

A study of natural disaster on agriculture: A case of drought prone areas in Andhra Pradesh

Anitha. M¹ and M. Swarna Pragathi²

Abstract: *India delivers a large population engaged in farming. A vast portion of this population is in the fragile ecosystems of farming in dry soil, rain fed situations. Drought is one of the major threats among natural hazards to people's livelihoods and socioeconomic growth. Droughts have now become an internal part in the survival mode of the people in the country. 19% of the total geographical area and 12% of the entire population is under drought prone conditions. Agricultural drought is more commonly by the lack of availability of water to support crop and forage growth than by the departure of normal precipitation over some limited period of time. Scanty rainfall leads to drought, which touched on water levels and caused misery and distress not only to small and marginal farmers but also to the big farmers. Andhra Pradesh is the state spread over two geographical areas, namely Coastal Andhra and Rayalaseema. The Rayalaseema Region consisting of four districts i.e. Chittoor, Kadapa, Anantapur and Kurnool. This under developed region has the doubtful distinction of standing from the twin problems of drought and poverty. Kadapa district is one of the drought affected districts in Rayalaseema region. The annual rainfall in the district is 747mm. During the final one year due to low rainfall in the district the agricultural sector faces so many troubles. Rainfall, Crop and Dry spell will be used as parameters for drought analysis. The rainfall being a major parameter for analyzing drought and the data records of Kadapa district were obtained and studied. The data shows that 38 of 51 mandals show that <750 mm (15%) of annual rainfall and remaining 13 models shows 750-1000 mm rainfall. Normal reduction in crop yield was 50% and above. The attempt has been constituted to evaluate the impact of drought on agriculture, economy in the study region. Usually it will lead to Agricultural drought.*

Keywords: Natural Disaster, drought, agriculture, rainfall, Kadapa District

Introduction

The Indian sub-continent is predominantly characterized by a tropical monsoon climate and entire regime is distinguished mainly by the differences in rainfall both in quantity and distribution. The most significant characteristic is the regional and temporal change of atmospheric flow patterns associated with monsoon. There are two monsoon systems operating in the region (a) the South-west or summer monsoon accounting for approximately 80% and (b) the northeast or the winter monsoon which accounts for about 20% of the rainfall.

¹ Assistant Professor, Department of Economics, Yogi Vemana University, Kadapa, Andhra Pradesh, India.

² Research Scholar, Department of Economics, Yogi Vemana University, Kadapa, Andhra Pradesh, India.

Corresponding author: Anitha. M can be contacted at: anumannem@yahoo.co.in.
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Approximately 60% of the cultivable area of India is rain fed or un-irrigated which is vital 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 catastrophes in many regions of the globe. Drought is a temporary, recurring natural disaster, which arises from the lack of precipitation and brings substantial economic losses. It is a normal, recurrent feature of climate that occurs in almost all climatic zones, from very wet to really dry. It is not possible to avoid drought. But drought preparedness can be built up and drought impacts can be made out. Droughts have now turn an internal component in the survival mode of the citizenry in the state. 19% of the total geographical area and 12% of the entire population is under drought prone conditions. Due to low and instability in productivity there exists several imbalances in regional and economic characteristics in these fields. The Government of India started a long-term drought eradication plan during the 5th five year program known as a Drought prone area program (DPAP). The programmes' strategy is to promote agriculture and allied activities and with these to achieve balanced regional growth. The important aims of the program are (1) to reduce the impact of drought, (2) to increase the incomes of people, (3) to restore ecological equilibrium.

The Present study is focusing on Kadapa district of Andhra Pradesh, which is completely drought area and also analyzes the economic impact of drought on Agriculture as well as policy implications.

Methodology

The data are gathered from secondary sources, i.e., Handbook of Statistics Kadapa district, Season and crop report, Manual for Drought Management (2009), District Agricultural office.

