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Distress Situation in Dryland Areas Impacts on Livelihood Pattern and the Coping Strategies: A Review

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Abstract

This paper is a review of the different coping mechanisms adopted by the households in different dryland area of India. The primary focus of the present paper is to understand the coping mechanisms adopted by the households in the dryland areas to cope with the distress situations in India. The paper has two fold objectives; one is to understand the impact of drought on the livelihood of the people in the dryland areas. Secondly, the paper aims to understand the different mechanisms adopted by the households to avoid the distress situations. The review helps to understand that most of the societies in dryland do not manage drought or distress situation in isolation from their overall farming system. They develop strategies like loss-minimizing land utilization and social arrangement to deal with drought. Thus, for the policy framework the proper understanding of the local people's awareness, response, priorities and own coping strategies is needed. A household level analysis of the different coping mechanisms developed by the poor villagers might help in the policy analysis.

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1 Introduction

Dryland is characterized by scarcity of water, which constrains two major interlinked services—primary production and nutrient cycling. In the long term, natural moisture inputs (that is, precipitation) are counterbalanced by moisture loss through evaporation from surfaces and transpiration by plants (evapotranspiration). This potential water deficit affects both natural and managed ecosystems, which constrains the production of crops, forage and other plants, and has great impact on humans and livestock. As a major proportion of the agricultural land in the world is dry arid and semi-arid, improving the agriculture sector and the social indicators in the dryland areas is necessary to achieve food security and also for the equity (Jodha, 1989; Singh, 1989; Rao, 1991; Ninan *et al.*, 1993). However, crop cultivation in dryland areas faces constraint in development as it is highly prone to the distress situation of drought. Different economic policies implemented for the development of dryland agriculture, did not give impressive results (Ramakrishna and Rao, 2008). The farmers in the dryland areas are poor, and thus they extract little from the different macro-economic policies (Harriss, 1984; World Bank Report, 2006).

The common constraints faced by the farmers in the dryland areas include environmental fluctuation, wind erosion, less-fertile soil, lower yield and use of traditional technologies. (Ramakrishna and Rao, 2008; Rani *et al.*, 2007). Droughts and famines are the general features of dryland agriculture. The annual rainfall in the semi-arid and arid regions ranges between less than 350 mm to 800 mm, and has a high coefficient of variation. Within a season also, rainfall varies significantly over a short duration. Moisture availability falls short of its demand for about eight months in a year in these seasonally dry areas. Thus in these areas, due to the absence of irrigation or moisture conservation, the period available for crop growth is limited to roughly 60 to 180 days a year. In dryland areas, the variation in amount and distribution of rainfall influence not only crop production but also the socio-economic condition of farmers. Farmers in the dryland areas have their routine plan for managing uncertainty associated with seasonal fluctuations and periodic drought-induced crises (Chen, 1991). Dryland households have developed resilience under hardship, variability and risk that is based on historic and current adaptive knowledge and skills (Harriss, 1984). Such skills are increasingly recognised, though it is commonly claimed that such capacities are not sufficient to cope with the sudden change in climatic variation. The strategies to cope with the seasonality and crisis depend upon the rainfall variability and documentation, and also

the specific location/region, and the socio-economic condition of the particular area (World Bank Report, 2006; Gautam and Rao, 2007). Thus, the micro-level understanding of the specific problems in a particular dryland area might be helpful for strengthening the policy implication. The impact of drought might not be the same for the whole community. The impact of the drought and the crisis is also different for the different cultivator groups (Rani *et al*., 2007). In this context, the main aim of the present paper is to understand the coping mechanisms adopted by the households in the dryland areas to cope with such distress situations in India.

Thus, the main objective of the present review paper is to understand:

1. Impact of drought on the livelihood of the people in the dryland areas.
2. The mechanisms adopted by the households to avoid the distress situation.

2. Dryland Area: An International Scenario:

Dryland areas are characterized by scarcity of water, which constrain the primary production and generate uncertainty in the yield. Dryland is not uniform and the areas differ in the degree of water limitations. According to the UNDP[1] terminology, four dryland subtypes are recognized: dry sub-humid, semi-arid, arid and hyper-arid. This classification is based on the increasing level of aridity[2] or moisture deficit. Dryland area covers about 40% of the world's area, and around 35% of the population live in the dryland area (CIESIN,[3] 2004). A total of 25% of the world's cultivable land comes under dryland agriculture.

Table 1: Classification of the Regions on the Basis of Aridity Index

Climate Zone	Aridity Ratio	% of World Covered
Hyper-arid	<0.05	7.5
Arid	0.05-0.20	12.5
Semi-arid	0.21-0.50	17.5
Dry sub-humid	0.51-0.65	9.9
Humid	>0.65	39.2
Cold	>0.65	13.6

Source: WMO-UNEP Report (1996): Interactions of Desertification and Climate.

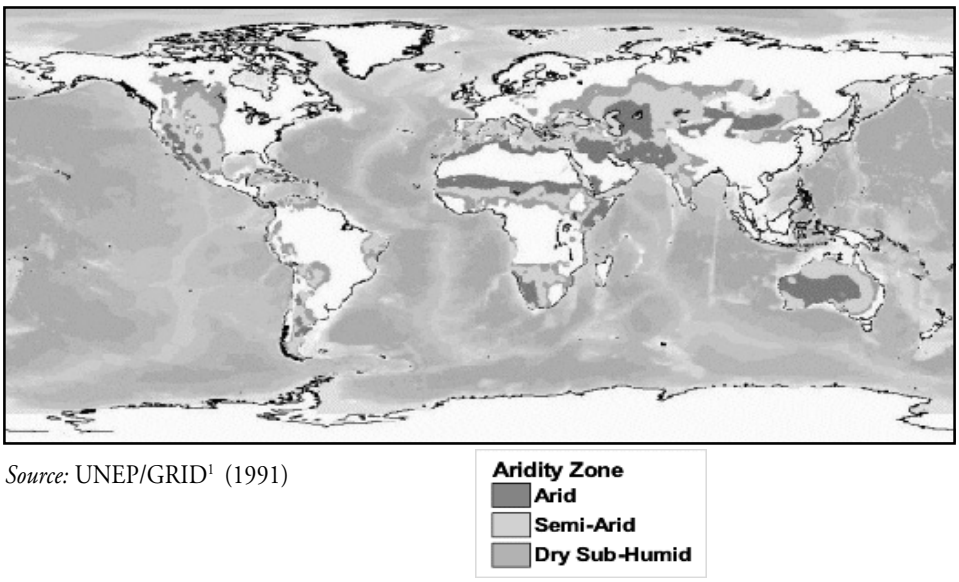
[1] United Nations Development Programme.

[2] A region is said to be **arid** when it is characterized by severe lack of available water, to the extent of hindering or even preventing the growth and development of plant and animal life. As a result, environments subject to arid climates tend to lack vegetation and are called xeric or desertic.

[3] Centre for International Earth Science Information Network, 2004.

Hyper-arid[4] area covers 7.5% of world's geographic area, whereas a major proportion of the area is covered by the arid and semi-arid regions. Both arid and semi-arid regions cover more than 30% of the total geographical area (Table 1). The spread of dryland area in the developing and the industrial countries is not uniform. It covers around 72% of the area in developing countries and 28% of the area in industrial countries (Safriel and Adeel, 2005). Thus, the majority of the dryland people live in the developing countries.

