129.7	15.3	122.1	132.5	10.4
Odisha	152.2	114.9	-37.3	123.7	117.3	-6.4
Punjab	177.5	190.1	12.5	179.2	189.8	10.6
Rajasthan	116.6	135.2	18.6	121.0	125.0	3.9
Tamil Nadu	120.4	116.0	-4.4	123.0	115.6	-7.4
Uttar Pradesh	147.1	154.1	7.0	139.6	146.1	6.5
West Bengal	159.6	179.5	19.9	130.4	176.7	46.3
India	128.8	138.0	9.2	131.9	139.0	7.1

Source: GoI (2007, 2014 & 2015c); Computed by Author.

2.3. Change of Agricultural Land Utilization Per Capita

Average agriculture land area per capita declined by about 31 per cent in the country, from 0.22 ha in TE1991-92 to 0.15 ha in TE2011-12 (Table 8). All states experienced a decline in per capita availability of agricultural land during the last two decades. However, the rate of change in loss of farmland area per capita varied from State to State. During the 1990s, agricultural land per capita declined at a rapid rate (-18.2%) compared with the last decade (16.7%). The decline in per capita availability of agricultural land was much rapid in states like Bihar, Odisha, Rajasthan, Haryana, Uttar Pradesh and West Bengal. By contrast, farmland area per capita in Southern States declined at a slower pace. It is interesting to note that rate of loss in per capita availability of agricultural land decelerated in most of the States during the last decade compared with the nineties. However, it is evident from the above analysis that there has been a substantial loss of agricultural land in most of the States except for Rajasthan and Gujarat. Almost a similar trend was observed in per capita net sown area. The per capita net sown area declined from 0.17 ha in TE1991-92 to 0.12 ha in TE2011-12.

Table 8: Per Capita Availability (ha/person) of Net Sown Area and Total Agricultural Land in Major States during TE1991-92 to TE2011-12

State	*Net Sown Area (ha/person)*			*Total Agricultural Land (ha/person)*		
	TE1991-92	*TE2001-02*	*TE2011-12*	*TE1991-92*	*TE2001-02*	*TE2011-12*
Andhra Pradesh	0.17	0.14	0.13	0.24	0.21	0.19
Assam	0.12	0.10	0.09	0.14	0.12	0.10
Bihar	0.09	0.07	0.05	0.13	0.08	0.06
Chhattisgarh	-	0.23	0.18	-	0.27	0.22
Gujarat	0.23	0.19	0.17	0.30	0.24	0.21
Haryana	0.22	0.17	0.14	0.23	0.18	0.15
Himachal Pradesh	0.11	0.09	0.08	0.16	0.13	0.12
Jammu & Kashmir	-	0.07	0.06	-	0.10	0.08
Jharkhand	-	0.06	0.03	-	0.16	0.13
Karnataka	0.24	0.19	0.17	0.29	0.24	0.21
Kerala	0.08	0.07	0.06	0.08	0.08	0.07

State	Net Sown Area (ha/person)			Total Agricultural Land (ha/person)		
	TE1991-92	TE2001-02	TE2011-12	TE1991-92	TE2001-02	TE2011-12
Madhya Pradesh	0.29	0.24	0.21	0.34	0.29	0.24
Maharashtra	0.23	0.18	0.15	0.27	0.22	0.19
Odisha	0.20	0.16	0.11	0.26	0.21	0.16
Punjab	0.21	0.17	0.15	0.21	0.18	0.15
Rajasthan	0.36	0.28	0.26	0.58	0.45	0.37
Tamil Nadu	0.10	0.09	0.07	0.15	0.13	0.11
Uttarakhand	-	0.09	0.07	-	0.18	0.15
Uttar Pradesh	0.12	0.10	0.08	0.15	0.12	0.10
West Bengal	0.08	0.07	0.06	0.09	0.07	0.06
India	***0.17***	***0.14***	***0.12***	***0.22***	***0.18***	***0.15***

Source: GoI (2007, 2014 & 2015c); Computed by Author.

2.4. Changes in Different Components of Agricultural Land

Total agricultural/arable land consists of net sown area, land under miscellaneous tree crops and groves (not included in net area sown), culturable waste land, and total fallow land (current and other fallows). Since the net sown area has declined in majority of states during the last decade, it is important to examine trends in other categories of arable land in order to explore possibility of increasing area under cultivation. The distribution of states according to changes in other components of total arable land, i.e., area under miscellaneous tree crops and groves, culturable wasteland, fallow land and permanent pastures and other grazing lands are presented in Table 9.

Permanent pastures and other grazing lands constitute an important component of rural livelihoods as these are primary source of fodder and animal grazing as well as source of fuelwood particularly in arid and semi-arid and hill states. However, pasturelands are under constant threat of conversion to other uses and encroachment. India has lost about 1.9 million ha of pastures and grazing lands during the last decade. Himachal Pradesh lost close to 10 lakh ha of pastures and grazing lands, followed by Madhya Pradesh (7.15 lakh ha), Chhattisgarh (4.44 lakh ha), Maharashtra (3.64 lakh ha) and Andhra Pradesh (1.85 lakh ha). These are the states where nomads/pastoralists constitute a sizeable proportion of farming

households. However, it is important to note that more than 10.5 million ha of additional land has been brought under tree crops and groves during the last decade. Almost all states, except Bihar and West Bengal, which recorded marginal decline in area under tree crops and groves, witnessed a significant increase in area under tree crops.