Drought in Andhra Pradesh

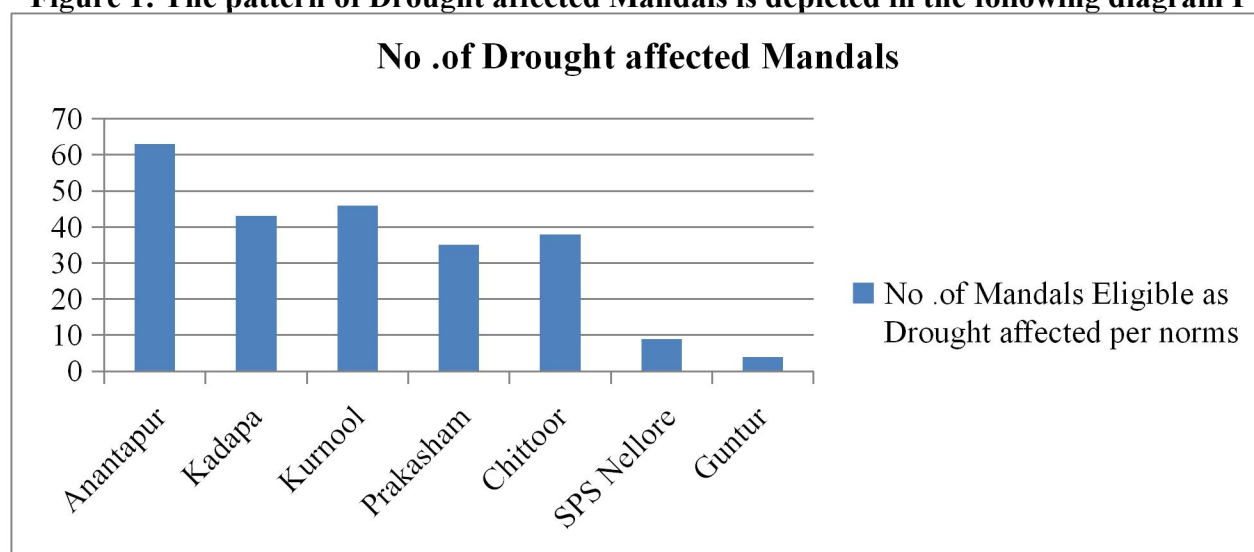
Andhra Pradesh state spread over two geographical areas, namely Coastal Andhra and Rayalaseema. The nation is mainly an agricultural state in which 70 Percent of its population is holding out in rural regions. The state is conventionally split into three Agro-ecological regions, namely, North Costal Andhra (Srikakulam, Vizianagaram and Visakhapatnam districts), South Coastal Andhra (East Godavari, West Godavari, Krishna, Guntur, Prakasam and Nellore districts), Rayalaseema (Chittoor, Cuddapah, Anantapur and Kurnool districts). Andhra Pradesh is the third most drought prone States after Rajasthan and Karnataka. The normal rainfall is 940 mm. 624 millimeter (66%) South-West Monsoon (June-Sept.), 224 mm (24%) North-East Monsoon (Oct-Dec), Remaining 10% is met during other months. The nation is exposed to cyclones, storm surges, floods and droughts. Every two to three years, AP has a moderate to severe intensity cyclone or landfall. Drought is one of the most crippling hazards that impact the state. 2009, 2011 and 2012 years are the major drought years to be adjudged by the state government. Most of the districts in Andhra Pradesh are now under the impact of drought and people are awaiting the announcement of such areas as drought-prone of the regime. The details of the Drought affected Mandals in AP are given in Table.1.

Table 1: Districts as eligible for declaration as Drought affected Mandals in Andhra Pradesh

S.No	District	No .of Mandals Eligible as Drought affected per norms
1	Anantapur	63
2	Kadapa	43
3	Kurnool	46
4	Prakasham	35
5	Chittoor	38
6	SPS Nellore	9
7	Guntur	4
	Total	238

Source: Manual for Drought Management (2009)

Figure 1: The pattern of Drought affected Mandals is depicted in the following diagram I



Agriculture in Drought-prone Andhra Pradesh

The recent documentary on the impact of droughts on agricultural production shows the extensive damages caused by the frequent return of droughts. The farmers were badly hit and their purchasing power reduced. During this year (2015-16) the Khariff and Rabi seasons were not normal and the distress among the people further got aggravated. Unemployment and drinking water problems existed. In Andhra Pradesh drought has been taking place at various intervals, particularly due to the delays in the arrival of monsoon rains. Due to scanty rains below the normal level a number of districts are getting involved. The soil water table is going below at a faster rate. The country under forest has been fast decreasing as the grazing field does. The farmers are not yet producing enough water for growing a single harvest. Tanks are dried and the ayacut areas which were yielding two crops (irrigated) in a year, for a period of two years when once filled with water, at present are kept fallow. Many villages are drinking water problem villages. Wells and bore wells is getting dried up. Live farm animals are being thrown away in urban markets at minimum prices due to non availability of fodder and water.