Figure 1: Extent of the World's Dryland:



Source: UNEP/GRID[1] (1991)

More specifically, hyper-arid zones are located in Saharan Africa, northern and south-eastern Saudi Arabia, Ethiopia and Namibia. Arid and semi-arid zones are more widespread, although there is a tendency for them to be found towards the western edges of tropical and sub-tropical areas of the continental masses—a feature that is particularly marked in southern Africa, the Americas, the Indian sub-continent, and to some extent, Australia. (Figure 1)

[4] Hyper arid region as a dryland classification is not included further in the analysis because it is considered as agriculturally not potential. According to FAO classification (2000), the growing period of crops begins when monthly precipitation exceeds half of the monthly potential evapotranspiration. The regions like hyper arid, where the monthly rainfall never exceeds half of the potential evapotranspiration. have zero growing days and thus not included in the drylands. Based on the above classification system, this area is classified as hyperarid and considered non-agricultural.

[5] UNEP/GRID. 1991. United Nations Environment Program/Global Resource Information Database *Global Digital Datasets for Land Degradation Studies: a GIS Approach*. Prepared by U. Diechmann and L. Eklundh. GRID Case Study Series No. 4. UNEP/GEMS and GRID. Nairobi, Kenya.

Approximately 54 million sq km or 40% of the land can be classified as dryland. The extent of dryland within each region ranges approximately from 1.3 to 18 million sq km. Region-wise, Africa is relatively the driest of the continents. Asia and Africa have the largest dryland area (13 and close to 12 million sq km, respectively) whereas America and Europe have the least dryland area (Table: 2).

Table: 2 Dryland Areas in Different Regions (in 000 km)

Region	Arid	%	Semi-Arid	%	Dry Sub-Humid	%	All Dryland
Africa	5052	17 (39.06)	5073	17 (39.23)	2808	9 (21.71)	12933
America and Caribbean	1201	3 (9.33)	7113	17 (55.27)	4556	11 (35.40)	12870
Asia	6164	13 (33.50)	7649	16 (41.57)	4588	9 (24.93)	18401
Australia and Oceanic	3488	39 (43.51	3532	39 (44.06)	996	11 (12.43)	8016
Europe	5	0 (0.37)	373	7 (27.86)	961	17 (71.77)	1339
World total	**15910**	**12**	**23739**	**18**	**13909**	**10**	**53558**

Note: The numbers in the brackets represents the share of dryland area in each region to the total dry land area.
Sources: UNSO/UNDP[6] (1997).

Asia contains substantial dryland area, with 39% of its total land mass being mostly arid and semi-arid, found in Central Asia and Western China. The hyper-arid region, which is excluded from the drylands, accounts for 9.9% of the global land area.

In Asia, Africa and South America significant share population reside in dryland area. In Asia around 42 percent, in Africa 41 percent and in South America 30 percent population concentrate in dry land region. These inhabit mainly the semi-arid and sub-humid regions. Thus, countries with high proportion of their population residing in the drylands should also be at risk of dryland degradation (Table 3).

Australia has more dryland than any other country in the world, with approximately 6.6 million square kilometres. Other countries with large amounts of dryland include the United States and three countries in Asia: Russia, China, and Kazakhstan-all with

[6] UNSO/UNDP. 1997. Office to Combat Desertification and Drought/United Nations Development Programme. *An Assessment of Population Levels in the World's Drylands: Aridity Zones and Dryland Populations*. Office to Combat Desertification and Drought. New York, NY.

more than 2 million square kilometres. Nine additional countries have more than 1 million square kilometres of dryland (Table 4).

Table 3: Extent of Population in Different Regions of the World (numbers are in thousands)

Continent	Arid	%	Semi-Arid	%	Dry Sub-Humid	%	Total Population in Dryland
Africa	40503	6	117649	18	109370	17	267522
America and Caribbean	19081	3	100753	14	581201	8	701035
Asia	161554	5	625411	18	657899	19	1444864
Australia and Oceanic	275	1	1342	5	5318	19	6935
Europe	629	6	28716	5	115216	20	144561
World total	**222042**	**4**	**873871**	**16**	**1469004**	**17**	**2564914**

Source: UNDP/UNSO - An Assessment of Population Levels in the World's Drylands.

Table 4: Countries with over 1 Million Square Kilometres of Dryland

Country	Area (000 km)	Dryland (000km)	
Australia	7705	6605	(85.71)
United States	9459	3902	(41.25)
Russia	16852	3672	(21.79)
China	9337	3177	(34.03)
Kazakhstan	2715	2693	(99.19)
India	3091	1848	(59.79)
Sudan	2508	1676	(66.83)
Canada	9909	1565	(15.79)
Argentina	2781	1469	(52.82)
Iran	1624	1466	(90.27)
Mexico	1962	1357	(69.16)
Brazil	8506	1305	(15.34)
Mongolia	1559	1015	(65.11)
Mali	1256	1007	(80.18)

Note: The numbers in the brackets represents the percentage share of dryland to the total area.
Source: ESRI[7] (1993).

[7] ESRI. 1993. Environmental Systems Research Institute. *Digital Chart of the World.*

A comprehensive survey by UNEP (1997) indicated that the dominant forms of land use and land cover in drylands is irrigated and rainfed agriculture, and rangelands, with forest and woodland occupying up to a quarter of all drylands. (Table 5)

Table 5: Dominant Types of Human Land Use (in mha) in the Susceptible Drylands (UNEP, 1997a)

Region	Irrigated Cropland	Rainfed Cropland	Rangelands	Total
Africa	10424 (0.79)	79822 (5.57)	1342345 (93.70)	1432591 (100)
Asia	92021 (4.89)	218174 (11.60)	1571240 (83.51)	1881435 (100)
Australia	1870 (0.27)	42120 (6.01)	657223 (93.73)	701213 (100)
Europe	11898 (8.17)	22106 (15.19)	111570 (76.64)	145574 (100)
N. America	20867 (3.16)	74199 (12.83)	483141 (83.56)	578207 (100)
S. America	8415 (2.05)	21346 (5.20)	380901 (92.75)	410662 (100)
World Total	**145495 (2.82)**	**457767 (8.87)**	**4556420 (88,31)**	**5159682 (100)**

Note: The numbers in the brackets represents the share of different land use pattern to the total area.
Source: http://www.envfor.nic.in/unccd/chap-2.pdf

3. Dryland[8] Agriculture in India:

3.1 Identifying the Dryland Area in India:

In India, 68% of the total net sown area comes under dryland cultivation, spread over 177 districts. In the country, 35% of the area receives rainfall between 750 mm and 1100 mm, and is drought prone. Most of drought prone areas lie in the arid (19.6%), semi-arid (37%) and sub-humid (21%) areas of the country that occupy 77.6% of its

[8] Dryland agriculture and rainfed agriculture are often used synonymously, but they are different from each other vastly. According to the US Department of Agriculture (Stewart *et al.*, 1985) the definition of the both are different:

Dryland agriculture implies areas where dry faming is practiced and includes farming systems without irrigation in regions of limited rainfall, usually < 750 mm per year.

Rainfed agriculture on the other hand implies areas where crops are produced without irrigation in sub-humid and humid regions, usually >750 mm per year.

total land area of 329 million hectares. Around 33% of the area receives less than 750 mm rainfall and is chronically drought prone, while 16% of the area receives less than 500 mm rainfall (large area of Peninsular and Rajasthan). On an average, rainfall is erratic in 4 out of every 10 years (Ministry of Agriculture/Drought Management Division, 2008).