Table 9: Classification of States according to Changes in Various Components of Arable Land between TE2001-02 and TE2011-12

Change in Area	***Permanent pastures & other grazing lands***	***Land under misc. tree crops & groves (not incl. in net area sown)***
Increase ('000 ha)	Punjab (6), West Bengal (25), Kerala (33), Uttarakhand (69), Jharkhand (70), Bihar (84), Gujarat (88), Tamil Nadu (109), U.P. (138), Rajasthan (296)	Punjab (15), Assam (18), Haryana (29), Kerala (50), Odisha (76), J&K (104), U.P. (120), Tamil Nadu (168), Jharkhand (239), Uttarakhand (279), Karnataka (467), Chhattisgarh (518), A.P. (536), H.P. (572), Maharashtra (853), M.P. (1174), Gujarat (1589), Rajasthan (3426), All India (10526)
Decline ('000 ha)	H.P. (-940), M.P. (-715), Chhattisgarh (-444), Karnataka (-428), Maharashtra (-364), A.P. (-185), Odisha (-60), J&K (-18), Assam (-17), Haryana (-5), All India (-1928)	Bihar (-34), West Bengal (-6)
	Culturable waste land	**Fallow Land (Current and Other)**
Increase ('000 ha)	Punjab (6), West Bengal (7), Haryana (10), Kerala (22), J&K (22), Uttarakhand (43), Assam (109), Bihar (111), M.P. (165), Chhattisgarh (276), Jharkhand (306), Odisha (371), Karnataka (408), A.P. (485), H.P. (495), Tamil Nadu (501), Maharashtra (547), All India (2904)	Punjab (5), H.P. (12), Kerala (18), J&K (24), Uttarakhand (25), U.P. (41), A.P. (56), Chhattisgarh (56), West Bengal (138), Tamil Nadu (265), Bihar(271), Jharkhand (360), Odisha (763) All India (196)
Decline ('000 ha)	Rajasthan (-817), Gujarat (-388), U.P. (-39)	Rajasthan (-1251), Gujarat (-472), M.P. (-256), Maharashtra (-104), Karnataka (-75), Haryana (-71), Assam (-33)

Source: GoI (2007 & 2014); Computed by Author.

The share of cultivable wastelands, which can be brought under cultivation, has declined sharply over the years but is still quite large. In early-1970s, culturable wastelands constituted about 5.6 percent of reporting area, while by 2011-12, this proportion declined

to 4.2 percent. However, during the last decade, culturable wasteland has increased by about 29 lakh ha in the country. Rajasthan (8.17 lakh ha), Gujarat (3.88 lakh ha), and Uttar Pradesh (39,000 ha) are the only states in which the area under culturable wasteland has declined. The decline in culturable wastelands could be partly due to diversion of such lands to non-agricultural use, increase in area under trees and bringing culturable wastelands under cultivation. The culturable wastelands that are brought under cultivation are not very productive, have lower crop yield and may not be cultivated every year due to lack of appropriate technologies, crops, and irrigation facilities. Therefore, there is a need to bring such lands under cultivation on a sustainable basis.

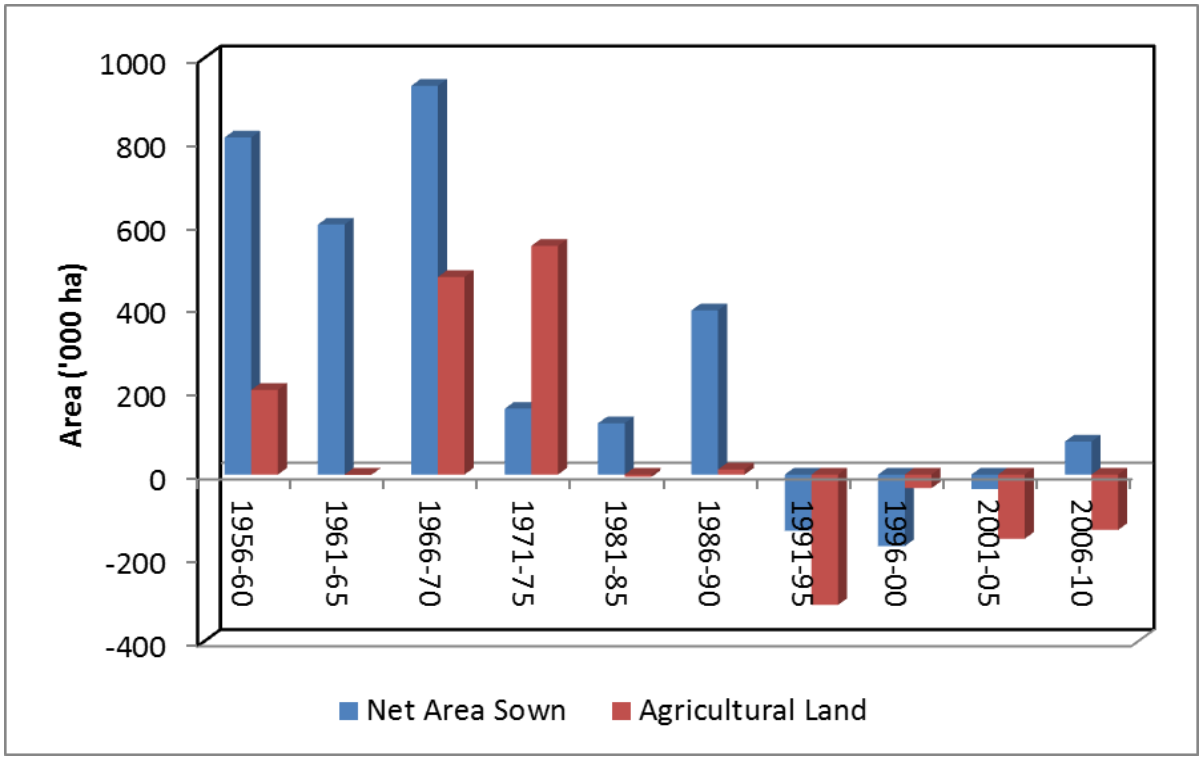
In India about 25.6 million ha of land is fallow and it has marginally increased during the last two decades. Since Indian agriculture depends on the vagaries of monsoon, the extent of fallows largely depends on rainfall. About 14 per cent of arable area is under total fallow lands, out of which about 8.2 per cent are current fallows and remaining other fallow land. The increase in fallow land in the country can be attributed to increased fallow land in states like Odisha, Jharkhand, Bihar, Tamil Nadu, West Bengal, Andhra Pradesh and Uttar Pradesh. On the other hand, the area under fallow land declined in Rajasthan (12.51 lakh ha), Gujarat (4.72 lakh ha), Madhya Pradesh (2.56 lakh ha), Maharashtra (1.04 lakh ha), Karnataka (75,000 ha), Haryana (71,000 ha), and Assam (33,000 ha). Since these fallow lands have low productivity potential, appropriates technologies and ensuring timely availability of quality inputs and services are needed to enhance the land productivity of such soils.

