

Impact of natural disaster on agriculture and economy: a study of Rayalaseema region of Andhra Pradesh

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Abstract

Background/Objectives: To study year wise drought affected Mandals of the study area, to study year wise Rainfall particulars of the region as a whole and to study the impact of drought on agricultural production of Rayalaseema region.

Methods/Statistical analysis: The districts of Rayalaseema region is selected for the present study. The study is based on secondary data, such as Chief Planning Office (CPO), (Anantapur, Chittoor, Kadapa& Kurnool), District Agricultural office of the region, Memorandum on drought in Andhra Pradesh- 2014, District Handbooks of Rayalaseema region (2014-15 & 2015-16).

Findings: The present study is focusing on Rayalaseema districts of Andhra Pradesh that is a completely drought-affected area. The recurrent failure of monsoons affects the crop production in the Rayalaseema region. This underdeveloped region has the dubious distinction of distress from the twin problems of drought and poverty. It has been noticed in that the total irrigated the area continuously decline in Rayalaseema varies from year to year. The cropping pattern is also varied with the effect of climate, rainfall, and lack of other irrigation sources. The basic change that occurred in the cropping pattern is that there was a significant decline of the area under food crops especially jowar, Bajra and maize in the whole region. The percentage of area under non-food crops has more than doubled. Commercial crops (Sugarcane, Sunflower, and Cotton) have replaced the area under food crops in the region.

Keywords: Natural Disaster, Drought, Agriculture, Rainfall and Economy.

1. Introduction

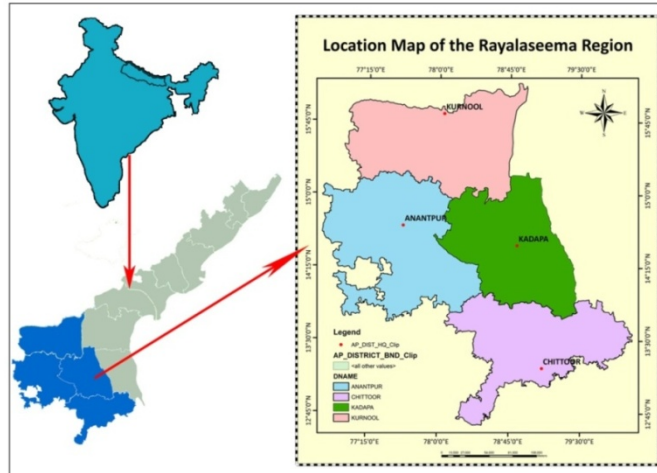
The Indian sub-continent is predominantly characterized by a tropical monsoon climate and the entire regime is distinguished mainly by the differences in rainfall both in quantity and distribution. The most important feature is the regional and temporal alteration of atmospheric flow patterns associated with the monsoon. There are two monsoon systems operating in the region (a) The south-west or summer monsoon accounting for about 80% and (b) The north-east or the winter monsoon which accounts for roughly 20% of the rainfall. About 60% of a cultivable area of India is rain-fed or un-irrigated which is critical in terms of securities for drinking, domestic and industrial water supply, fodder, feed, food, farmers' distress and farm income. Drought is one of the major environmental disasters in many parts of the world. Drought is a temporary, recurring natural disaster, which originates from the lack of precipitation and brings significant economic losses. It is a normal, recurrent feature of climate that occurs in virtually all climate zones, from very wet to very dry.

It is not possible to avoid drought. But drought preparedness can be developed and drought impacts can be managed. Droughts have now become an internal part of the survival mode of the people in the country. 19% of the total geographical area and 12% of the total population is under drought-prone conditions. Due to low and instability in productivity there exist several imbalances in regional and economic characteristics in these areas. The Government of India initiated long-term drought eradication plan during the five-year plan known as Drought Prone Area Programme (DPAP). The programmes' strategy is to encourage agriculture and allied activities and with these to achieve balanced regional development. The important aims of the programme are (1) To reduce the impact of drought, (2) To increase the incomes of people, (3) To restore ecological balance.

