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Impact of climate change on dry-land farming: With special reference to dry zone areas of Karnataka state

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Abstract
Climate change is believed as main reason for farmers suicide in Karnataka state. Unexpected rainfall destroys all crops at the harvesting time and most expected rain will not come on time to start sowing, this situation made life critical in dry land farming. After 50 years of Green Revolution, Still it remains critical issue to address in the country. Although the technology has improved a lot and providing irrigation facilities to farmers for coming over from such problems. But still, a sustainable solution is difficult to find for the issue.
This study based on secondary data sources, examine the impact of Climate change on production and productivity of agriculture goods in dry zone areas of Karnataka state. Especially in backward and dry-land areas like Gulbarga, Bijapur, Bidar, Bellary and Raichur districts. Raichur district is one of the most backward districts in Karnataka State and this has been identified by the Dr. Najundappa Committee by the Government of Karnataka. So it is hoped that the study tries to find out the basic problems farmers facing in dry-land areas and how these problems has been addressed.

Keywords: climate change, agriculture, farmer, dry-land farming

1. Introduction
Climate change is believed as one of the main reason for farmers suicide in Karnataka state. Unexpected rainfall destroys all crops at the harvesting time and most expected rain doesn't come on time to start sowing activities, this situation made life critical in dry land farming. After 50 years of Green Revolution, Still it remains critical issue to address in the country. Although the technology has improved a lot and providing irrigation facilities to the lands of farmers for coming over from such problems. But still, a sustainable solution is difficult to find for the issue. Mainstream scientists have argued that manmade Global warming is the main cause for the climate change, Industrial development vanished all thick forests and continually producing carbon dioxide.
Most of the dry land farmers dependent on locally available sources of water (traditional well, tube well, pond, etc) and these sources are not able to provide water for their crops throughout the year. Hence, water problem is became an unsolvable problem for most of the dry land farmers. Krishna and Tungabhadra rivers flows through the districts of north Karnataka, but Raichur districts benefited very less by Krishan and Tungabhadra rivers. Raichur district is a hilly area, where there are less irrigation facilities, due to rock hills made the way critical for irrigation facilities to reach the agricultural land in the district. While digging the wells for underground water farmers need to pay more for the machines to go through the rocks to reach the underground water source. Traditional water ponds are there for every village but those became sources for drinking water for the people and their animals in summer season.

2. Raichur district profile

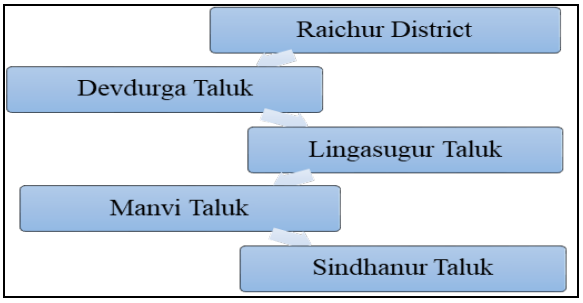

Fig 1

The district, which is situated in the north-eastern part of Location the Karnataka State, falls within the northern median region, the chief characteristics of which are large expanses of treeless plains, black soil with a bare hillock here or a boulder there and some lower belts following the main rivers. The general slope of the district is from the north-west towards the south-east, its average height above the mean sea-level being just 1,311 feet. The district is bounded on the north by the district of General Gulbarga, on the west by the districts of Bijapur and Dharwar, boundaries on the cast by the district of Mahboobsiagar of Andhra Pradesh, and on the south by the districts of Kurnool, also of Andhra Pradesh, and Bellary. The two rivers, the Krishna and the Tungabhadra, form the entire northern and southern boundaries of the district.
Raichur district has total 83, 53,843 Sq. Km. Geographical area with total 19, 28,812 number of population and 6, 28,839

Households living as for the report of 2011 census. In that around 9, 64,511 number of males and around 9, 64,301 number of Female population is existing in the district. Most of the population living in rural areas of Raichur district, around 4, 86,971 Households are living in different villages and interior areas in the district. The population around 1, 41,868 Households are living in urban areas like Raichur city, Devdurga taluk, Lingasugur taluk, Manvi taluk and Sindanur taluk. Lingasugur taluk as wide Geographical Area 1,948 Sq. Km. But the density of population can see more in Raichur district. Because Raichur is a town and infrastructure and availability of basic facilities may be the main reason. Around 3, 63,853 number of population living in Raichur city and the number of households living in Devdurga taluk is very less about (48,437), because in Devdurga taluk there is no productive agriculture, no irrigational facility and no job opportunities for the peoples so people migrate to other cities.

