

### Trends in land use and crop acreages in Karnataka and their repercussions

Agriculture in India is going through a systemic crisis as evidenced by the sector's sluggish growth rate and the seemingly long phase of farmers' distress. Fingers have been pointed in every direction while concrete reasoning for agricultural distress seems to be lacking. Hence, other than indebtedness and socio-economic stress which are cited as proximate reasons behind farmers' suicides, we are not exactly sure about what drives these reasons. In this context, one poorly understood area in Indian agriculture is the impact of the structural change in agricultural land use on the long term socio-economic-ecological viability of agriculture. We believe that the trend analysis of land use and crop acreage changes provides one of the missing linkages between agricultural policies and their field level impacts on agriculture. This premise is based on the facts that a. any policy related to agriculture if effective, brings changes in productive use of agricultural and related land use categories and b. Ecological, economic and social problems in agriculture at the field level are strongly linked to the current crop acreage or the changes associated with it. In this background, the objective of this article is to analyse district level trends in land use and crop acreages over a period of four decades in order to help strengthen the linkage between various land use changes and sustainability in production landscapes. The result of this analysis indicates a diverse set of changes in land use and crop acreages across the districts of Karnataka. These changes have become much more volatile in the last decade. These observations call for a micro level understanding of the drivers of such developments in order to initiate policy changes to address issues affecting agricultural growth.

We use the case of Karnataka as exemplifying the story of agriculture and economic growth in India. We carried out trend analysis of changes in land use and crop acreages in Karnataka for over four decades first at the state level and then at the district level. Then, this analysis was split into three phases: 1966 - 1976 (the green revolution period), 1976-1991 (the post-green revolution period) and 1991 - 2003 (the liberalization period). Changes in land use in Karnataka described below thus present major changes at the state and district level, with a focus on agriculture for four time periods: for the entire period of 1966 to 2003, for green revolution era, the post green revolution period and then for the liberalization phase. Data for this analysis was collected from various publications of the Directorate of Economics and Statistics, Government of Karnataka, and the Department of Agriculture, Karnataka State.

*Change in land use in Karnataka during the four decades:* The results of the state level analysis suggest structural changes in land use in distinctive phases and changes in crop

acreages of the state. Among the land use categories we observe certain important trends. These changes are presented in Figure 1.

Permanent pasture lands decreased consistently and area under non-agricultural uses increased consistently in all the three phases. Current fallows which showed a slightly increasing trend over the first two phases demonstrates a pronounced increasing trend during the liberalization period. Snapshots of three yearly averages of the land use categories showing major variations presented in Table 1 confirm these trends. However interpretation of this data is difficult due to many factors like illegal encroachments and conversion of land use.

In future the demand for land for non-agriculture purposes is going to increase. Area used for non-agriculture purposes mainly includes land under urban areas, land used for infrastructure projects, dams and irrigation systems, industries and special economic zones, mines and quarries and dams and irrigation systems. The district wise estimate shows that districts like Shimoga and Bellary need minimum of 0.1% of total geographical land and districts like Tumkur, Mandya, Chamrajnagar and Hassan require close to 1% of the total geographical land for the urban expansion at 2025. Similarly for industrial expansion, for future land requirement ranges from 0.02% in Shimoga till 0.1% in Kolar and Chitradurga. The Perspective Land Use Plan for Karnataka - 2025, published by the State Land Use Board, GOK in 2001 presents the projected land use plan under various land use categories for Karnataka up to the year 2025. It lists the current area and projected demand for non-agriculture purposes in Karnataka. Table 2 presents the summary of land use plan for these categories.

It is already felt that these estimates are lower bound as they do not include the SEZs proposed, urban infrastructure projects, and airports etc which need the land converted from agriculture. Even these estimates project that more than 220000 hectares of land has to be found for non-agriculture purposes.