3. Factors Affecting Availability of Agricultural Land

Agriculture is the single largest user of land resources in India, accounting for nearly 60 per cent of total reporting area. However, since economic reforms began in early-1990s, the area under agriculture has experienced a consistent decline (Figure 4). While the pace of agricultural land conversion has marginally slowed during the last decade (arable land from about 3.13 lakh ha per year in 1991-95 to 1.33 lakh ha in 2006-10 and net sown area from about 1.72 lakh ha in 1996-00 to net addition of about 79 thousand ha in 2006-10) largely because of the introduction of land protection policies and pressure from civil society, farmers organizations and media. For example, Government of India issued the guidelines issued in June 2007 restricting the State Governments to undertake any *compulsory*

acquisition of land for setting up of the SEZs and not giving approval to any SEZs where the State Governments have carried out or propose to carry out compulsory acquisition of land for such SEZs after 5th April 2007. Similarly, the Standing Committee on the Land Acquisition (Amendment) Bill, 2007 recommended that *only waste and barren lands should be used for SEZs and under unavoidable situations use single-crop and rain-fed land and a ban on use of double or multi-crop irrigated land*. Despite all these restrictions/precautions, SEZ developers have been able to acquire more than required land, which is evident from the fact that only 62 per cent of land acquired for Special Economic Zones has been used for its intended purpose and part of that land has been de-notified to benefit from price appreciation.

Figure 4: Average Change in Net Area Sown and Total Agricultural Land in India: 1951-2010



Source: GoI (2014)

The recent Ordinance to amend the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 has led to a renewed debate on diversion of productive farm land to non-agricultural uses. It is true that more land for required for urban expansion, and related activities such as housing (both rural and urban), roads, airports, railways, industrial estates, rural infrastructure like irrigation development,

storage and warehousing, and social infrastructure such as schools, hospitals, etc. but unplanned and uncontrolled conversion of agricultural land would have serious adverse impact on food security and self-sufficiency of the country as well as livelihood of millions of farming households and agricultural labourers. Therefore, there is a need to formulate a comprehensive land policy which takes into account both the rural and urban perspectives. It is therefore important to identify important factors and drivers that influence agricultural land use.

Muth (1961) hypothesised that urbanization and agriculture compete for land and this theory continues to be the most appropriate for explaining diversion of agricultural land to non-agricultural uses. Numerous studies expressing concerns over loss of agricultural land have been published but the issue has gained significance in the country in view of the ongoing debate on land acquisition bill. In this section, we try to identify major drivers of agricultural land conversion using time series data for the period 1991-2011. According to Setiawan and Purwanto (1994) (in Firman, 1997), there are two main types of drivers, namely, internal and external. Internal drivers include location of land, land productivity, ownership pattern, farm size, household size, farm income, technology intensity, etc. The important external drivers include urbanization, industrialization, road, port, airport, railways infrastructure development, government policy, etc. Van Doorn and Bakker (2007) discussed *various processes that are driven by biophysical and socioeconomic drivers that shape landscape patterns and determine their spatial organization*. Hersperger and Burgi (2007) divided these *driving forces into five groups: cultural, natural/spatial, political, economic and technological*. Smith, et. al. (2010) made a distinction between drivers and pressures in understanding interrelated causes for competition for land. *Pressures represent direct causes such as land degradation, natural calamities and land transitions to urban uses, road building, oil and mining, etc., the visible motivations for competition for land. Drivers, underlying causes, for competition are factors of higher causal order such as socio-economic and technological factors, institutional factors and societal trends that determine the degree of the actual direct pressures*. Azadi, et. al. (2010) examined the level of *intensity, trend and drivers of agricultural land conversion* in less developed, developing and developed countries.