3. Objectives of the study

The major objectives of the proposed study shall be on Climate change and dry land farming in Raichur district of Karnataka state. The study shall have the following specific objectives.

1. To study the impact of climate change on dry zone areas of Karnataka state
2. To analyse the status of dry land farming in Raichur district
3. To analyse the critical situation of the farmers in Raichur district

4. Methodology

Paper based on secondary data sources such as Books, Journals, Magazines and Official records of Ministry of Rural Development and Panchayat Raj, Statistical Department Government of Karnataka and District Statistical Office Raichur.

5. Importance of ground water in dry zone areas

Ground water is the substitute way, people find in dry land areas. When farmers find the annual rainfall will not meet the need for their crops then they automatically go for ground water. Majority of the farmers depend upon ground water sources in districts of Hyderabad Karnataka.

Table 1: District-wise number of canals, reservoirs, tanks, pump sets, wells and lift irrigation in dry zone areas of Karnataka state

District-wise Source of Irrigation (in Numbers)							
Sl. No.	**Districts**	**Canals**	**Reservoirs**	**Tanks total**	**Pumpsets**	**Wells/Tubwells for Irrig. Purpose**	**Lift Irrigation**
1.	Raichur	8	-	305	28475	15520	4470
2.	Bellary	13	3	149	49835	25585	3597
3.	Bidar	4	-	85	56627	26728	8
4.	Gulbarga	6	3	114	33108	24390	97
5.	Bijapur	5	-	92	99120	72511	1
6.	Karnataka State	188	53	32993	1704134	1115706	24829

***Source*:** *Raitha mithra, Department of Agriculture Karnataka state*

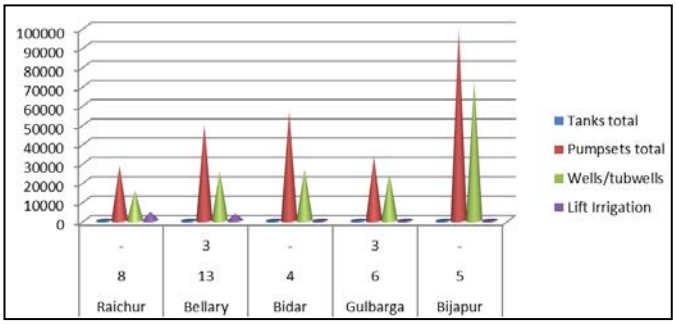

Fig 2: District-wise Number of Canals, Reservoirs, Tanks, Pumpsets, Wells and Lift Irrigation

Table- 1 shows the district-wise number of canals, reservoirs, tanks, pumpsets, wells and lift irrigation in Karnataka state, especially dry zone areas like Raichur, Bellary, Bidar, Gulbarga and Bijapur. Among all five dry zone districts Raichur district is having very less number of about 8 canals 4.26 percent of canal irrigation and those canals supply water in rainy and winter season but not in summer season. In the month of March, April and May when water becomes very essential for agriculture and allayed sectors all canals will goes dry, the water problem in Raichur district is due to no reservoirs in the district. For the water conservation about 305 tanks are there and Majority of farmers in Raichur district depend upon Pumpset for irrigation facilities, which is very less around 23,475 compared to all other district of dry land area. Bidar and Bijapur districts also doesn't have reservoirs as like Raichur district, even though these districts have good number of water bodies like water tanks, pumpsets and wells for irrigation facilities, as Bidar has about 85 tanks, around 56,627 pumpsets and total 26,728 wells for irrigation and Bijapur has about 92 tanks, majority of pumpsets that is around 99,120 and good number total 72,511 well irrigation in Bijapur district. Tub well and open well irrigation is common water bodies for the irrigation purpose in the district, around 15,520 open wells were there in the district. Lift irrigation is a traditional water irrigation method, around 4,470 lift irrigation found in the district.