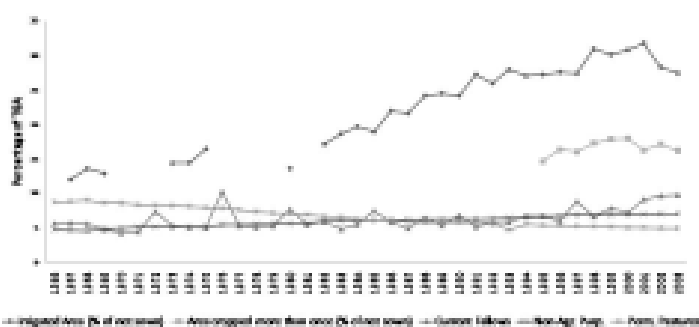


Fig 1. Notable changes in Karnataka land use

Table 1. Area under various land use categories

Land use category	1966-68	1976-78	1986-88	1996-98	2001-03
Non-Agr. Purp.	876.33	1036.47	1172.37	1288.60	1330.95
Perm. Pastures	1675.57	1449.53	1131.57	1003.18	951.75
Current Fallows	1065.53	1305.73	1090.33	1358.64	1804.73
Net Sown Area	10067.23	9939.87	10621.50	10401.23	9907.74
Gross Irrigated Area	1297.32	-	2383.33	2970.22	2950.57

Area in '000 hectares

Table 2. Current and estimated demand of land for non-agricultural purposes

Category	2001	2025
Towns	427	567
Mining	65	68
Industries	18	39
Roads	88	132
Railways <sup>1</sup>	16	16
Power	81	93
Irrigation (submerged)	195	195
Total	890	1110

Figures in '000 ha

Estimated projections for railways and irrigation not available.

Hence, it is obvious that some part of it has to come from the agricultural land as forest lands are rarely liable for conversion and most of the common lands are already encroached.

Within the agricultural land use in the state, net sown area shows an increasing trend in the first two periods while it consistently decreased in the third period. Area irrigated shows a rising trend in the first two periods and shows a more volatile increase in the third period. At present, area irrigated varies between 25% to 30% of the net sown area. Together with total area irrigated, total area sown more than once has increased (although to a lesser extent) and now varies between 14% to 16% of the net sown area.

*Changes in crop acreages:*The overall trends in area allotted for various crops in the four decades show that acreage for Oilseeds followed by Cotton have been the most volatile. Other commercial crops like Maize, Sugarcane and Coconut show a consistently upward trend. Acreages of millet crops like Jowar and Bajra decline consistently. Acreages of Paddy and Ragi show marginal variations. These changes are presented in figures 2 and 3.

Period-wise trends among agricultural crops show that, the green revolution period saw marginal, but stable variation in acreage of land allocated to most of the crops other than Jowar which showed a steady decline. In the post green revolution period, area allotted to different crops begins to show marked changes. Jowar acreage shows increase whereas Cotton acreage reduces drastically and recovers marginally after 1986. Oilseeds, including Groundnut and Sunflower begin to show large increases in their acreage.

Table 3. Acreage under various crops

Crops	1966-68	1976-78	1986-88	1996-98	2001-03
Jowar	2638.33	1935.33	2403.67	1915.33	1741.00
Pulses	1316.00	1451.00	1685.67	1759.67	1931.00
Paddy	1144.33	1058.33	1150.33	1380.00	1185.00
Ragi	1046.67	1070.67	1147.00	1001.67	883.33
Bajra	524.33	699.67	464.00	329.33	276.67
Groundnut	940.33	870.33	1123.67	1185.00	849.50
Sunflower	-	-	712.58	881.00	865.46
Cotton	956.00	993.33	514.67	599.33	445.67
Maize	37.33	138.67	229.00	506.00	581.67
Sugarcane	96.33	152.00	207.67	310.00	369.67
Coconut	110.30	157.73	213.62	301.14	375.00

Area in thousand hectares

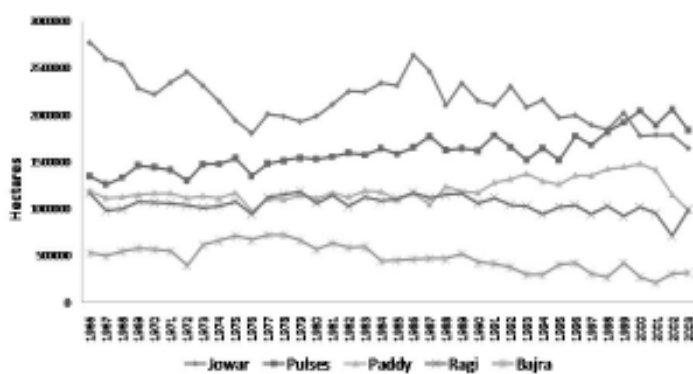


Fig 2. Acreage of cereals and pulses

In the liberalization period, crop variations show a very volatile trend. Even the acreages of crops like Paddy and Ragi that were comparatively stable begin to show variations. Table 3 presents three year average acreages of crops showing significant variations for different years.