The ordinary least squares regression technique was used to determine the impact of factors affecting demand for agricultural land and the competition for land between agriculture and non-agriculture. A linear regression model was specified as follows:

$$Y = \alpha + \beta_1 POP_u + \beta_2 GDP_{ind} + \beta_3 Road + \beta_4 GDP_{agri} + \beta_5 IRRI + \beta_6 TECH + u$$

Where, the dependent variable, Y, is the total agricultural land available in the country ('000 ha), POP_u is urban population (million) and it is expected that process of urbanization and migration from rural to urban areas will influence the availability of land for agriculture. The country will experience conversion of agricultural land to non-agricultural uses due to rapid urbanization and with growing population. We would expect a negative association between the urban population growth and availability of land for agriculture.

GPD_{ind} is growth (%) in real GDP from industry. It is expected that high growth in industrial sector would lead to higher demand for land for industrial estates development; hence, the industrial sector would exert more pressure on agricultural land and lead to conversion of farmland to non-agricultural uses.

Road, a proxy for infrastructure, is defined as growth in road network (total road length in thousand kms). Road infrastructure development is necessary for sustained economic growth in the country. It is believed that road construction that supports industrial development as well as rural/agricultural development causes encroachment on fertile agricultural lands. Therefore, road construction contributes to loss in agricultural land.

GDP_{agri} is defined growth rate (%) in real gross domestic product from agriculture (at 2004-05 prices). Higher growth would make agriculture more profitable and lead to increase in area under crop farming and thereby reduce competition for non-agricultural uses.

IRRI (gross irrigated area as % of total cropped area) is a proxy for agricultural infrastructure. Increase in area under assured irrigation would reduce agricultural risks and improve profitability. Hence, farmers would have incentive to continue with farming occupation and less possibility of diversion of agricultural land. However, construction of irrigation infrastructure such as dams, canals and field channels would require land and may adversely affect availability of agricultural land. Therefore, irrigation can have either positive or negative impact on agricultural land availability.

TECH (number of tractors in thousand) is a proxy for technology intensity in agriculture. It is hypothesised that when farmers use new technologies mainly farm mechanization in agriculture, demand for human labour will reduce and technology would lead to surplus labour in the agricultural sector. The surplus labour will migrate to urban areas for jobs and therefore need more land for the growing urban population. Hence, more possibility of loss of agricultural land to urban uses can be expected.

The results of the multiple linear regression analysis are presented in Table 10. It is evident from the Table that R^2 of about 0.99 has strong explanatory power and this indicated that approximately 99 per cent of the variation in agricultural land use was explained by the independent variables included in the model.

The coefficient for change in urban population was negative (-12.1573) and highly significant as indicated by the t-statistic of variable in the model. This means that increase in urban population in the country reduced the availability of agricultural land and prime agricultural land was converted to urban use in the country.

The road construction that supports industrial development and links rural areas with urban centres contributes to loss of agricultural land. The coefficient of roads was of expected sign (-0.4067) and statistically significant at one per cent level of significance. The results show that increase in road network will reduce availability of agricultural land as road project demand a large amount of agricultural land.

The coefficient for growth in GDP from industrial sector was of the expected sign and was significant at a probability level of 99 per cent. These results clearly indicate that industrial development would have significant adverse effect on agricultural land and lead to loss of agricultural land. However, land is also needed for industrial development, therefore, policy directive to set up industrial estates on uncultivable wastelands, which are not suitable for agriculture, and restricting the amount of land acquired for industrial estates might reduce the competition.

Gross domestic product from agriculture has a positive impact but the coefficient was non-significant at a probability level of 90 per cent or more. The coefficient of technology was neither of expected sign nor statistically significant. The lack of significance for the variable as well as opposite sign can possibly be attributed to rather low migration of agricultural

labour and less demand for living space by most of the population which migrates from rural areas to urban areas for jobs.

The coefficient of irrigation was negative but statistically non-significant. It is well known fact that lands with better qualities and large size are more attractive for real estate development as it reduces cost of development (Firman, 1997). Therefore, more productive lands with assured water resources facilities and located near to urban areas are at higher risk of being diverted to housing and other infrastructure. In addition, agricultural land is also required for setting up irrigation projects as well as construction of irrigation network.

Table 10: Determinants of Changes in Agricultural Land in India: Summary of Analysis

	Coefficient	***Standard Error***	***t-Stat***	***Significance***	***Beta***
Constant	189103.9	724.9212	260.8613	0.0000	
POP_u	-12.1573	2.5292	-4.8069	0.0002	-0.632
Road	-0.4067	0.2107	-1.9299	0.0727	-0.288
GDP_{ind}	-56.1891	11.5778	-4.8532	0.0002	-0.159
GDP_{agri}	8.1874	6.1136	1.3392	0.2004	0.039
TECH	0.1694	0.5306	0.3193	0.7539	0.021
IRRI	-9.7046	31.5886	-0.3072	0.7629	-0.035
R^2	0.994	122.7826			
Adjusted R^2	0.989				
Observations	22				
F	215.7981				

The standardized coefficients indicate the relative importance of independent variables in the model. It is evident from the Table that urban population expansion and road infrastructure development are the highly influential variables in agricultural land loss. Other important variables included GDP from industry and GDP from agriculture while technology intensity was the least influential variable.