The present study is focusing on Rayalaseema districts of Andhra Pradesh which is completely drought affected area and also examines the impact of drought on agriculture and economy.

2. Growth and structure of Rayalaseema region

Figure 1. Location map of the study area



Rayalaseema is a geographic region in the Indian state of Andhra Pradesh. The Rayalaseema region is the land once ruled by the 'Rayas' of the famous Vijayanagara Empire. The name has become popular after Sri Krishnadevaraya, the great king who ruled Rayalaseema as part of his kingdom from 1509 to 1530 AD. It was also poetically called as 'Rayalaseema is Rathanalaseema' (area of precious stones) [1]. Also, it is an economically backward region of Andhra Pradesh when compared to coastal Andhra. This is a typically dry tract of AP, situated in an unfavourable zone and has been declared as famine zone of south India [2]. It includes the four southern districts of Anantapur, Chittoor, Kadapa, and Kurnool (covering an area of 67,298 Sq kms (42 % of state area)). Anantapur revenue district is the largest district with an area of (19130) square kms; followed by Chittoor (15151), Kadapa (15359) and Kurnool (17658), the total numbers of Mandals of the districts are 234. The particulars of the district wise, area wise population, density and sex ration of Rayalaseema districts are given (Table 1), and location map of the area indicate Figure 1.

2.1. Climatic features

Rayalaseema region lies between 12° 30' N and 16° 30' N latitudes and 76° 30' E to 79° 55' E longitudes. The climate of the region is a normally dry sub-humid type. Rayalaseema forms a part of the semiarid region of the interior Deccan. Diversified climatic conditions prevail as per the changing seasons. The climatic conditions of the region can be divided into four seasons. (a) The period from December to February is a dry and comparatively cool season. (b) Hot summer spreads from March to May. April is the hottest month, the mean maximum temperature is 45°C and the mean minimum temperature is 24.6°C. (c) South-west monsoon from June to September. (d) October and November contribute the post-monsoon or retreating monsoon season. The period from November to the end of February is the coolest part of the year.

3. Drought

Drought is a compound natural hazard. It is defined as any deficiency of water to satisfy the normal need for agriculture, livestock, industry, or human population. Drought produces both direct and indirect impacts. The direct impacts are the scarcity of agricultural production due to the failure of crops, minimal water levels for human need and the shortage of fodder for livestock or reduction of livestock. The indirect impacts are followed by decrease income for farmers, increase prices for food production and agricultural employment leads to migration [3].

Table 1. Population, density and sex ratio of Rayalaseema (As per 2011 Census)

S. No	Name of the District	Area (Sq Km)	Population	Density (per Sq Km)	Sex ratio (Per thousand Males)
1	Anantapur	19130	4081148	213	977
2	Chittoor	15151	4174064	275	977
3	Kadapa	15359	2882469	188	985
4	Kurnool	17658	4053463	229	988

Source: Hand book of statistics Anantapur, Chittoor, Kadapa and Kurnool (2015-16)

3.1. Drought indicators

Government of India has recommended the following 4 norms for a considered declaration of Drought Mandals [3].

3.1.1. Deficiency of rain fall

1. Mandals where annual normal rainfall is less than 750 MM is 15% and above.
2. Mandals where annual normal rainfall is 750 MM to 1000 MM is 20% and above.
3. Mandals where annual normal rainfall is more than 1000 MM is 25% and above.

3.1.2. Reduction in cropped area: 50 and above under all Principal Crops.

3.1.3. Reduction in crop yield

1. Normal reduction in crop yields of 50% and above.
2. 40% reduction in crop yield for high input oriented crops viz., Groundnut, Bengal gram, Hybrid sunflower etc.