Table 6: Classification of Rainfall Zones in India

Classification of Rainfall Zones in India (Rainfall in mm)	Zone	Net Sown Area (%)	Rainfall
<500	Arid	16	Very low
500-750	Semi-arid	17	Low
750-1100	Dry sub-humid	35	Medium
1100-1400	Moist sub-humid	24	High
>1400	Humid mountains	8	Very high

Source: Ramakrishna (1997)

Table 6 illustrates that in India, according to the rainfall zones, around 16% of the net sown area comes under the arid region with very low rainfall. The highest percentage of net sown area (35%) comes under the dry sub-humid zone. Only 32% of the net sown area comes under the high rainfall zone.

Rao et al. (1972) in the following table classified the climates of India by utilizing the available water capacity of the soil on the basis of soil type and crop (Table 7).

Table 7: Climatic Conditions in the Different Indian Regions

Region	Climate Type
Saurashtra, Kutchch, Western Rajasthan, Bellary (Karnataka), Anantapur (A.P.) and Tirunelveli (T.N.)	Arid
The area from Kanyakumari in the south to Punjab in the north, covering practically the whole of the Peninsula, east of western ghats and Gaya-Jumai area in Bihar	Semi-arid
Northern parts of Punjab, Harayana, Uttar Pradesh, Bihar, West Bengal, Orissa, Madhya Pradesh, Vidarbha and northern parts of A.P., and from Chennai to Nagapattanam (T.N.).	Sub-humid (moist or dry)
NE region, west coast and adjoining hills	Per-humid and humid zones

Source: Rao *et al.* (1999).

3.2 Characteristics of Dryland Agriculture in India

The economic and social indicators of drought prone areas in India are low when compared to those of non-drought prone areas. The share of net irrigated area to net sown area is drastically lower in drought prone areas compared to the non-drought areas. The other indicators such as area under double cropping, fertilizer consumption, number of tractors per net sown area and the land put under lease are comparatively much higher in the non-drought districts than in the drought prone areas (Nadkarni, 1985). This present section makes an attempt to examine the different indicators of dryland areas in India.

Rainfall Uncertainty and Output

Rainfall in dryland areas is inadequate to meet the water needs of the crop even during the main season, namely Kharif. As a result, it leads not only to lower yield but also leads to higher fluctuation in yield. This in turn, leads to uncertainty in income. The uncertainty in income in dryland areas is mainly because of variability in production rather than in price. Price variability is less important in dryland farming, and production variability is mainly affected by climatic variability (Walker, Singh and Asoken, 1986). Areas with assured rainfall and traditional irrigation systems are better placed in this respect. But the duration of cropping season as well as yields in these regions was also constrained by availability of water (Vaidyanathan, 2001). The dryland regions are relatively backward and the green revolution has bypassed the millions living in the drylands, surviving on one rainfed crop a year—which is either bound to fail or is not taken into consideration at all if the monsoon is poor, erratic, delayed or absent (ICAR, 1998).

Cropping Pattern

The dryland areas of the country contribute to about 42% of the total food grain production. Most of the coarse grains like sorghum, pearl millet, finger millet and other millets are grown in drylands only (Rao, 2004). Dryland crops account for as much as 48% of the area under food crop cultivation and 52% under non-food crop cultivation (Ministry of Agriculture, 2008). The high seasonal concentration of rainfall as well the variability of its quantum and timing, limits the duration of the cropping season, the kind of the crops grown and the yield obtained (Joshi, 2001; Pravakar and Shaw, 2008). According to Singh *et al.* (2000), the rainfed area covers 218 districts in the states of Punjab, Harayana, Rajasthan, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Gujarat, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu. In this belt, cultivation of coarse cereals (91%), pulses (91%), oilseeds (80%) and cotton (65%) predominate (Sharma and Singh, 2006).

Dryland districts in India are generally dominated by low value and low yield crops such as millets and pulses. However, the drought prone districts also cultivate commercial crops such as oilseeds and cotton, but they are subject to high instability both in respect to yield and prices (Nadkarni, 1985).

The farmers in the dryland areas generally cultivate multiple crops and do not specialize in a particular crop due to the high risk involved in the cropping pattern (Mohanti and Padhi, 1999; Pathy, 2003). Mixed cropping and multiple cropping are also strategies for crop protection from pests and it helps to prevent the spread of the risk (Pionetti and Reddy, 2002). Crop diversity constitutes one of the pillars of agriculture in semi-arid regions. Nadkarni (1985) pointed out that cropping pattern is more complex in the dryland areas. For example, cotton is mainly combined with either pulses or oilseeds. Similarly, jowar is combined with cotton, oilseeds or pulses; there is remarkable variation over regions in such combinations.

The diversification of crop in the dryland areas again depends upon factors such as the size of operational holding (Pathy, 2003) and wealth (Arrow, 1990) of the farmer. Besides, farmers' dependence is very high on livestock as an alternative source of income, apart from arable cropping.

Landholdings:
The dryland areas in India are mainly classified as the backward agriculture where the agents are mainly small and marginal farmers (Ffolliott *et al.*, 2002). The average landholding in dryland areas is around 0.15 ha, which is uneconomical for farming. Rainfed farmers are economically weak with little ability to withstand risk. Out of the 97 million farm holdings, 76% are small (<2 ha) and marginal, cultivating only 29% of the total arable land. The holdings are unconsolidated and scattered (Sharma and Singh, 2006). Knowledge transfer is minimal in these regions, information regarding new production is limited to relatives and neighbours (Mahapatra, 1978). Thus, in small landholdings following traditional cultivation, and with limited scope for innovation, the income of the farmer is very low.

Workforce
When one counts the total workforce that resides in the dry districts, it amounts to about 50% (Ministry of Agriculture/Drought managements, 2008). The data regarding the percentage of population engaged in cultivation in the semi-arid regions of India shows that around 51% of producers work in 8% of the land. The skew in the land distribution in the semi-arid tropics is greater than it is for the country as a whole (Harriss, 1984). Thus, in the drought prone areas with lower share of land under

irrigation, the skew distribution of land, does not allow the poor farmers to gain much income from farming (Pathy, 2003).

3.3 Risk[9] involved in the Dryland Agriculture in India

The agents in the dry land areas prefer to cultivate the traditional varieties of crop rather than the modern, as they involve lesser risk. However, traditional varieties generate lesser profit compared to the modern varieties. This is one of the factors for increasing the inequality among the coastal and dryland regions (Kshirsagar and Bellon, 2002). The small size of the operational holdings and the absence of irrigation facilities have not facilitated modernization of agriculture in the dryland regions (Singh, 1982). Lesser gain from the agricultural sector in the dryland areas forces the agents to diversify their occupation, but in the dryland backward regions the shift from the farm to the non-farm sector is distress-driven, whereas in the developed regions the shift is mainly towards increasing the income due to the improvement in the human development index (Jha, 2005). Dryland farming is generally defined as farming in regions where lack of soil moisture limits crop or pasture production. Expansion of cropland areas in dryland regions can fail owing to overexpansion of inappropriate production technologies into the drylands environment. Increased population pressures into these areas during long wet periods leave an increasing number of people vulnerable to drought. In the dryland area people live in the marginal environment and try to survive by avoiding the damage resulting from hazards. Poor people in the dryland generally not capable of investing sufficiently in the crop production, this leads to economic inefficiency and exploitation and degradation of the resource base and in turn sustain their poverty.