In Andhra Pradesh, during the last one year (2015-16) due to low rainfall in the state the agricultural sector faces so many troubles. There is no sign of rain fall in Khariff season. Severe drought conditions have been prevailing in Guntur, East & West Godavari, Krishna, Prakasham,

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Kadapa, Kurnool, and Anathapur. The total food grain production in Andhra Pradesh increased in the year 2013-14 and it was 2849745 hectares, further it will decline in the year 2015-16, 2348713 hectares The details of the total cultivated crops in Andhra Pradesh between 2011-12 to 2015-16 by showing below table II.

Table 2: Crop-Wise Irrigated In Andhra Pradesh from 2011-12 to 2015-16
(Area in Hectares)

S. No	Name of the Crop	2011-12	2012-13	2013-14	2014-15	2015-16	% of Total irrigated area of current year
1	Paddy	2270809	2141823	2514341	2323517	2086905	58.84
2	Wheat	139	195	156	48	9	0.00
3	Jowar	42602	49259	34667	42984	45437	1.28
4	Bajra	10802	11404	10900	8821	7762	0.22
5	Maize	210603	234279	269735	231132	174959	4.93
6	Ragi	7307	6258	7594	5864	5684	0.16
7	Total Major Millets	271314	301200	322896	288801	233842	6.59
8	Samai	0	0	0	0	0	0.00
9	Korra	815	534	183	527	1422	0.04
10	Varagu	0	0	9	0	0	0.00
11	Total Minor Millets	815	534	192	527	1422	0.04
12	Total Major & Minor Millets	272129	301734	323088	289328	235264	6.63
13	Total Cereals and Millets	2543077	2443752	2837585	2612893	2322178	65.47
14	Horsegram	23	3	196	1992	22	0.00
15	Green-gram	4004	1689	1555	3783	3798	0.11
16	Black-gram	24201	5496	3494	9585	17598	0.50
17	Red-gram	2788	1343	914	1641	3102	0.09
18	Bengal-gram	13807	10550	5796	3496	1700	0.05
19	Cow-gram	364	511	185	215	268	0.01
20	Rajma Beens	0	0	0	0	0	0.00
21	Anumulu	46	38	20	32	47	0.00
22	Yerra Pappu /Mysoor	0	0	0	0	0	0.00
23	Total Pulses	45233	19630	12160	20744	26535	0.76
24	Total Food grains	2588310	2463382	2849745	2633637	2348713	66.23