4. Socio-Political and Policy Challenges in Land Use Planning and Management

The possibilities for expansion of agricultural land are very limited, therefore, improving the use and efficiency of the existing land resources is critically important. Land use planning problems are generally attributed to socio-political, economic, policy and institutional factors, which are further aggravated by population growth and rapid urbanization. Therefore, understanding the socio-political, economic and policy issues that affect land use pattern in the country is essential for designing sustainable land use policies. In this section we discuss important challenges facing land use planning and management in India.

1.1. Need for Protection of Agricultural Land for Food and Feed

According to The State of Food and Agriculture 2014, demand for food is growing while land and water resources are becoming more scarce and degraded. Climate change will make these challenges more difficult. Therefore, farmers need to produce significantly larger amounts of food over the coming decades, mostly on land already in production. The need to protect and preserve agricultural land for the sustainable development of agriculture is receiving an increasing attention from all stakeholders in India because of on-going debate about the Land Acquisition Bill in the country. It is also true that we need more land for housing, transport infrastructure, and various other purposes. The problem of agricultural land conversion, which is almost unavoidable during the process of urbanization, rising population and economic development, does require serious attention. But is scarcity of agricultural land a problem? Can agriculture and industrial development and urban expansion co-exist? We try to answer these questions in this section.

Scarcity of Agricultural Land: Is it a Problem?

Scarcity of agricultural land does not appear to be a serious problem if land resources are planned and managed properly. For example, about 77 per cent of total available agricultural land has been brought under cultivation in the country and it varies among states (Table 11). Disaggregated analysis at state level shows that in some states like Punjab (98.4%), Haryana (95.2%), Kerala (97%), West Bengal (90.5%), there is no further scope for increasing area under cultivation, while in other states like Andhra Pradesh (67.9%), Tamil

Nadu (60.8%), Odisha (67.5%), Rajasthan (69.6%), some North-eastern and Himalayan states, there is still a scope for bringing more arable land under cultivation.

Table 11: State-wise Sectoral Land Use Dynamics in India: TE2011-12

('000 ha)

State	Barren & Unculturable Land		Culturable Wastelands		Total Fallow		NSA % of Arable Land
	Total	*Change*	*Total*	*Change*	*Total*	*Change*	
Andhra Pradesh	2031	-66	629	-108	4179	56	67.9
Arunachal Pradesh	38	10	64	29	109	34	50.3
Assam	1408	-47	77	0	129	-33	87.5
Bihar	432	-5	45	-1	975	271	80.8
Chhattisgarh	302	-39	353	19	530	56	84.1
Goa	0	0	53	-3	13	13	66.7
Gujarat	2552	-48	1960	-25	395	-472	81.4
Haryana	104	5	28	4	137	-71	95.2
Himachal Pradesh	783	-40	128	7	82	12	65.9
Jammu & Kashmir	288	-3	140	0	119	24	69.6
Jharkhand	569	5	336	2	2719	360	26.6
Karnataka	787	-6	414	-14	1874	-75	80.0
Kerala	20	-10	95	35	128	18	90.1
Madhya Pradesh	1339	-34	1100	-109	1062	-256	87.4
Maharashtra	1729	185	919	-40	2559	-104	82.4
Manipur	1	0	1	0	0	0	97.9
Meghalaya	132	-4	392	-100	214	-13	27.0
Mizoram	8	-4	7	2	247	43	28.0
Nagaland	2	2	54	-9	154	-12	54.3
Odisha	1057	289	514	105	1498	763	67.5
Punjab	30	-22	23	10	41	5	98.4
Rajasthan	2353	-203	4292	-583	3465	-1251	69.6
Sikkim	0	-54	3	1	9	-8	79.0
Tamil Nadu	489	13	329	-34	2605	265	60.8
Uttarakhand	225	-85	310	-76	127	25	46.8

State	Barren & Unculturable Land		Culturable Wastelands		Total Fallow		NSA % of Arable Land
	Total	*Change*	*Total*	*Change*	*Total*	*Change*	
Uttar Pradesh	479	-127	426	-101	1742	73	86.8
West Bengal	18	-9	30	-9	454	138	90.5
All India	***17195***	***-283***	***12744***	***-887***	***25610***	***196***	***77.2***

Source: GoI (2014); Change is defined as change in area between TE2011-12 and TE2011-02.

Currently there are about 25.6 million ha fallow lands in the country, as a result of various factors such as less fertile soils, lack of irrigation facilities, problem of soil salinity, waterlogging, shifting cultivation system, or for some other reasons. More than 80 per cent of total fallow land is in Andhra Pradesh, Rajasthan, Jharkhand, Tamil Nadu, Maharashtra, Karnataka, and Uttar Pradesh. The existing fallow lands could be used for farming, if appropriate technologies, infrastructure and institutional arrangements are put in place. During the last decade, some states like Rajasthan (12.51 lakh ha), Gujarat (4.72 lakh ha), Madhya Pradesh (2.56 lakh ha) and Maharashtra (1.04 lakh ha) have been able to reduce area under fallow lands and thereby increase net sown area in the state. However, low productivity on such land is an issue and needs to be addressed.