4. Crisis in Dryland Agriculture:

One of the main crisis in the dryland area is the occurrence of drought in periodic basis. Drought is a common feature in rainfed agriculture. According to the National Commission of Agriculture in India, drought is classified as "meteorological drought",

[9] *Type of Risk the Farm Households Face:* The income of the producers generally faces three types of risks: production risk, price risk and input risk. The production or the yield risk is due to two principle factors. The first one is random uncontrolled inputs due to weather and the second one is due to diseases. Price risk arises because there is substantial production lag in agriculture. The production decision is made far in advance of the date when output is realised. The farmer faces a risk when the forecasted price by the farmers is lower than the actual price. Price risk can also be a subject of the demand shock as well as instability in expectations formation. The input risks occur when there is shortage of inputs or when there is price variation. According to Barah and Biswanger (1982), stabilizing the yield of the dominant crops in the semi-arid regions is more effective then stabilizing the price risk. The farmers in the rainfed areas in India are mainly dominated with marginal holdings and produce for the local consumption. Thus, the price risk is not that severe for the farmers in the dryland areas compared to the farmers in the coastal areas.

"hydrological drought" and "agricultural drought". *Meteorological drought* is defined as a situation when there is significant decrease from normal precipitation over an area, i.e., more than 25% decrease. More precisely, meteorological drought is defined as an occasion when the rainfall for a week is half of the normal or less; when the normal weekly rainfall is 5 mm or more. *Agricultural drought* occurs when soil moisture and rainfall are inadequate to support healthy crop growth to maturity and cause crop stress and wilting. From the farming point of view, agricultural drought refers to drought during the growing season. An agricultural drought is defined as a period of four consecutive weeks of drought from May to middle of October. *Hydrological drought* may be a result of long-term meteorological drought which results in drying up reservoirs, lakes, streams and rivers and fall in the ground water level. Conceptually, drought is considered to describe a situation of limited rainfall that is substantially below what has been established to be a "normal" value for the area concerned (Pandey and Bhandari, 2007).

The concept of drought varies from one region to another depending upon normal climatic conditions, available water resources, agricultural practices and the various socio-economic activities of the region (Prasad, 1998). According to Gautam and Rao (2007), the risk involved in successful cultivation of crops depends on the nature of drought (chronic and contingent), its probable duration, and periodicity of occurrence within the season. In the arid region where the mean annual rainfall is less than 500 mm, drought is almost an inevitable phenomenon in most of the years. In semi-arid regions (mean annual rainfall 500-750 mm), droughts occur in 40 to 60% of the years due to deficit seasonal rainfall or inadequate soil moisture availability between two successive rainfall events. Even in dry sub-humid regions (annual rainfall 750-1200 mm), contingent drought situations occur due to break in monsoon conditions.

The classification of the area covered by drought in the states shows that the number of districts under DPA is highest in Maharashtra and Madhya Pradesh. The number of districts under DPA is also high in Tamil Nadu, Karnataka, Jharkhand and Gujarat (Table 8). Table 9 presents the occurrence of drought in the different meteorological sub-divisions in India. It is seen that the occurrence of the drought is very frequent in the sub-divisions like West Rajasthan, Tamil Nadu, Jammu & Kashmir and Telangana Region of Andhra Pradesh.

Table 8: Selected State-wise Number of Districts, Blocks and Area Covered under Drought Prone Areas Programme (DPAP) in India. (as on 31.01.2007)

States	Number of Districts	Number of Blocks	Area in Sq Km
Andhra Pradesh	11	94	99218
Bihar	6	30	9533
Chhattisgarh	8	29	21801
Gujarat	14	67	43938
Himachal Pradesh	3	10	3319
Jammu & Kashmir	2	22	14705
Jharkhand	15	100	34843
Karnataka	15	81	84332
Madhya Pradesh	24	105	89101
Maharashtra	25	149	194473
Orissa	8	47	26178
Rajasthan	11	32	31969
Tamil Nadu	17	80	29416
Uttarakhand	7	30	15796
Uttar Pradesh	15	60	35698
West Bengal	4	36	11594
India	**185**	**972**	**745914**

Source: Ministry of Statistics and Programme Implementation, Govt. of India. www.indiastat.com.

Table 9: Probability of Occurrence of Drought in Different Meteorological Sub-Divisions

Meteorological Sub-Division	Frequency of Deficient Rainfall (75% of normal or less)
Assam	Very rare, once in 15 years
West Bengal, Madhya Pradesh, Konkan, Bihar and Orissa	Once in 5 years
South Interior Karnataka, Eastern Uttar Pradesh and Vidarbha	Once in 4 years
East Rajasthan, Gujarat and Western Uttar Pradesh	Once in 3 years
West Rajasthan, Tamil Nadu, Jammu & Kashmir and Telangana Region of Andhra Pradesh	Once in 2.5 years

Source: Ministry of Statistics and Programme Implementation, Govt. of India. www.indiastat.com.

Jodha (1988), in his study, showed the percentage of area covered by the different rainfall zones. The percentage of area in India where the frequency of drought varies between 2-3 years covers around 13% of the total geographical area, 11% of the total cropped area and 6% of the rural population. The share of area where the frequency of drought is 4 years covers 36% of the geographical area, 42% of the total cropped area and 36% of the rural population. In around 30% of total country's geographical area, drought reoccurs in every 5 years and it covers 37% of the rural population and 30% of the total gross cropped area.

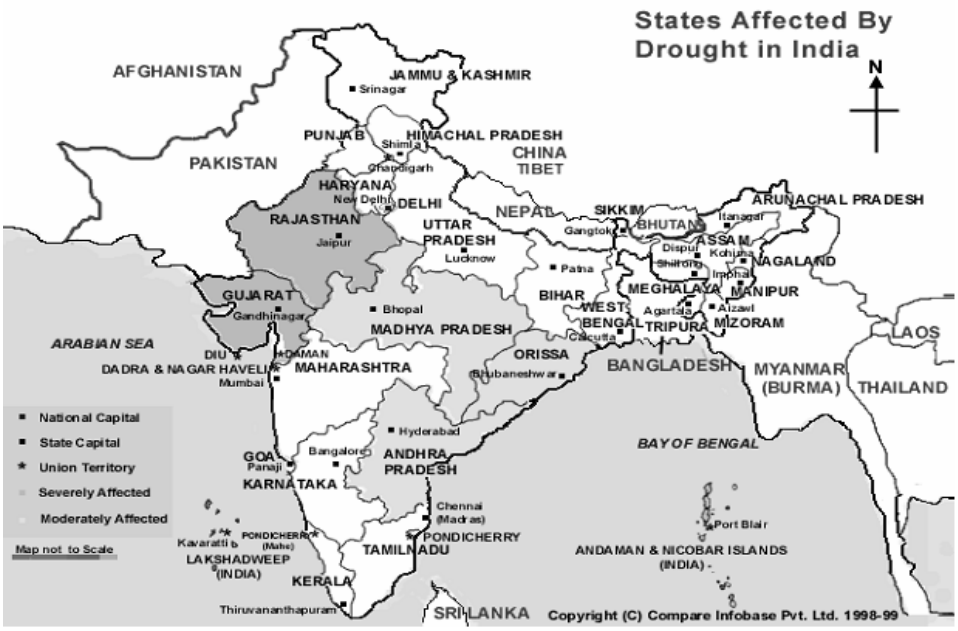
Table 10: Administrative Districts Frequently Affected by Drought

States	Districts
Andhra Pradesh	Anantapur, Chittoor, Cuddapah, Hyderabad, Kurnool, Mehaboobnagar, Nalgonda, Prakasam
Bihar	Munger, Nawadah, Palamau, Rphtas, Bhojpur, Aurangabad, Gaya
Harayana	Bhiwani, Gurgao, Mahendragarh, Rohtak
Jammu & Kashmir	Doda, Udhampur
Karnataka	Bangalore, Belgaum, Bellary, Bijapur, Chitradurga, Chickmangalur, Dharwad, Gulbarga, Hassan, Kolar, Mandya, Mysore, Raichur, Tumkur
Madhya Pradesh	Betul, Datia, Dewas, Dhar, Jhabuva, Khandak, Khargaon, Shahdol, Shahjapur, Sidhi, Ujjain
Maharashtra	Ahmednagar, Aurangabad, Beed, Nanded, Nashik, Osmanabad, Pune, Parbhani, Sangli, Satara, Sholapur
Orissa	Phulbani, Kalakhandi, Bolangir, Kendrapada

Source: Ministry of Statistics and Programme Implementation, Govt. of India. www.indiastat.com.