The state level changes in land use categories and crop patterns above described revealed a complex set of variations distinctly visible in the three phases in the timeline. For the last 15 years, rainfall pattern (Figure 4) for selected districts does not show much variation. As per some reports by Department of Agriculture, it has been observed that the pests attack in some of the crops is a recently added risk factor in agriculture system. Crops like cotton, paddy, oilseeds and pulses are the

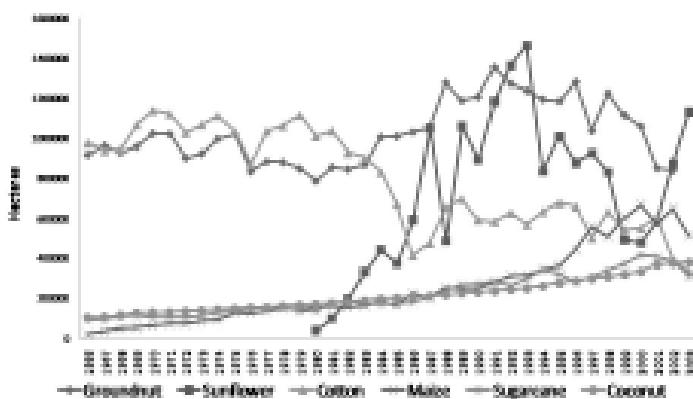


Fig 3. Acreage of commercial crops

*Trends in land use an.....*

most vulnerable to pest attacks.

Hence, these variations suggest that a variety of pressures less understood are acting on the diverse system of agricultural practices spread across 10 agro-ecological zones in Karnataka. As seen in the case of acreage of a few food as well as commercial crops, a trend is being observed in minimum support price of food crops as well. Figure 5 represents this fluctuation in price for the last 2.5 decades for food and commercial crops. Cotton, Ground nut and Sunflower show a different trend from others.

To better understand the major state-level variations in land use and crop acreages explained above, we analyzed land use patterns in Karnataka from 1980 - 2004 at the district level. In the following sections, we summarize district-level trends in the land use categories of permanent pasture lands, land under non-agricultural purposes, current fallows and area cropped more than once. Major trends analyzed in the district-level cropping patterns include the decline of Jowar acreage, the increase in area under Pulses and Oilseeds, the increase in area under other commercial crops like Maize, Sugarcane, Cotton and Coconut.

Districts showing major changes in land use and cropping patterns

Shimoga, Kolar, Mysore, Tumkur, Chitradurga and Chickmagalur account for 65% of the permanent pasture lands in Karnataka. Land under permanent pastures in all of these districts show a steady declining trend over the three phases. This reduction in area under permanent pastures account to more than 3.5% of the Total Geographical Area (TGA) of Karnataka. Bangalore, Dakshina Kannada, Dharwad, Gulbarga, Hassan and Mandya show consistent increase in area under non-agricultural purposes over the all the three periods.

As mentioned in the earlier section, current fallows shows consistent increases during the first two phases and rapidly increasing trend in the liberalization period. This trend is decidedly visible in the districts of Belgaum, Bijapur, Mandya, Kolar and Koppal. Raichur and Chitradurga show increasing trends in the green revolution and post green revolution periods. However, Hassan, Tumkur and Shimoga show decreasing trends in current fallows over all the three periods.