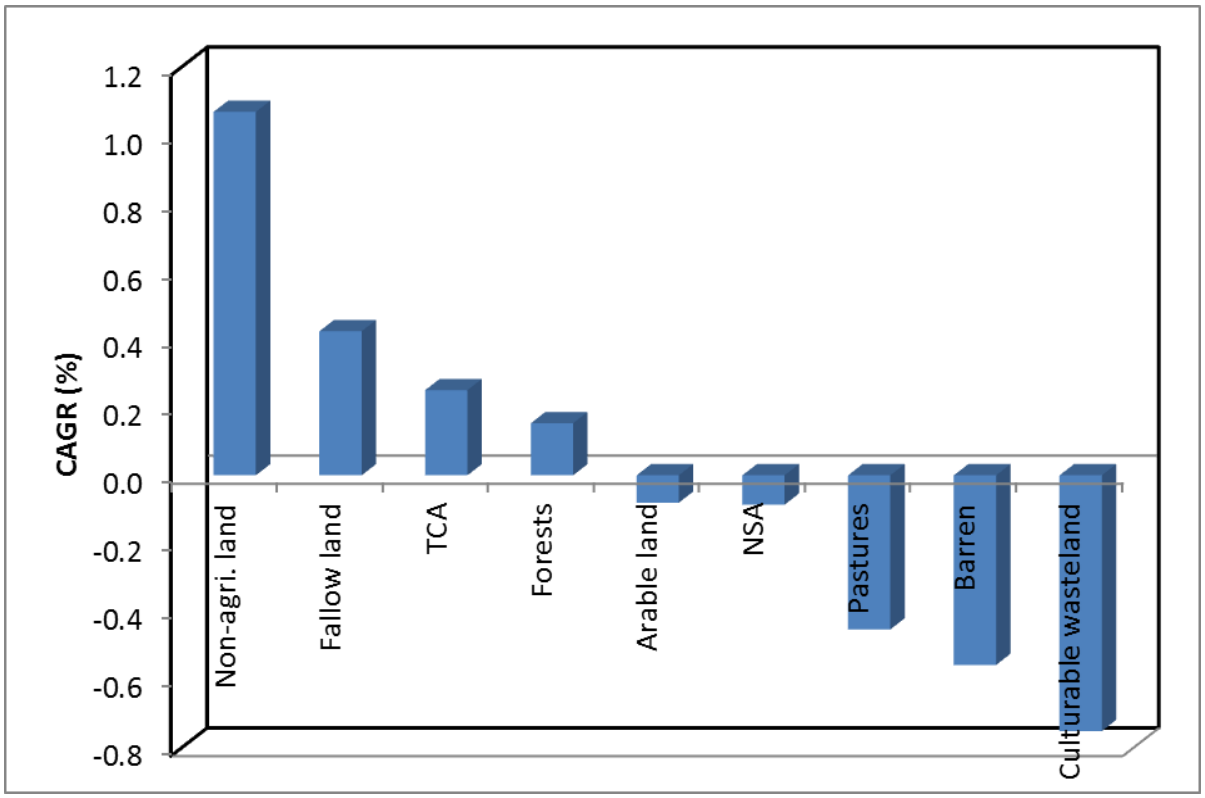
Although culturable wastelands, which are available for cultivation but not cultivated, have declined significantly over the time (from about 15 million ha in early-1990s to 12.74 million ha in TE2011-12), but still account for nearly 7 per cent of total arable land, indicating that nearly 4-5 per cent of the land in the country is not being put to productive use. Therefore, efforts should be made to bring these culturable wastelands under agriculture. Rajasthan has been able to reduce culturable wastelands by more than 5.8 lakh ha during the last decade. Other states, which have been able to reduce culturable wastelands and bring them under cultivation, are Andhra Pradesh, Madhya Pradesh and Uttar Pradesh. The above trends clearly show that an additional area of about 38 million ha can be brought under cultivation or put to use for other productive purposes.

1.2. Competition between Agriculture and Non-agricultural Uses

Currently land occupied by urban and rural settlements, industrial estates, infrastructure such as roads and railways, rivers, canals and any other uses other than agriculture occupy

an estimated 26.3 million ha or nearly 10 per cent of the total land available in the country but has recorded the highest growth rate in area expansion among all categories of land in the country during last two decades (Figure 5). The land required for urban expansion, infrastructure, industry and other non-agricultural purposes is expected to increase in future. Population growth, urbanization and expansion of industry and infrastructure will adversely affect availability of agricultural land in general and near urban areas in particular, if appropriate land use policies are not formulated and implemented.

Figure 5: Compound Annual Growth Rates (%) in Major Land Use Classes in India (1991-92 to 2011-12)



Source: Computed from GoI (2014 & 2015c)

Barren and unculturable land, which account for more than five percent of total available land in the country, is generally unsuitable for agriculture and allied activities and could be used for non-agricultural purposes. However, in order to develop these lands for industrial development or other uses, government should create basic infrastructure like road, railways, electricity, water, etc. If additional land is needed for non-agricultural uses, culturable wastelands or fallow land should be used and productive agricultural land should not be acquired except for rural infrastructure such as rural roads, irrigation projects, etc. In

addition, a real assessment about land requirement must be done before acquiring land for non-agricultural purposes.