3.1.4. Dry spells: Non receipt of rainfall continuously for a period of 21 and above days.

3.2. Drought in Rayalaseema

Drought is one of the most frequently occurring national disasters in India. Due to erratic rainfall in Rayalaseema, the drought was found as an uninvited guest in the region. Rayalaseema of Andhra Pradesh which is historically known as 'Stalking ground of famines'. At present 'Rayalaseema is Rathalaseema' is replaced by 'Rayalaseema is Rallaseema'. It is estimated that drought occurs once in three years in Rayalaseema region. Among four districts in the region, Anantapur district is the second driest part of the country next to the Jaisalmer district of Rajasthan. Rayalaseema region comes under semi-arid area which records rainfall from 375 to 700mm [4]. In recent years; drought and other natural calamities have adversely affected the Rayalaseema region economy and its people. Since 1995, the region has witnessed a drought in 14 years out of 20 years (1995-1996 to 2014-2015) [5]. The total number of revenue Mandals in the region is 234, out of these in the year 1995-1996, 190 Mandals have been declared as drought affected. The severe droughts affected in years are 1999-2000 (232), 2001-2002 (231), 2002-2003 (233), 2004-2005 (204), 2009-2010 (229) and 2011-2012 (217) Mandals are affected, followed by 1997-1998, 199 Mandals, 2000-2001, 144 Mandals, 2003-2004, 167 Mandals, 2006-2007, 163 Mandals, 2012-2013, 170 Mandals, 2013-2014, 136 Mandals, and 2014-2015, 165 number of Mandals are affected by drought. The number of Mandals as drought affected in each of these years is indicated in (Table 2).

Table 2. District-wise, year-wise number of Mandals declared as drought affected- (1995-1996 to 2014-2015)

S. No	Name of the District	Total Mandals	1995-1996	1997-1998	1999-2000	2000-2001	2001-2002	2002-2003	2003-2004	2004-2005	2006-2007	2009-2010	2011-2012	2012-2013	2013-2014	2014-2015
1	Anantapur	63	63	63	63	60	63	63	62	53	63	63	63	63	63	63
2	Chittoor	66	66	32	65	45	65	65	42	56	37	66	49	28	33	42
3	Kadapa	51	37	50	51	05	51	51	32	49	33	51	51	43	16	48
4	Kurnool	54	24	54	53	34	52	54	31	46	30	49	54	36	24	12
5	Rayalaseema Total	234	190	199	232	144	231	233	167	204	163	229	217	170	136	165

Source: Memorandum of drought in Andhra Pradesh- 2014

4. Rainfall deficiency of Rayalaseema

The Rayalaseema region comprises four drought prone districts and predominant areas under rainfed cultivation. The entire region lies in the rain shadow zone of Western Ghats. This region receives an annual normal rainfall from 375 to 700 mm, which is received from South-West monsoon (June- September) and North-East monsoon (October to December). Consequently, this area receives very low rainfall during the South-West and the North- East monsoons as well. Out of four districts in the region, Anantapur district received the lowest rainfall of 531mm (% Deviation is >2); Chittoor district received highest rainfall 819mm (% Deviation is <9.8) when compared to Kadapa-653mm (% Deviation is <5) and Kurnool -687mm (% Deviation is >2) in the year 1995-1996. The excess rainfall (>19%) recorded in the districts are in the year 2001-2002, Anantapur district received rainfall 702mm (% Deviation is >27), Chittoor district received rainfall 965mm (% deviation is >3.4), Kadapa district received rainfall 897mm (% Deviation is >28) in the year 2004-2005, Kurnool district received rainfall 897mm (% Deviation is >34) 2000-2001.

The normal rainfall (-19% to +19%) recorded in the districts are in the year 1999-2000, Anantapur district received rainfall 521mm (% Deviation is), Chittoor district received rainfall 936mm (% Deviation is 0.2) in the year 2012-2013, Kadapa district received rainfall 708mm (% Deviation is 1.3) in the year 2013-2014, Kurnool district received rainfall 671mm (% Deviation is 0) 2003-2004. The deficit rainfall (<59% to <20%) recorded in the districts are in the year 2014-2015, Chittoor district received rainfall 563mm (% Deviation is <39.6), Kadapa district received rainfall 409mm (% Deviation is <20), Kurnool district received rainfall 468mm (% Deviation is <30), followed by the year 2002-2003, Anantapur district received rainfall 290mm (% Deviation is <47). The district wise rainfall particulars of the Rayalaseema region (1995-1996 to 2014-2015) are furnished at (Table 3).