Area cropped more than once in the districts of Belgaum, Bijapur, Dharwad, Gadag, Mysore and Hassan show increasing

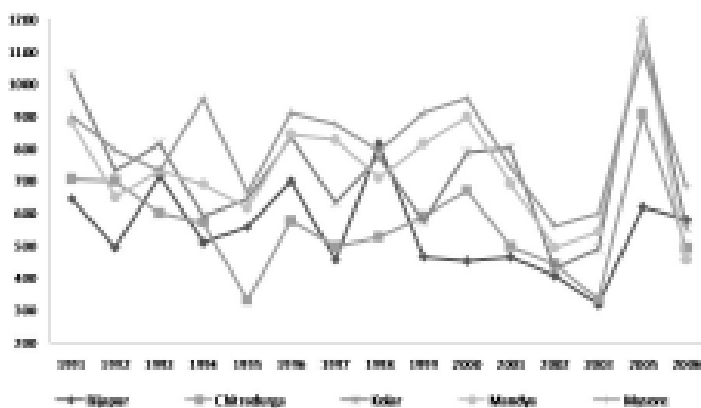


Fig 4. Rainfall pattern for few selected districts

trends in during the liberalization phase whereas Chickmagalur shows a decreasing trend in the same period. Other districts display uneven Trends.

North Karnataka districts like Bidar, Gulbarga, Bijapur, Belgaum, Dharwad, Bellary and Raichur showed increasing trends in Jowar acreage during the post-green revolution period. However, Jowar acreage in these districts begins to decline in the period between 1986 to 1988, and during the liberalization period, except for Bijapur, this reduction has been more pronounced.

Gulbarga shares the bulk of land allotted to Pulses in Karnataka. Gulbarga and Bidar account for more than two thirds of the total land allotted for Tur in Karnataka. While Bidar shows a gradual and stable increase in area allotted to Pulses over the post-green revolution and liberalization phases, Gulbarga shows a drastic increase during the liberalization phase. However, Bijapur, Bellary, Belgaum, Dharwad and Raichur show declining trends in Tur. In the liberalization period, most of these districts show an inconsistent pattern. Districts in South and Western Karnataka which had small portions of land allotted to Pulses also show a decreasing trend.

Acreage of Oilseeds like Groundnut and Sunflower showed both increasing and unstable trends at the state level. Districts like Tumkur, Chitradurga, Dharwad, Kolar, Raichur and Gulbarga showed increased acreage for Groundnut during the post-green revolution period but have shown an unstable decline in the liberalization period. Traditionally, major Sunflower growing districts in Karnataka are Bijapur, Bellary, Gulbarga and Raichur. These districts, including the districts of Dharwad and Chitradurga show gradual increases in Sunflower acreage in the post green revolution period. The acreage of Sunflower in individual districts peak between the periods of 1987 - 1993. In the liberalization period, the major Sunflower growing districts show a decline in the 1990s but begin to recover in the 2000s. The trend in their acreage in the liberalization period remains unstable. In summary, major Oilseed growing districts show similar profiles of increasing acreage allotment in the post-green revolution period, sudden drops after 1993 followed by gradual recovery in the 2000s.

Maize is another important commercial crop in Karnataka. Its adoption became widespread during the green revolution period and its acreage has increased from then on. Now, Karnataka is the leading producer of Maize in India. The districts of Chitradurga, Davanagere, Shimoga, Bellary, Belgaum and Haveri show a slow but stable increase in land under Maize consistently in the first two phases. However, during the third phase, except for Belgaum, Maize acreage shows a rapidly increasing trend in other districts mentioned above.

Belgaum accounts for more than 30% of the total land allotted to Sugarcane in Karnataka. Other major districts growing Sugarcane include Bagalkote, Mandya, Bijapur and Bidar. The trend in Sugarcane area in Belgaum and Bagalkote suggests an accelerated growth in area allotted to it during the liberalization period.

Dharwad, Bijapur, Haveri, Belgaum, Bellary, Gulbarga, Raichur and Mysore are important Cotton growing districts in Karnataka. Cotton acreage reduced rapidly in Bijapur, Gulbarga