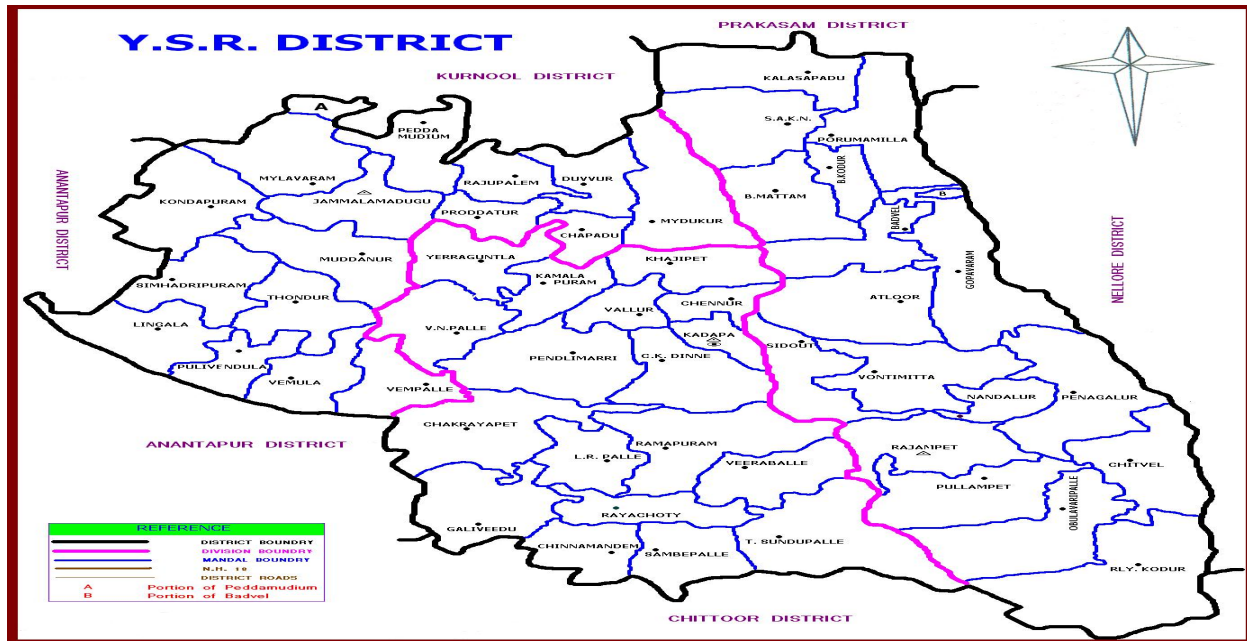
Source: Season and Crop Report 2015-16, Directorate of Economics & Statistics, Government of Andhra Pradesh, Vijayawada.

Brief Profile of Kadapa District

Kadapa district is said to be the heart of the Rayalaseema as it is centrally located. Rayalaseema region, comprising of Kadapa, Kurnool, Anantapur and Chittoor, lies in the rain shadow zone of Western Ghats. Consequently, this area receives very low rainfall during the South West and the North East monsoons as well. The rainfall of 365.8 mm of the Khariff period in Rayalaseema is still distributed and undependable. It is utterly inadequate even to raise the dry crops like groundnut or jowar. Kadapa District is the extreme south eastern district of Andhra Pradesh rainfall situated within the geographical co-ordinate of 13043' And 15014' of northern latitude and 77055' and 79029' eastern longitude. The latitude varies from 269 to 3787 meters above sea level. The District has a glorious history and a rich cultural heritage. The total geographical area of the District is 15,379 sq. Kms. with 3 Revenue Divisions and 51 Mandals. Holy rivers like Penna (Panakini), Papaghni, Chitravati, Mandavya cut across the District giving the land sanctity of their own. Kunderu, Sagileru are the chief Northern tributaries to Penna and Cheyyeru, Papaghni and Chitravathi are the Southern tributaries. A major irrigation sources in the district

are K-C canal, the Mydukur and the Chapadu Project, the upper Sagileru and lower Sagileru and the Pincha Projects.

Figure 2: Location Map of the Kadapa District



The Majority of the people here are depending on Agriculture only. The major crops in the District are Paddy, Groundnut, Sunflower, Cotton, Betel leaves and Horticultural crops like Mango, Papaya, Banana, Lemon and Oranges. The gross cropped area in the District is 432970 hectares, out of this, gross irrigated area.

The Economic impacts of drought on agriculture in Kadapa district

Agriculture is known to be the most affected sector from environmental threats due to its dependency to climate factors. Drought as one of the threats seen in recent years affects agricultural production. The effects of drought are based on frequency, severity, degree and on the vulnerability of the region and sectors. 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 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, fewer agricultural producers, rural population loss. The details of the total no of Mandals under Drought & the total no of Mandals under Drinking water from 2001-2015 in Kadapa district are given in Table 3.

Table 3: Number of Drought Mandals from 2001-02 to 2014-15 in Kadapa district

S.No	Year	No of the Mandal under Drought	No of the Mandal under Drinking water
1	2001-02	2	-
2	2002-03	6	45
3	2003-04	32	5
4	2004-05	49	-
5	2005-06	-	9
6	2006-07	33	-
7	2007-08	-	11
8	2008-09	-	-
9	2009-10	51	-
10	2010-11	-	17
11	2011-12	51	-
12	2012-13	51	-
13	2013-14	16	-
14	2014-15	48	-

Source: Chief Planning Officer, Kadapa

The above table represents the total numbers of Mandals affected by drought. At present there are 51 Mandals are affected it but declines as 16 Mandals in 2013-14. The notable thing is during the year 2002-03, the lack of drinking water, 45 Mandals were affected.