Drought affects slowly over a considerable period of time and may linger for years even after the termination of the event. The occurrence and severity of drought adds confusion for the suitable planning of the government. Drought produces a complex set of highly differentiated adverse impacts that ripple through many sectors of the economy. It affects the biophysical, socio-economic and environmental sectors of the region hit (Pandey, Bhandari and Hardy, 2007). Drought leads to food insecurity, malnutrition, starvation, poverty, disinvestment in human capital and reduction in the financial resources. For example, in the village of Jhabua, Madhya Pradesh, the incidence of

Figure 2: States Affected by Drought in India



Source: Ministry of Statistics and Programme Implementation, Govt. of India. www.indiastat.com.

drought caused failure of crops like wheat, groundnuts and cotton, and the production of all the Kharif crops was less than 10% of the normal availability. There was big loss in fodder availability which was only 13% of the normal availability. Due to non-availability of fodder and water, milk production also reduced. Death and distress sale of cattle was the long-term loss that occurred during the drought period (Joshi, 1999).

Wilhite (1993) and Alston and Kent (2004) argue that the problem of the dryland agriculture has received attention in recent times not because of the increase in the frequency and the severity of drought, but because the vulnerability of the society to drought has increased due to growth in population, changing farming practices, etc.

One of the sectors where the immediate impact of drought is felt is agriculture. With the increased intensity or extended duration of drought prevalence, a significant fall in food production is often noticed. Drought results in crop losses of different magnitude depending on their geographic incidence, intensity and duration. Drought not only affects the food production at the farm level but also the national economy and the overall food security (SAARC/SDMC). The detailed consequence of drought on the aggregate economy of the dryland area and on the livelihood of the people includes

decline in the crop area under cultivation and set back of the agricultural production that leads to fall in employment. This in turn leads to fall in the income and the purchasing power of those engaged in agricultural activity (Pandey and Upadhyay, 1979; Dubhashi, 1992; Muranjan, 1992; Uddin, 1984; Acharya, 1992). Drought also leads to scarcity of drinking water, and scarcity of food grains results in increase in the prices of food grains and other commodities. The effect of the drought can be felt at the aggregate level. The fall in the effective demand from the agricultural sector leads to slowing down of the economic activity in the secondary and tertiary sector. As drought leads to the reduction in the calories intake, the result is health problems and death due to malnutrition among children.

The effects of drought can be classified as short term and long term. Short-term effects lead to decline in the crop area and agricultural activity; and in the long run, it in turn leads to the migration of people to other areas. The consequence of drought in the short run adversely affects the food grain production which can lead to drop in employment and income, and in the long run, it leads to distress sale of assets and migration out of the village. Another short–term effect of drought is decline in the food stock; it leads to the increase in food grain prices, and thus, there is reduction in the intake of food, and in the long run, it affects the health of people and leads to starvation.

The dryland areas of India are mainly identified as the backward areas and dominated by small and marginal holders (Harriss, 1984). Distress situations such as drought lead to sale of assets. In this process, the marginal farmers join the group of the landless labours during the drought and they remain landless for a long time as they do not have any means of recovering their lands unless public policies come to their aid (Dubhashi, 1992). The poor households in the backward drought prone areas are affected from both demand side and supply side. The price at which the farmers sell their assets during the drought period is lower compared to the purchase price of the assets in the normal year. On the other hand, the price of these assets acquires greater momentum during the post-drought year, and nearly doubles the amount at which these assets were sold during the drought year. However, in case of agricultural produce like food grains and fodder, the prices are quite high during the drought period and are lower during the post drought period. Thus, the extent of loss in the process is more than sustenance income (Jodha, 1978).

5. Coping with Distress Situation in the Dryland Areas

Drought and seasonality are regular phenomenon in the dryland areas. The people in the dryland areas have their own strategies to cope with distress situations. The farmers in the drought prone areas can predict the seasonal rainfall fluctuations based on historical

averages. They formulate coping strategies to deal with the expected rainfall variability around the averages and also during distress situations such as drought (Chen, 1991). As explained by Davies (1993), coping is defined as an array of short-term strategies adopted in response to crisis. The main aim of a coping mechanism is to maintain the various purposes of the house, such as livelihood security, consumption, health and status, thus ensuring individual and collective well-being. Livelihood security and status are long-term objectives involving the strengthening of assets, incomes and social position, to maximise future claims on resources. Food consumption and health are more immediate objectives that entail finding sufficient food and income to meet the health and nutritional needs of the family members (Adams, Ceken and Sauerborn, 1998).

According to Binswanger, Jodha and Barah (1979) there are mainly two types of strategies adopted to ensure the survival of the peasant households in dryland areas. The coping strategies are: (1) the households seek to minimize the risk of failing to produce their subsistence; and (2) they seek to limit their losses following a production failure. Swinton (1988) categorises the different measures adopted by the agents in dryland areas. According to him, there exist a number of possibilities for the farm households to face the deficit caused by drought. The initial reaction involves foregoing special kind of consumption and intensifying habitual dry-season income-generating activities such as suspension of unnecessary consumption, i.e., ceremonies, gathering of famine foods from the natural environments, dry-season gardening, sale of gathered hay and wood, sales of handicrafts, borrowing of grain from kin, and temporary migration of wage labour. The other type of response is the management of asset loss. These include: livestock sales, borrowing from merchants, selling domestic assets, selling land, and permanent migration. In his study, he argues that these responses are region-specific. According to him, although there may seem to be a wide range of alternatives in practice, only a few have a significant impact, while others are options only for specific locations. For example, dry-season gardening is viable only where there exists accessible reserve irrigation water.

Broadly, the literature identified two types of coping strategies of the peasant households in dryland areas to handle distress situations. Such mechanisms involve both activities undertaken in anticipation of rainfall variability, called *ex-ante* or risk management strategies, and response to drought, known as *ex-post* or crisis management strategies. The type of initiatives that a farmer takes before a particular climatic event (monsoon fluctuation or bad rainfall) is known as *ex-ante*. These risk management mechanisms are based on expectations of the likelihood of bad or good events, which are in turn primarily based on historical experience. These activities are called risk-reducing strategies. The activities that take place after the event, i.e., *ex-post*, attempt to rearrange what has

already occurred (Stern, 1999). If the risk-averse households are not able to achieve an entirely smooth consumption path through *ex-post* mechanisms such as insurance, saving and credit transaction, they have an incentive to devote resources *ex-ante* in an effort to secure a more stable income stream (Ramswami *et al.*, 2004). The *ex-ante* coping mechanisms can also be called the "income smoothing mechanisms", and the *ex-post* mechanisms can be referred to as "consumption smoothing mechanisms" (Bhandari *et al.*, 2007)). It has been pointed out by Jodha (1981) that the *ex-ante* strategies are often identified as permanent features of the farming systems and therefore their role in risk management is sometimes overlooked.