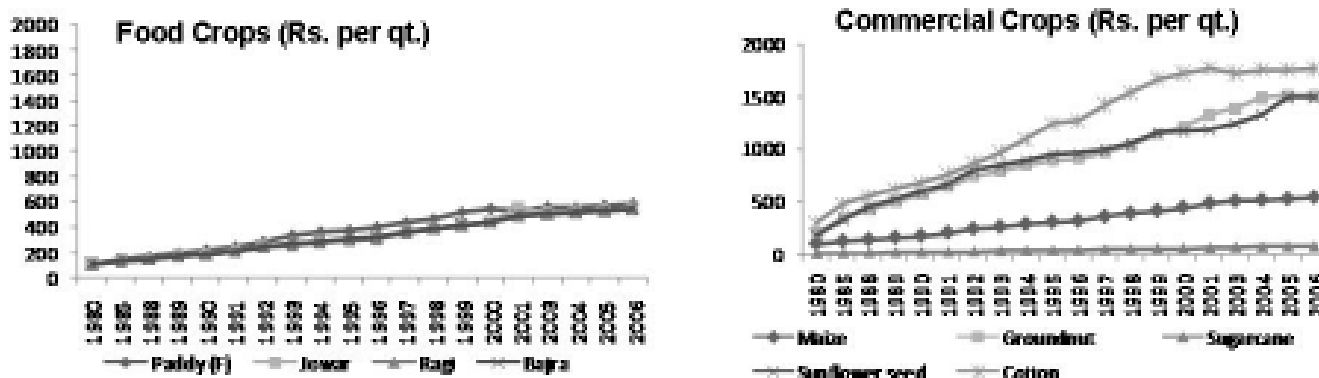


Fig 5. Variation in the minimum support price

and Raichur during the post green revolution period and has stayed at the lower acreage level in the liberalization period. However, Mysore and Shimoga show slight increases in both the phases.

Tumkur, Hassan, Chickmagalur and Chitradurga account for the bulk of land under Coconut. Most other South Karnataka districts including the coastal district of Dakshina Kannada show gradual increase in acreage under Coconut. However, the increase Coconut area in Tumkur during the liberalization period is much more in magnitude as well as rate of growth.

The above analysis shows the major land use changes and cropping pattern variations that have occurred in Karnataka over the past four decades, divided into green revolution, post revolution and liberalization periods. It also provides district level view of trends in different land use categories and cropping patterns of major agricultural crops. A diverse set of district level trends have contributed to the variations in land use visible at the state-level. Also, many of these variations overlap in districts like Belgaum, Bijapur, Dharwad and Gulbarga in the north, Chitradurga in the center, Chickmagalur, Hassan, Kolar, Mysore and Tumkur in the south.

While not all the changes analyzed here can be pinpointed to policy drivers, there are some marked changes that can be superimposed with policy regimes in the respective years. For example, expansion in the net sown area during and after the green revolution era (1966-76) shows the impact of intensification policies in different districts. Policies like the technology mission for Oilseeds (1986), Pulses (1990) and Maize (1995) can be correlated to the increase in the area allotted to these crops in many districts. The analysis also shows that both land use changes and crop acreages have become significantly unstable during the liberalization period.

The above analysis also leads to a few issues that need to be looked at more closely before arriving at conclusions. For example, there may be possible signs of specialization at district level during the liberalization period. Increasing acreage of Pulses in Bidar and Gulbarga, increasing acreage of land under Coconut in Tumkur, decreasing acreage of Cotton together with increasing acreage of Oilseeds in Bijapur may reflect growing specialization of crops in these districts. Further, the analysis showed, increasing current fallows and area cropped more than once in districts like Belgaum and Bijapur. These districts have also shown increasing trends in land allotted to crops like Oilseeds and Sugarcane and decreasing trends in staple crops like Jowar. Such trends ask for a closer look on the drivers and impacts of these crops on issues of capital formation in agriculture and agricultural credit as well as issues of input use and soil fertility. However, in districts like Kolar and Chitradurga, we observe trends like decreasing permanent pastures and increasing current fallows. These trends point towards a different set of issues being important in agricultural growth of such districts.

These insights together with the volatility of crop acreages observed during the liberalization period raise issues of concern since the liberalization regime can enforce unrestrained commercialization of agriculture without guaranteeing socio-ecological sustainability.

In summing up the discussion above, policy formulation should look at policy drivers of these land use changes at micro level to understand their impacts in diverse agro-ecological and social situations. This decentralized understanding of impacts should prelude policy changes so as to address specific local problems as opposed to the blanket changes in agricultural policies in practice today if we are to suggest viable policy alternatives to address the crisis in agriculture.

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