As In dry zone areas like Bellary and Gulbarga districts have better water supply facilities compared to Raichur district. As Bellary district has Tunga-bhadra dam very near, which has water storage. The district has around 13 canals, 3 reservoirs, about 149 tanks, majority of around 49,835 pumpsets, about 25,585 total number of wells and 3,597 lift irrigation facilities and Gulbarga district has around 6 canals, 3 reservoirs, about 114 tanks, majority of around 33,108 pumpsets, 24,390 number of wells and 97 lift irrigation facilities. The table also revealed that Raichur district is most backward area, lack behind in infrastructure and basic facilities and also dryland area compared to other northern dry zone district like Bellary, Bidar, Gulbarga and Bijapur in Karnataka state.

Table 2: Geographical area, annual rainfall and rainy days in Raichur district

Geographical Area and Annual Rainfall in Raichur District (2011 Census)							
Sl. No.	**Actual Annual Rainfall from 2001 to 2010 (in mms)**	**Devdurga Taluk**	**Lingasugur Taluk**	**Manvi Taluk**	**Raichur Taluk**	**Sindhanu Taluk**	**Total**
1	2001	714.0	535.5	806.3	748.6	644.8	689.8
2	2002	582.0	646.8	416.6	507.2	420.7	514.7
3	2003	675.0	294.7	614.2	488.3	536.0	521.6
4	2004	680.1	319.6	595.6	616.3	613.8	565.1
5	2005	1086.5	427.3	811.9	785.2	711.0	764.3
6	2006	633.9	373.0	590.4	562.0	400.9	512.0
7	2007	723.7	490.0	719.3	847.0	1132.0	782.4
8	2008	652.8	513.5	567.5	575.0	539.1	569.6
9	2009	831.2	793.5	977.8	938.5	1175.7	943.3
10	2010	702.4	542.7	883.5	750.6	731.1	722.06

***Source*:** Census 2011

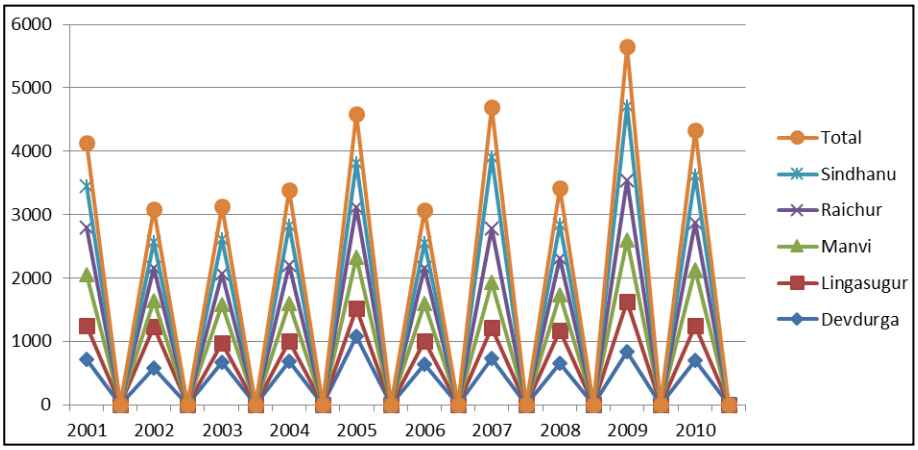

Fig 3: Geographical area and annual rainfall and rainy days in Raichur district

Table- 2 revealed the Annual Rainfall and Rainydays in Raichur district. In the period of ten years Lingasugur taluk

and Manvi taluk have got less annual rainfall and rainydays in the year of 2003 compare to other taluks of Raichur district. Rainfall was good in the years of 2005, 2007 and 2010 in these years productivity was good in the district. There was heavy Rainfall in the year of 2009. The heavy Rainfall around 943.3 mm has turned in to flood and 90 per cent of the district was affected by the flood, Most of the people loss their crop and livelihood.