The *ex-ante* and *ex-post* are strategies explained by Stern (1999) can be categorised into two sets of variables. The different types of coping strategies are explained in a tabular version (Table 11) as follows.

Table 11: The different Types of Coping Mechanisms adopted by the Farm Households

Production and Consumption	***Ex-ante***	***Ex-post***
Production: reduce adverse impact of climatic events on agricultural output and profit; exploit opportunities	- Diversify crop	- Reduce or intensify inputs
	- Rely on no-farm	- Change crops
	- Invest/disinvest in irrigation, fertilizer	- Depend on irrigation sources
Consumption: reduce impact of fluctuations in output on access to consumer goods and services	- Accumulate assets	- Buy or sell assets
	- Purchase crop or weather insurance	- Receive or provide transfer
	- Share cropping	- Seek non-agricul tural employments
	- Arrange to share with family	- Migration
	- Diversify income sources	

Source: Stern (1999)

5.1 Ex-ante Coping Mechanisms

Diversification of the Field:

Agricultural activities vary from location to location. The distribution of rainfall is also different from one field to the other across different locations. This helps the farmers to stabilize their agricultural output through spatial scattering of fields. The aim of

diversifying the field is that even if the output in one location where the rainfall is low fails, the farmers can gain from the field where the rainfall is good. This mechanism also helps the farmer to better exploit the specific inches of different micro-environments for productivity enhancement. Thus, the same risk factor like drought does not affect all types of fields in the same manner; hence they can minimise the yield variability (Ramkrishna *et al.*, 2004). However, this method can cause loss to the farmer due to increasing cost of moving inputs and marketing output from widely separated fields (Bhandari *et al.*, 2007). This technique is also not applicable in a condition where the farmers are with small and marginal land holdings (Subbiah, 2004).

Diversification of the Cropping Pattern:

Crop diversification is regarded as the most common and effective risk management strategy that is employed by the farm households (Burton *et al.*, 1996; Ramaswami *et al.*, 2004; Reddy, 2009). The logic behind this strategy is that even if one crop does not do well, it may be compensated by gains in the other crop. Growing a number of crops is also one method to reduce the risk caused by the weather (Gajana and Sharma, 1990). The study by Gajana and Sharma (1990) observed that in the study village, the farmers produce 7-10 crops on their farms. Mixed cropping or inter cropping was found to be more prominent in small farms. In the study village, around 90% of the marginal farmers went for mixed/inter cropping in around 69% of the total area. Mixed cropping was found to be mainly groundnuts based. It also consists of red gram, horse gram, cow pea, jowar and bajra. This type of involvement not only helps the farmer to meet the cereals needs, but also the fodder needs of cattle. Groundnuts meet the financial needs of the farming family. The study by Walker and Ryan (1990) shows that in the ICRISAT villages, large farmers are more diversified than the small farmers. The large farmers have more landholdings; therefore they can exploit location-specific production opportunities and also have greater access to credit for financing more input-intensive cropping activities. Another study by Gupta and Tiwari (1985) on crop diversification in various states felt that small farmers are more diversified than the large farmers. However, Singh *et al.* (1985) and Haque (1985) had a different opinion that there exists an inverse relation between crop diversification and farm size. This contradictory view of cropping pattern diversification might depend upon the specific region's economic and social conditions. Again the practice of the crop diversification needs careful attention while choosing crop variety. Many attempts of dryland farming failed due to lack of recognition of the requirements for the variety selection (Ramakrishna and Rao, 2008).

Inter Cropping:

Inter cropping is another way for farmers to manage yield risk. Inter cropping lowers the yield risk as it has greater potential for yield compensation (Walker and Ryan, 1990;

Pionetti and Reddy, 2002). Varieties with different durations can reduce risk by avoiding period-specific risk. Short-duration crops can escape terminal drought that can severely affect the yield of longer duration varieties. In a rainfed rice village of Orissa, more than 70% of the farmers have been found to grow four or more rice varieties, while 20% of the farmers grow 6-8 varieties (Kshirsagar *et al.*, 1997). But this mechanism of risk avoiding is specific to location and the same cropping system and does not always work (Walker and Ryan, 1990). The inter cropping method can reduce risk when the covariance between the crops is either negative or zero. The study by Walker and Jodha (1986) found that there exists higher correlation between sorghum and pearl millets (0.63) in the study village. This shows that these crops are affected by the same sources of risk. Like crop diversification, inter cropping appears to be a response to physical recourse endowments, particularly to the quality of those endowments. Difference in the personal characteristics, such as risk-averse attitudes does not appear to affect the variation in the extent of inter cropping between households. Lack of access to irrigation, marginal quality of land reflected in low land values and rainy season cropping are the driving forces conditioning the inter-household variation in inter cropping (Singh and Jodha, 1986).

Production Flexibility:

Production flexibility is integral to the practice of dryland farming (Jodha, 1981). When crop failure is predicted, the households begin saving by-products and other low-value operations that would not be useful during normal years. The farmers shift from high-value crop cultivation to crops that have a greater chance in adverse weather circumstances (Walker and Ryan, 1990). The rainfall pattern during the early stages may determine the choice of crops. If rainfall is low or delayed, the farmers may forego rice completely and expand the area under crops that require less water. If the crop fails to establish itself due to lack of rainfall, the farmers may think to replant. Walker and Rayan gave an example where castor is substituted for sorghum due to late arrival of the monsoon in Aurepalle. But these temporal adjustments in production by this mechanism is subject to constraint by farmers' ability to acquire and process the necessary information regarding crop status, and the likely future realizations of uncertain events (Bhandari *et al.*, 2007).

Occupational Diversification:

Occupational diversification is another measure to adjust in the risk environment. The farmers generally try to engage themselves in multiple activities that can provide them flexibility and strength to face risks. When the farmers have a secondary occupation they can easily face risk situations. The most common subsidiary activities observed in rainfed areas are dairy, poultry, sheep rearing and sericulture, along with crop cultivation. The farmers also engage themselves in wage labour and non-farm activities (Subbaiah,

2004). The analysis of the coping mechanisms in two zones of Tamil Nadu, i.e., Uttangarai (Zone: I) and Dharmapuri (Zone: II), showed that income diversification was observed to be a common mechanism in the areas (Umamaheswari *et al.*, 2001). Chen (1991) stated that in the dryland village of Maatisar, the people engaged in multiple activities for income. In terms of the secondary occupation in the village, the majority of peasant households engaged in wage labour for some part of the year. Many households reared milch animals and a smaller number of households, mainly cultivators, reared draught animals. Some households also engaged in cotton spinning and manufacture of rope from a local wild grass. Sheep rearing is generally practiced by the small and marginal farmers to generate stable income. However, these activities are influenced by the social status of the households. Thus, this activity is confined to a particular caste (Gajana and Sharma, 1990). The sale of labour power is found among the marginal farmers. The study by Gajana and Sharma (1990) found that these farmers had extended the duration of wage earning from two to four months to tide over the financial difficulties during the drought year. It is observed that the farmers in the study area are not willing to switch over from agriculture to a totally different profession like business even if RBI advanced loan for setting up small business. The shift to non-agricultural activity again depends upon factors like rural education, transportation infrastructure, access to institutional credit and availability of local resources (Bhandari *et al.*, 2007). According to Reardon (1988), in areas where the environmental condition is conducive for strong agricultural base, income-generating activities that take advantage of agriculture's forward and backward linkages expand. But income diversification in the agriculturally poor areas tends to be outward looking, with households diversifying their income geographically. According to Agarwal (1990), variation in the employment opportunity and diversification of income sources requires close family co-operation. For example, livestock and poultry are typically looked after by women and children.