The above results clearly show that agriculture and industrial/infrastructure development can co-exist, if appropriate land use policies are in place. Restricting the industrial development to unculturalable wastelands would reduce competition between agriculture and non-agriculture sector. Agriculture land should be acquired only for rural and social infrastructure which is needed for rural development and poverty alleviation.

1.3. Fragmentation of Farms and Shrinking Farm Size

Several studies indicate that small farms face various problems in both input and output markets as institutions/organizations providing inputs and services as well as output markets are not scale neutral. The problem is further compounded by fragmentation of farms. Farm fragmentation is a common phenomenon in the country. Increase in population and the system of inheritance of land, not only reduce the size of holdings, but are increasingly fragmented into small plots. Although the number of parcels per household has declined over period but is still high in some states. There are significant regional variations in the incidence of fragmentation. Table 12 shows the fragmentation situation for farm operational holdings for small and large and for all holdings in India in 2006-07. It is evident from the Table that the number of parcels and area per parcel increases with the size of holding in all the states. The average number of parcels is 2.22 per holding and varied from 1.64 on marginal farms to 5.61 on large farms. The problem of land fragmentation is more serious in those states where land consolidation has not been undertaken. For example, in states like Punjab, Haryana, Uttar Pradesh, Gujarat, Tamil Nadu Himachal Pradesh, and Kerala, where land consolidation was achieved through state programmes, the number of parcels per household is significantly lower than other states.

The small size and fragmentation of land holding raises considerable concerns about their economic viability and has led to an intense public debate regarding the impacts of fragmentation (Lerman and Climpoies, 2006). There is a need to increase effective farm size either through land consolidation or appropriate land tenancy reforms. The land tenancy can be used as an effective tool for consolidation, which benefits both lessees through increased farm incomes and lessors through income from rent payments for their land.

Table 12: Land Fragmentation in India: Number of Parcels per Operational holding and Average Size of Parcel (ha) on Different Size Class of Holdings

State	*<1 ha*		*>10 ha*		*All Size Classes*	
	No of Parcels	*Area per Parcel*	*No of Parcels*	*Area per Parcel*	*No of Parcels*	*Area per Parcel*
Andhra Pradesh	1.52	0.31	5.37	2.50	1.95	0.62
Assam	2.46	0.19	2.69	4.90	2.88	0.35
Chhattisgarh	2.15	0.21	15.63	1.02	4.09	0.37
Gujarat	1.03	0.55	2.60	5.33	1.25	1.78
Haryana	1.14	0.49	2.05	6.23	1.36	1.56
Himachal Pradesh	3.01	0.14	15.41	1.00	4.62	0.22
Jammu & Kashmir	2.58	0.14	14.18	2.88	3.24	0.21
Karnataka	1.65	0.30	3.69	3.69	1.90	0.86
Kerala	1.15	0.13	2.02	7.75	1.20	0.18
Madhya Pradesh	1.74	0.29	10.21	1.59	3.17	0.64
Manipur	1.04	0.50	1.93	10.29	1.12	0.99
Meghalaya	1.01	0.47	1.04	13.69	1.04	1.08
Mizoram	1.03	0.60	2.00	6.56	1.09	1.08
Nagaland	1.40	0.37	2.79	6.41	2.23	3.01
Odisha	1.87	0.27	4.57	2.95	2.36	0.48
Punjab	1.06	0.64	1.90	7.83	1.28	3.06
Rajasthan	1.86	0.29	5.28	3.19	3.50	0.95
Sikkim	1.00	0.46	1.00	13.91	1.01	1.50
Tamil Nadu	1.45	0.27	4.64	3.02	1.70	0.49
Uttarakhand	3.11	0.14	20.23	0.72	4.42	0.21
Uttar Pradesh	1.35	0.30	9.02	1.42	1.68	0.48
West Bengal	2.58	0.20	5.01	2.71	3.16	0.24
All India	1.64	0.26	5.61	2.78	2.22	0.59

Source: Computed from GoI (2012)

The inverse relationship between farm size and productivity has been intensely discussed and a large number of authors provided evidence (Sen, 1964; Mazumdar 1965; Khusro, 1968; Hanumantha Rao 1966; Saini 1971; Bardhan 1973; Berry, 1972, Chand, *et. al.*, 2011). However, very small farm size (<0.8 ha) does not generate enough income to keep a farm family out of poverty despite high productivity (Chand, *et. al.* 2011). Therefore, there is a need to increase effective farm size and deregulation of land-lease markets can play an important role in increasing farm size. The outright ban on tenancy (leasing) as in Uttar Pradesh, Odisha Madhya Pradesh, Bihar, Karnataka, and few other states (albeit with certain exceptions), has particularly perverse effects and leads to concealed tenancy arrangements. Therefore, there is a need to have a re-look at such policies.

5. Concluding Observations and Policy Implications

As discussed in the paper, diversion of agricultural land is almost unavoidable phenomenon because of growing population, urbanization, industrialization and infrastructure development. However, unplanned and unrestricted diversion of agricultural land for non-agricultural purposes has significant adverse impact on agricultural production and therefore a threat to food security and livelihoods.