Drought Indicators

Government have suggested the following 4 norms for considered declaration of Drought mandals.

Deficiency of Rain fall

- (a) Mandals where Annual Normal Rainfall is less than 750 MM is 15% and above.
- (b) Mandals where Annual Normal Rainfall is 750 MM to 1000 MM is 20% and above.
- (c) Mandals where Annual Normal Rainfall is more than 1000 MM is 25% and above.

Compression / Reduction in Cropped Area: of 50 % and above under all Principal Crops.

Reduction in Crop Yield:

- (a) Normal reduction in Crop Yields of 50 % and above.
- (b) 40% reduction in Crop Yield for high input oriented crops viz., Groundnut, Bengal gram, Hybrid Sunflower etc.

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

Moisture Adequacy Index (MAI)

Moisture Adequacy Index (MAI) is also one of the Drought indicator. which is based on a calculation of weekly water balance, is equal to the ratio (expressed as a percentage) of Actual Evaporate transpiration (AET) to the Potential Evaporate Transpiration (PET) following a soil – water balancing approach during a cropping season., MAI is obtained by using the following equation:

$$\text{MAI} = \text{AE/PE}$$

Where, AE is actual evapotranspiration and PE is potential evapotranspiration (in %) during different phonological stages of a crop.

Rainfall in Kadapa district

Based on the Agro-climatic conditions the District falls under Southern and scarce rainfall zone. In southern zone rainfall ranges from 700 to 800 m.m. while it is 500 to 700 m.m. rainfall in scarce rainfall zone and with large dry tracts. The rainfall of Kadapa district is mainly influenced by South-West monsoon and part of the district viz., Rajampet, Kodur, Rayachoty and L. R. Palli Mandals receiving the rainfall from North-East Monsoon also. The normal rainfall of the district is 700 m.m. as against the state average of 940 m.m.

Drought indices are normally continuous functions of the rain fall and / or temperature, river discharge or other measurable variable. Rain fall data are widely used to calculate drought indices, because long-term rain fall records are often available. Rain fall data alone many not reflect the spectrum of drought- related conditions, but they can serve as a pragmatic solution in data – poor regions. Some of the well known and less- well known indices used in studies, monitoring and management. The details of the season wise and month wise normal and actual rain fall in kadapa district are given in table 4.

Table 4: Season wise & Month wise Normal & Actual Rainfall in Kadapa District

Season	Month	Normal Rainfall	2013-14		2014-15		2015-16	
			Actual	% Variation	Actual	% Variation	Actual	% Variation
South-West Monsoon	June	69.2	37.6	-46	41.8	-40	60.9	-12.0
	July	96.7	117	21	125.0	29	85.2	-11.9
	August	114.0	168	47	88.2	-23	122.7	7.6
	September	113.7	52	-54	37.1	-67	177.7	56.3
	Total	393.6	374.6	-5	292.1	-26	446.5	13.5
North-East Monsoon	October	131.9	114	-14	76.5	-42	208.5	58.0
	November	93.4	92	-1	75.4	-19	27.5	-70.5
	December	25.7	23.8	-7	57.7	125	1.5	-94.3
	Total	251.0	229.6	-9	209.6	-16	237.5	-5.4
Winter	January	2.2	1.6	-27	0.0	-100	0.0	-100.0
	February	1.2	0	-100	29.4	2351	0.0	-100.0
	Total	3.4	1.6	-53	29.4	765	0.0	-100.0
Summer	March	3.7	0.1	-97	7.8	110	3.8	1.5
	April	11.2	31.6	182	8.9	-21	4.5	-59.7
	May	36.7	27.6	-25	22.7	-38	16.4	-55.3
	TOTAL	51.6	59.3	15	39.4	-24	24.7	-52.2
GRAND TOTAL		699.6	665.1	-5	570.5	-18	708.7	-1.3

Source : Chief Planning Officer, Kadapa

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

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not sure of being able to harvest the crops. Thus, water scarcity becomes a serious bottleneck in drought in agriculture.

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.

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