Share Cropping:

Share cropping is a basic arrangement that leads to share of inputs and outputs and also leads to share of risk between the landlord and the tenant. This a mechanism by which both the landlords and the landless try to overcome the risk. For example in the study village, during the winter season in normal years, an estimated 15 to 20% of the households enter share-cropping contract involving 10 to 15% of the total cultivable land (Chen, 1991). There are few general norms for the share cropping in the dryland area during distress situations: tenancy contract is mainly short-term, generally for specific crop and specific region, the majority of share-crop contracts are negotiated for the winter season, when irrigation is necessary. The households decide to share-crop land when they do not own either labour, capital, bullocks, pump sets or farm equipment (Jodha, 1981). Share tenancy helps the farmers make better use of their specific asset-

base across the different seasons. The households owning land but no pumps may choose to cultivate their land during the monsoon season and share-crop their land during the Rabi season and migrate to return in time for preparing their land for the next monsoon season. The study by Shaban (1987) shows that share cropping is quite common in the ICRISAT villages. The analysis of the land lease with regard to the size of the landholdings shows that in the ICRISAT villages, around 47% of the partners share crop among the same holding size, 32% share crop on the reverse, and 22% of the land is leased by large farmers to smaller farmers. Even though share cropping helps the farmers to avoid risk, from the economist's point of view, it is an inferior system of tenancy (Ramaswami, *et al.*, 2004). However, this system persists because unlike in the fixed tenancy, the tenant can pass half of the risk to the landlord in share cropping. Thus, share cropping is a common feature in places where there is little scope for decision making and the entrepreneurial profit is low, i.e., in the backward areas of dryland (Rao, 1971).

Crop Insurance:
Crop insurance gives financial means of risk-spreading mechanism through which the cost of natural disasters are distributed among other sectors and throughout the society (Ramaswami, *et al.*, 2004). Crop insurance is a contingency contract in which farmers pay premiums and collect indemnities when yields fall below an insured level. This is normally provided by the public sector. The crop insurance can help in two ways: by increasing mean income levels or by reducing income variability. The former is known as transfer benefit and the latter is known as risk benefit (Walker *et al.*, 1986). But quite surprisingly it has been observed in the literature that few farmers demand crop insurance both due to lack of awareness as well as linking it with institutional credit (Rani *et al.*, 2007). It also has been observed that traditional crop insurance schemes failed world wide, may be because of high cost of monitoring, adverse selection and moral hazards (Pandey *et al.*, 2007).

5.2 Ex-Post Coping Strategies:
This strategy basically practices to cope with the distress that occurs despite various risk-reducing measures. The literature identifies the following main activities that the farmers generally adopt after drought occurs.

Reducing Consumption:
Reducing food consumption is observed as an integral part of the response to drought in India. In a study of survival during drought and non-drought years in sample villages in Tamil Nadu, it was found that a large reduction in food intake was a feature of consumption pattern during drought years even for the large farmers (Subbaih, 2004). The study by Prasad and Rao (1997), shows that reduction of consumption leads to less

intake of meal; from solid to liquid food, i.e., jowar or *korra balla* to *ganji*, and taking solid food during alternate days. The people also shift from eating course gains to the uncultivated greens and forest collected foods (Sateesh and Reddy, 2000).

Another study by Umamaheswari *et al.* (2001) on the two zones of Tamil Nadu (the two zones are defined on the basis of the probability of the occurrence of drought) shows that the consumption expenditure during the drought years reduced by 17.45% and by 15.14% respectively in zones I and II. The decline in expenditure on total food items was the smallest while the cut down in expenditure on items like food, socio-religious ceremonies, clothing, education and medicine was higher.

Asset Sale:
The people in the dryland areas adopt hard options like selling of assets during crisis situations. It has been found that people sell draught animals, agricultural implements, jewellery and other such assets in the drought prone areas in order to cope with the distress situation (Jodha, 1978; Nadkarni, 1985; Prasad and Rao, 1997). The analysis of the coping mechanisms in the two zones of Tamil Nadu, i.e., Uttangarai (Zone I) and Dharmapuri (Zone II) showed that sale of assets like livestock was on a large scale during the drought period due to difficulty in maintenance. The second category of disposed assets includes home and farm assets (Umamaheswari *et al.*, 2001). A study of 90 rainfed rice farmers from Philippines showed that 20% of the respondents were forced to sell their farms and 6% sold their household properties in order to cope with the distress situation (Lazo and Tapay, 1999). The selling of the assets may have different purposes for different groups of cultivators. Large and medium farmers sell surplus as well as needy livestock during crisis situations because of non-availability of fodder, whereas small farmers, marginal farmers and the landless are forced to resort of selling livestock to meet their consumption needs, or to get money before migration (Prasad, 1998). In his study, Prasad observed that 50% of the medium farmers sell their assets, whereas only one-fourth of the marginal and small farmers sell their assets at the time of migration. The ICRISAT village survey also witnessed the sale of assets mainly for consumption purpose, and it has been observed that 86% of households were involved in at least one transaction of bullocks, indicating that many of them were perhaps motivated to meet consumption requirements (Ramaswami *et al.*, 2004). In some places, the mortgage of assets is higher and generally practiced compared to the sale of the productive assets (Chen, 1991). Chen's study found that over 15 to 20 years, the number of reported land sales has been far lower than the number reported mortgage transactions: 19 sales were found, totalling 150 acres in the study village.

Swinton (1988) analysed the drought coping strategies in Niger. The study result shows that livestock liquidation was the principal means by which the farm households financed

their cereals needs following the 1984 drought. A combination of livestock sales, temporary migration, non-agricultural income activities, loans and food aid allowed virtually all of the farm households to survive the drought. They succeeded by retaining intact the productive resources that are most difficult to recuperate if lost like family labour, land and farm equipment. Livestock losses were significant but generally recoverable within 2 years.

The study by Singh (1988) calculated the monetary value of the assets depleted in five districts of Uttar Pradesh. On an average, the total amount of depleted assets per household varied from Rs.525, in Alora District, to Rs.1,397, in Muzaffernagar District. The study also found that the depletion of assets per household increased with increase in the size of holdings in all districts. It shows that cultivators belonging to large size groups depleted their assets more in comparison to cultivators belonging to small size groups in all the selected districts. Among the assets depleted, it was found that livestock depletion was highest compared to other fixed assets. Disposal of home, livestock and farm assets reduce the farmer's capacity for further investment, and in turn, their income, and hence, they are forced to borrow money (Umamaheswari *et al.*, 2001).