The study showed that loss of prime agricultural land to non-agricultural uses is intensifying in the country but varied across different states. The area under non-agricultural uses increased by about 23 per cent (21.3 million ha to 26.3 million ha) during the last two decades. While states like Uttar Pradesh, Andhra Pradesh, Odisha, Madhya Pradesh, Bihar and Tamil Nadu showed the higher rate of increase, Gujarat, and some North-Eastern States showed the lower rate of increase in land under non-agricultural uses during the last two decades. However, the trend for almost all states is increasing.

Underutilization of agricultural land as indicated by share of net sown area in total arable land is an issue and concentrated in Andhra Pradesh, Odisha, Rajasthan, Tamil Nadu, the hilly states and states having a large number of tribal areas. The low utilization of arable land in most of these states is primarily due to lack of irrigation facilities. The high utilization of agricultural land as expected is concentrated in states like Punjab, Haryana, Uttar Pradesh, and West Bengal, which have good irrigation facilities and other infrastructure.

Another pattern that was consistent across majority of states is the loss of net sown area and total arable land. From TE1991-92 to TE2011-12, about 1.8 million hectares of net area sown and over 3 million ha of total arable land were lost to other sectors. These trends throw up some interesting insights. At All India level, it appears that reclamation and development of culturable wastelands is adding to net sown area but increase in fallow land and non-agricultural uses is offsetting the efforts of reclamation and development of culturable wastelands. Rajasthan, Gujarat, Madhya Pradesh and few north-eastern states have been successful in bringing more area under cultivation during the last two decades. While Odisha, Bihar, Maharashtra, Tamil Nadu, Karnataka, Andhra Pradesh and West Bengal lost substantial amount of agricultural land to other sectors during this period. These evidences suggest that the trend will continue in future if there is no intervention/restriction from the government. However, fallow lands and culturable wastelands, which are potentially cultivable but not cultivated, are under-utilised. Hence efforts should be made to bring these lands under farming with proper safety nets as farming in these areas is highly risky.

Multiple regression analysis results showed that urbanization, industrialisation and rapid increase in road development in the country are the main factors influencing conversion of prime agricultural land. Therefore, proper planning and management of land resources and appropriate policy framework is required to check conversion of agricultural land. Managing urbanization process and industrial expansion in a desired way that protects productive agricultural land and uses barren and unculturable wastelands (about 17.2 million ha) is very critical to country's prosperity and sustainability. Therefore, restrictions on converting agricultural land to non-agricultural uses and proper planning and effective implementation of land use management policies are needed. The problem of small and fragmented farms underlines the need for revisiting tenancy laws so as to increase the effective farm size to make it viable. The legal framework must be accompanied by appropriate economic, institutional and incentive systems to encourage farmers to remain in farming and also improve their incomes. Strategic planning that avoids land use conflict by identifying areas for non-agricultural activities such as urban and industrial expansion and protecting fertile agricultural lands is necessary to address land use conflicts and co-existence of agriculture and other non-agricultural activities.

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Annexure I[5]

i. ***Area under Non-agricultural Uses:*** This includes all land occupied by buildings, roads and railways or under water, e.g. rivers and canals, and other land put to uses other than agriculture.

ii. ***Barren and Un-culturable Land:*** This includes all land covered by mountains, deserts, etc. Land, which cannot be brought under cultivation except at an exorbitant cost is classified as unculturable whether such land is in isolated blocks or within cultivated holdings.

iii. ***Permanent Pasture and other Grazing Land:*** This includes all grazing land whether it is permanent pasture/meadows or not. Village common grazing land is included under this category.

iv. ***Land under Miscellaneous Tree Crops, etc.:*** This includes all cultivable land, which is not included in 'Net area sown' but is put to some agricultural use. Land under casuarina trees, thatching grasses, bamboo bushes and other groves for fuel, etc. which are not included under 'Orchards' are classified under this category.

v. ***Culturable Waste Land:*** This includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during the last five years or more in succession including the current year for some reason or the other. Such land may be either fallow or covered with shrubs and jungles, which are not put to any use. They may be accessible or inaccessible and may lie in isolated blocks or within cultivated holdings.

vi. ***Fallow Lands other than Current Fallows:*** This includes all land, which was taken up for cultivation but is temporarily out of cultivation for a period of not less than one year and not more than five years.

vii. ***Current Fallows:*** This represents cropped area, which is kept fallow during the current year.

viii. ***Net Area Sown:*** This represents the total area sown with crops and orchards.

ix. ***Gross Cropped Area:*** This represents the total area sown once and/or more than once in a particular year, i.e. the area is counted as many times as there are sowings in a year. This total area is also known as total cropped area or total area sown.

x. ***Area Sown more than once:*** This represents the areas on which crops are cultivated more than once during the agricultural year. This is obtained by deducting Net Area Sown from Gross Cropped Area.

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[5] *Reproduced from Land Use Statistics at a Glance 2003-2004 to 2012-2013, Directorate of Economics & Statistics, Department of Agriculture & Cooperation, Ministry of Agriculture, Government of India, New Delhi, May 2015, pp. iii-iv.*

xi. ***Cropping Intensity:*** It is the ratio of Total Cropped Area to Net Area Sown.

xii. ***Agricultural Land/Total Culturable Land /Total Cultivable Area/Total Arable land***: This consists of net area sown, current fallows, fallow lands other than current fallows, culturable waste land and land under miscellaneous tree crops.

xiii. ***Total Un-Cultivable Area/Land:*** It is the area arrived at by deducting the total cultivable area from the total reported area.