Table 3. District-wise, year-wise rainfall particulars of the Rayalaseema districts (1995-96 to 2014-15)

S. No	Year	Name of the district											
		Anantapur			Chittoor			Kadapa			Kurnool		
		Normal	Actual	% Deviation	Normal	Actual	% Deviation	Normal	Actual	% Deviation	Normal	Actual	% Deviation
1	1995-1996	521	531	2	908	819	-9.8	699	653	-5	670	687	2
2	1997-1998	521	441	-15	908	959	7	699	678	-12	670	597	-11
3	1999-2000	521	521	0	908	725	-20.1	699	535	-21	670	481	-28
4	2000-2001	552	612	11	934	865	-7.3	699	730	2	670	897	34
5	2001-2002	552	702	27	934	965	3.4	699	865	24	670	724	8
6	2002-2003	552	290	-47	934	620	-33.4	699	416	-18	670	506	-24
7	2003-2004	552	552	-5	934	917	4	699	822	8	670	671	0
8	2004-2005	552	434	-21	934	706	-24.4	699	897	28	670	542	-19
9	2006-2007	552	408	-26	934	717	-23.1	699	654	-6	670	543	-19
10	2009-2010	552	616	11	934	759	-18.7	699	874	25	670	755	13
11	2011-2012	552	496	-10	934	868	-7	699	665	-5	670	515	-23
12	2012-2013	552	455	-18	934	936	0.2	699	570	-18	670	616	-8
13	2013-2014	552	538	-4	934	745	-20.2	699	708	1.3	670	650	-3
14	2014-2015	552	404	-24	934	563	-39.6	699	409	-20	670	468	-30

Source: Chief Planning office & hand book of statistics of Anantapur, Chittoor, Kadapa and Kurnool (2014-15)

5. The economic impacts of drought on agriculture in Rayalaseema

Agriculture is known to be the most affected sector from environmental intimidation due to its dependency to climate factors. Drought as one of the threats seen in recent years affects agricultural production. Drought has also economic effects such as income losses, loss to industries directly dependent on agricultural production, decreased land prices, unemployment from drought-related declines in production, strain on financial institutions (foreclosures, more credit risk, capital shortfalls), reduction of economic development, less agricultural producers, rural inhabitants loss. In famine areas like Rayalaseema, the economy of the farmers has to necessarily depend upon development of cattle to a large extent. Most of the rural population in Rayalaseema still clings to agriculture due to the lack of opportunities in other sectors of the economy [6]. The

food crops occupy an important place such as Paddy, Jowar, Major and small millets, Red-gram, Green-gram, Black-gram, Bengal-gram, Horse-gram, Cow-gram, and other horticulture crops; among commercial crops Groundnut is followed by the Sugarcane, Cotton etc.

Table 4. Year-wise total area irrigated by major crops of Rayalaseema districts (1995-96 to 2014-15) (Area in Hectares)

S. No	Year	Total area irrigated by major crops										
		Paddy	Jowar	Bajra	Maize	Green-gram	Red-gram	Bengal-gram	Sugarcane	Groundnut	Total major & small Millets	Total Pulses
1	1995-1996	163071	24567	3423	9560	690	346	1760	47890	75690	24562	6732
2	1997-1998	154780	16782	4536	11345	710	789	1630	35678	92670	57453	4615
3	1999-2000	145390	26734	2435	36208	593	456	1538	34200	87356	19567	2561
4	2000-2001	176452	14356	5745	9245	823	615	2789	39780	66729	24562	4123
5	2001-2002	147890	34289	4235	11892	912	725	1920	44560	54372	39872	6732
6	2002-2003	173650	26734	3642	8934	746	610	4538	51900	67341	44627	4512
7	2003-2004	197562	25435	5167	9278	789	524	7360	47210	83526	62813	7354
8	2004-2005	200956	33723	6729	10403	705	571	2454	39934	101220	57638	9022
9	2006-2007	218322	18763	4485	13758	1325	537	2376	67481	94952	42261	7224
10	2009-2010	297950	25204	5754	22454	1062	640	1903	53375	102468	58953	917
11	2011-2012	259612	40581	7067	48321	1778	770	13807	59077	96016	89702	746
12	2012-2013	196158	39350	5792	41003	1516	1341	9962	56413	105917	90440	938
13	2013-2014	165150	30822	5422	44782	1186	878	5796	54523	92876	90035	11525
14	2014-2015	232411	24230	4384	25084	1140	937	2504	56517	10816	53840	9432