Migration:
Seasonal migration is a regular feature observed among the poor farmers during distress situations (Friendly, 1994; Prasad and Rao, 1997; Prasad, 1998; Umamaheswari *et al.*, 2001; Subbiah, 2004; Shah and Shah, 2005; Reddy, 2009). Seasonal migration as defined by Reddy (1992) is the movement for employment for a short duration. The basic reason for this type of migration is non-availability of adequate work in one's own place of residence. The study by Prasad (1998) shows that in the study village, nearly 70% of the total households migrate seasonally to different places, since the past two decades. Among the different classes of migrants, 60% of the total landless, 78% of the total marginal farmers, 85% of the total small farmers, 47% of the medium farmers and a small proportion of the big farmers (8%) seasonally migrate. The higher share of the small and marginal farmers among the migrants compared to the landless is because the landless are relatively more dependent on landlords and consequently get tied up as attached labourers in the village. Chen (1991) analysed the reason for migration among the villagers, both from the supply side and the demand side. On the supply side, there are two reasons. The first reason is that the local labour markets do not adequately absorb the available labour. Secondly, the small and tenant-farmers cannot afford the irrigation costs to cultivate crop. Similarly, there are two reasons for seasonal migration from the demand side. Firstly, there exist job opportunities outside, where they can engage themselves in the production of cash-crop and non-farm employment opportunities. Secondly, the migrant labourers are able to negotiate reasonably steady

employment for five to eight months during the dry season. The period of seasonal migration is mainly during the off-season where they do not find a job inside the village. The study of Jhabua Village in Madhya Pradesh shows that seasonal migration during the low rainfall periods is around 46%—from Diwali to the beginning of rain; when the Kharif crop fails, the migration starts two months earlier (Joshi, 1999).

The pattern and magnitude of migration depends upon the temporal dimension of the drought/distress situation in the village (Friendly, 1994). For example, in a localised drought the migration may be either inter-district or among the neighbouring districts. But migration to the area by place may be less effective at the time of prolonged drought condition because of covariate movements in income within small geographical areas (Pandey, *et al.*, 2007). The prospects of earning income within localities affected by drought are limited due to reduction in demand for labour in both agricultural as well as non-agricultural sectors.

Borrowing:
To compensate the erosion in the income and purchasing power, the farmers use borrowing as an adjustment mechanism (Harriss, 1983). During a drought year, the villagers borrow from both institutional and non-institutional agencies for consumption as well as production purpose (Acharya, 1992). His study shows that in the sample village, half of the families adopted this adjustment mechanism. Out of the total families, 70% borrowed for consumption purpose, while 51% borrowed funds for production purpose. Out of the total borrowing, 42% was from institutional agencies, while 57% was from non-institutional agencies. The consumption credits are mainly from the informal market, which charge high rates of interest (Prasad, 1998). The detailed study by Chen (1991) showed that the study village Maatisar witnessed several types of informal and formal credits. Credits such as short-term loans, interest-free loans, barter or exchanges between kinship and caste groups, credits advance for the casual labour and the credit sales at the local shops are generally witnessed to be used for consumption purpose in the particular village. Marriage costs in the village are generally met by mortgaging land and by credit advance to attached labour. The major investments (buying of pump sets or bullocks) in the village are made either by mortgaging land, pawning ornaments, negotiating government bank credit or through credit purchases in the market towns. In the village, to fulfil the working capital needs, the peasants finance themselves by informal sources of credit. The study of Ananthapur District by Prasad (1998) also witnessed a similar pattern of loan arrangements among the households. Cultivators who have better accessibility to formal and informal credit institutions and individuals advance loans more freely than others. Women were found to be active negotiators of day to day consumption needs; they

take credit for the basics from the local shops and loans from the kin and neighbours (Chen, 1991; Prasad, 1998). Women draw upon other women for borrowing small amounts of foodstuffs, fuel and fodder. There exist some helping relationships among the people; the kin can provide labour exchange, sharing irrigation water, renting agricultural implements, draught animals and machinery, thus enabling to increase small farm productivity (Agarwal, 1990).

Drawing from Common Property Resources (CPR):

Income drawn from the common resources can be considered as a method to cope with the shock faced by the people in the village (Jodha, 1986). The dependence on the CPRs by the poor is mainly because of the fodder and fuel wood. The poor agricultural households obtain their income from various sources. Apart from agriculture, they engage themselves in livestock, poultry and collect/sale products in the common resources such as fruits, honey and fuel wood (Agarwal, 1990; Jodha, 1975). Access to the village CPRs and the state forests plays a critical role in enabling poor rural households to obtain essential items for daily use, to diversify income sources, and to increase viability and stability of traditional farming systems by allowing a more integrated and diversifying production strategy (Agarwal, 1990). The study of the semi-arid tropics of seven regions of India by Jodha (1986) illustrated that in most of the districts, the poor households derive more than 20% of their income from the CPRs. In all the other districts, the range of income varies between 9-13%. The common resources are not always physical but can also be financial resources, which are mostly micro-finance projects. Such projects aim at building funds at the village level. This also helps in structuring the social capital within the communities, which leads to the better enforcement of mutual insurance mechanisms (Ramaswami *et al.*, 2004). Chen's (1991) study on Maatisar Village households' coping mechanism demonstrated that CPRs can be grouped into several categories, including physical products, supplemental income and employments, and certain community gains. In the study village, around 35 physical products were reported to be harvested from CPRs. The greater number of products contributes to subsistence fuel and fodder supplies. The other set of products that contribute to local market are artisan products. In the village, poor households collect 70% of their fuel and 55% of their fodder from the CPRs. The remaining households collect over 50% of their fuel and 25% of their fodder from free sources. Thus to conclude, the CPRs not only serve as buffer against seasonal shortages but also contribute to rural equity (Dasgupta, 1987).

Conclusion:

From the above discussion, it is obvious that seasonality and drought adversely affect the farm households. The economic loss of seasonality and drought is long term. The multiple effects of the drought can be physical, economic, social or environmental. The

large-scale loss by drought leads to a distress situation in dryland agriculture, making it more uncertain and variable. The economic loss of drought leads to disinvestment which adversely affects the asset creation of the farm households. It is identified in the literature that farm households adopt different coping mechanisms to face the distress situation. The *ex-ante* and *ex-post* coping mechanisms are defined depending upon whether they help to reduce the risk or reduce the impact of the risk. Some of the strategies are also identified as influential in handling the distress situation. However, these coping mechanisms again differ from region to region and among different class structures. For example, coping with risk can vary from large landholders to small or marginal landholders. These coping mechanisms again have some opportunity cost involved in it. For example, the cultivator can shift from superior crop cultivation to the inferior or traditional crop varieties, but that in turn reduces the income of the cultivators compared to the normal years and compared to cultivators in other areas. These coping mechanisms often reduce the capital investment of poor farmers. Again, the poor backward farm households depend upon some non-market institutions for the credit to cope with drought, but these are very costly and affect the long-term growth of income of the farm household. Thus, these coping mechanisms adversely affect the asset creation of the backward households and again push them into poverty.

Most of the traditional societies in drought prone areas do not manage drought in isolation from their overall farming system. They develop strategies like loss-minimising land utilization and social arrangement to deal with drought, in tune with the survival compulsions. Thus, for any policy framework and management intervention, a proper understanding of the local people's awareness, response, priorities and own coping strategies is needed.

Research Questions that Come up from the Above Discussion:

1. What is the impact of the drought on the income of the agent in the dryland areas at the aggregated level?
2. Which section of farmers is more prone to risk in rainfed agriculture?
3. What are the different coping mechanisms adopted by different classes of farm households?
4. What are the institutional support mechanisms available for coping with adverse situations and what section of farmers gain out of that?

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