Northern part of Karnataka state always affected by climate change and especially Raichur is more subject to the climate change. Lingasugur taluk receives very less rainfall in entire Raichur district. It has received lowest rainfall in the period of ten years, about 294.7 mms in the year of 2003 which is very less rainfall during the period of ten years in Raichur district. About 319.6 mms, 373.0 mms in 2004 and 2006 and about 427.3 mms, 490.0 mms in 2005 and 2007, about 535.5 mms, 542.7 mms in 2001 and 2010. About 646.8 mms, 793.5 mms in 2002 and 2009 which is more in the taluk. Devadurga taluk has got rainfall about 1086.5 mms in 2005, 831.2 mms in 2009, 723.7 mms in 2007 and 702.4 mms in 2010, but the productivity in this taluk is very less. Because most of the area in devadurga taluk is covered with rock hills and lack of water sources the rock hill areas are not suitable for the cultivation activities.

Table 3: Geographical area and land utilization in Raichur District

Geographical Area and Land Utilisation 2012-13 (in Hectares)								
Sl. No.	**Name of the Taluk**	**Geographical Area (Sq. Km) 2001 Census**	**Fallow Land**			**Area Sown**		
			Current	**Others**	**Total**	**Net**	**More than once**	**Total**
1	Devdurga	150979	43783	6469	50252	76093	14107	90200
2	Lingasugur	194010	9298	5887	15169	145417	19275	164692
3	Manvi	179273	82550	3812	86362	80302	15715	96017
4	Raichur	151415	47810	22442	70252	67477	5388	72865
5	Sindhanur	160166	44279	8441	52720	88773	28588	117361
Total		835843	227704	47051	274755	458062	83073	541135

***Source*:** District statistical office Raichur district

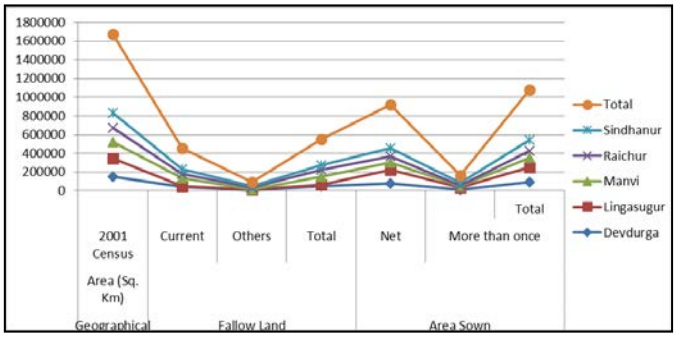

Fig 4: Geographical area and land utilization in Raichur District

Table- 3 estimates the total land utilization pattern of Raichur district in the year 2012-13. Total Geographical area in Raichur district is about 8, 35,843 Sq. Km. In that around 2, 74,755 hectare area is total fallow land which is not suitable for cultivation activities. Among the total geographical area around 5,41,135 hectare used for sowing purpose and in that the net sown area is around 4,58,062 and around 8,3,073 hectare of area found more than once sown in the district.

Lingasugur taluk has more geographical area about 1, 94, 010 Sq.km. and more net sown area around 1, 45, 417 hectares. But, the production level is less compare to Sindhanur and Manvi taluk, because Sindhanur taluk as about 2, 8, 588 hectare area sown more than once in every year. The irrigational facilities and fertile land in the area is more supportive for the good yield in sindhanur and Manvi taluks.

Table 4: Agricultural area of principle crops in Raichur district.

Agriculture, Area of Principle Crops Year: 2012-13						
Cereals Area (Hectares)						
Sl. No.	**Name of the Taluk**	**Paddy**	**Jowar (Sorghum)**	**Green Millets (Bajara)**	**Wheat**	**Total**
1	Devdurga	14750	7769	7225	182	29926
2	Lingasugur	5653	40653	29524	2116	77946
3	Manvi	40687	18171	3297	9	62164
4	Raichur	13490	4134	780	0	18404
5	Sindhanur	68120	15411	5390	0	88921
Total		142700	86138	46216	2307	277361

***Source*:** District statistical office Raichur district

Table- 4 shows the Agricultural area of principle crops in Raichur district. About 277361 total hectare of Cereal Crop produced in Raichur district in the year of 2012-13. Paddy production in the district is more, but Jowar is considered as major crop in the district. Because, paddy will be grown in the rainy season only and in some areas, where irrigation facility is available will grow twice in a year. But, Jowar is considered as farmer friendly crop, as it does not need more water facilities. Most of the farmers prefer to sow Jowar in the end of rainy season and winter season and they will harvest the crop in summer.