Source: Chief planning office & seasonal and crop report of Andhra Pradesh (1995-2015)

At present, food crops are replaced by commercial crops in Rayalaseema. Groundnut occupies more than the half of the cropped area after cultivation of Paddy. The main crops which lost the area to groundnut are Jowar, Bajra, and Maize etc. Decline can be observed in the area under Green-gram, Red-gram, Bengal-gram and Pulses out of four districts of the region, Anantapur agriculture was completely dominated by Groundnut. The details of year-wise (1995-96 to 2014-15) total area irrigated by major crops of Rayalaseema districts is furnished (Table 4).

6. Impact of rainfall, drought on agriculture

The occurrence and conditions of drought are influenced by a number of factors. Rainfall and cropping pattern are different across the region. It is not just the deficiency of rainfall, but also uneven distribution of rain across the season, duration of rainfall deficiency and its impact on region agriculture, economy and its people livelihood. Commonly it will leads to agricultural drought that characterize drought. The effects of drought on crop production might be annual and perennial crop losses, damage to crop quality, income loss for farmers due to reduced crop yields, reduced productivity of cropland, insect infestation, plant disease, increased irrigation costs, cost of new or supplemental water resource development (Wells, Dams, Pipelines). Drought conditions are long-lasting due to poor rainfall in frequent years; these conditions do not allow people the opportunity to recover from the impact of drought to survive with the impact. The effects of drought are based on frequency, severity, degree and on the vulnerability of the region and sectors.

The recurrent failure of monsoons affects the crop production in the Rayalaseema region. It has been noticed in that the total irrigated area continuously decline in Rayalaseema varies from year to year. The cropping pattern is also varies with the effect of climate, rainfall and lack of other irrigation sources. The fundamental change that occurred in the cropping pattern is that there was significant decline of area under food crops especially Jowar, Bajra, and Maize in the whole region. The percentage of area under non-food crops has more than doubled. Commercial crops (Sugarcane, Sunflower, and Cotton) have replaced the area under food crops in the region. The trends and impact of drought, rainfall on agriculture.

7. Conclusion and recommendations

Droughts may not be avoidable, but their effects can be avoidable. Even after utilizing all the available water resources, about 50% of our cultivable area will still depend on rains. Therefore, our agricultural scientists, policy formulators and farmers should appropriately realize the magnitude of role that. The rains are very erratic, uncertain and unevenly distributed. Therefore, the agriculture in these areas has become a sort of gamble with the nature and very often the crops have to face climatic hazards. The farmers also take up farming half-heartedly as they are not sure of being able to harvest the crops. Thus, water scarcity becomes a serious bottleneck in drought in agriculture. In dry areas where unpredictable rain and famine are a frequent phenomenon the farmer has to look up for a secondary occupation to augment his income. To a large extent cattle development as a subsidiary occupation has been thought of to relieve the suffering of the people in this Rayalaseema.

7.1. Recommendations

1. There is an urgent need to change the cropping pattern in drought prone areas of the regions to prevent further downslide of underground water table.
2. It is also necessary to identify backward districts and specific area programmes may be initiated through state and central grants.
3. Contingency crop plan to support farmers for sowing of dry crops to the government.
4. Relief fund and local area development fund for drinking water and others integrated watershed management programme-water harvesting and conservation water saving technologies-drip and sprinkler irrigation systems.
5. To strengthen government employment programmes especially in drought seasons.

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