Paddy has majority of production among all crops, about 142700 hectare of area cultivating paddy in the study area. Next comes Jawar (Sorghum) about 86138 hectares of land producing Sorghum in Raichur district. Lingasugur taluk producing majority of Jowar around 40653 hectare compared to other taluks in the district. The Sorghum produced in the district will be used for the purpose of daily feeding in the district. Jawar (Sorghum) is the most using food crop in the district. Every day people use "Rotti" for their afternoon lunch and night dinner, which is made by Jawar (Sorghum). Jawar (Sorghum) is good food compare to Paddy and Wheat for the hot areas like Raichur, Gulbarga and Bijapur where temperature will be more than 45 degree in summer season. Green Millets (Bajara) is not major crop it will be growing as sub crop with the major crops in the district. About 46216 hectares of land produced green millets in 2012-13. Wheat is less important crop in the district about 2307 hectares of land has produces wheat in the district.

Table 5: Agricultural area of principle crops (Oil seeds) in Raichur district.

Agriculture, Area of Principle Crops Year:2012-13						
Oil Seeds (Hectares)						
Sl. No.	**Name of the Taluk**	**Ground Nut**	**Sun Flower**	**Safflower**	**Sesa-mum**	**Total oil Seeds**
1	Devdurga	15500	13724	195	0	29419
2	Lingasugur	15356	18526	1946	5202	41030
3	Manvi	1602	9868	30	20	11520
4	Raichur	5135	4370	166	0	9671
5	Sindhanur	455	7702	537	105	8799
Total		38048	54190	2874	5327	100439

***Source*:** District statistical office Raichur district

As far the Table- 5 Ground nut and sun flower are considered as commercial crops growing more in the district. These crops do not required more water facilities, sunflower and ground nut will grow with the help of mist in winter season. Hence, ground nut and sun flowers called as farmer friendly crops in dryland areas. Total oil seeds cultivated in the district are about 100439 hectare area in the year of 2012-13. About 38048 hectare of area cultivated ground nut and about 54190 hectare area sun flower cultivated in the Raichur district which is more compare to safflower and sesamum. About 2874

hectare area of safflower and about 5327 hectare area of sesamum cultivated in the district.

Lingasugur taluk is producing more oil seeds in Raichur district. About 41030 hectare of area producing oil seeds in sindhanur taluk. In that around 15500 hectare area producing ground nut and 13724 hectare of are producing sunflower. Safflower about 195 hectares but sesamum is not producing in lingasugur taluk. Sindhanur taluk producing total 8799 hectares of area oil seeds which is very less in the district. In that about 455 hectare of area producing ground nut and 7702 hectare of area producing sun flower in sindhanur taluk.

6. Suggestions and Conclusion

From the above discussion it is clear that farmers in dry land area have to adjust to their production according to availability of water. Even though land in Raichur district is fertile and more suitable for produce paddy and other crops, as there is acute shortage of rainfall plus inadequate irrigation facilities inducing farmer to chose in the production of agriculture crops, which need less water by selecting crop like Jawar, Ground nut, Tur, Cotton and sunflower etc. farmers are making their efforts in many dryland farming more sustainable. The pathetic condition of agriculture communities and their dependence on uncertain rainfall clearly shows that there is urgent need to develop irrigation facilities in these areas. Unless providing adequate irrigation facilities and sufficient water it is not development and it is very difficult to make equal productive in this region.

Farmers in dry land areas are badly facing the scarcity of water, they are not getting water facilities for their crops and they are compelled to use the underground water. In areas like Raichur, Bellary, Bidar and Gulbarga farmers are highly depend upon rain water. Thus there is an urgent need to increase the irrigational facilities to dry land areas and creating more water resources.

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