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1. Preface

1.1. India is predominantly an agrarian country. Agriculture and allied sectors such as livestock, forestry together contributed 13.7 per cent of the country’s GDP (Gross Domestic Production) in 2013 and employed around 50 per cent of the nation’s workforce. The Green Revolution rolled out during mid-1960s and practised over the subsequent decades has imparted to the country, food security, as also surpluses in certain commodities. The year 2017-18 ended with record foodgrain production of 284.83 MT. Of this rainfed agriculture contributed more than 45 per cent. The rainfed region supports two thirds of livestock population and thus is, considered critical to food security, equity and sustainability. Despite India ranking first in rainfed agriculture globally in terms of area (more than 50 per cent of the country’s net sown area) and production, productivity is among the lowest in the world. Rainfed agriculture in India is complex and diverse which is highly dependent on rainfall.

1.2. More than 50 per cent of net sown area is under rainfed regions which is highly vulnerable to various climatic factors. The major challenges in rainfed agriculture are decline in factor productivity, poor soil health, loss of soil organic carbon (SOC), ground and surface water pollution besides depletion stress, increased incidence of pests and diseases, increased cost of inputs, and adverse impact of climate change. Further, poor infrastructure & flow of credit, lower coverage of insurance, lack of skill and knowledge aggravate the vulnerability of rainfed systems.

1.3. Most rainfed areas are confined to arid, semi arid and sub humid regions of the country and are highly dependent on rainfall for both crop production and allied activities. Notwithstanding that the country receives 4000 BCM of water per annum through rainfall, it has been facing severe water crisis over the recent years due to erratic or uneven distribution of rainfall, exacerbated by the impact of climate change. The crisis is also an outcome of unscientific practice of agriculture, non judicious use of groundwater, poor soil and moisture conservation practices and the like. Drought cause deleterious impact on productivity and incomes. Anticipation of droughts dis-incentivises the farmers from making necessary investments in asset creation, technology etc. In result a vicious cycle of poor management of agriculture
and low gross output & incomes is created in rainfed areas. Hence the need for comprehensive drought proofing of drought vulnerable areas.

1.4. The Drought Proofing Action Plans (DAPs) are the proposed blue print for drought proofing of most vulnerable districts over a period of 5 years. The action plans document the current scenario of the district in terms of its agriculture including crop production (both seasonal & horticultural crops) and sericulture (cropping system, production, productivity), animal husbandry (cattle, buffaloes, horses, camel, small ruminants and their nutritional status), human population (male, female, SC, ST, literacy and employment status), rural industries (current and future, their employment generation potential based on natural resources available), and most importantly its natural resources - the soils and water. The most critical approach while developing a drought proofing plan for a district is sustainability with respect to key natural resources – soil, water and bio-diversity.

1.5. Drought comes with appointment: Water is critical to agricultural production system. In India 85 percent of the utilisable water is used for agriculture, in contrast to industrial economies like those of western countries, where only about 30 percent of the utilisable water is used in agriculture, and industry & urban centres consume 70 percent.

While it is true that an agricultural drought is due to shortfall in the normal rainfall, it may not be totally correct to say that drought comes unannounced. Based on the historical trend combined with more robust meteorological forecast systems of today, the probability of an agricultural drought can be predicted with greater certainty.

More importantly, the effect of drought can be contained to a large extent by building resilience into the production system. It is also said, that drought comes with an appointment and not unannounced. It is therefore, possible to negotiate the associated risk more effectively, by adopting a comprehensive drought proofing plan.
2. Droughts in India

2.1 Defining drought
Drought is a normal, recurrent feature of climate associated with deficiency or erratic distribution in rainfall that occurs in all climatic regimes, and is usually characterized in terms of its spatial extension, intensity and duration. It is a complex phenomenon and is difficult to predict, though not impossible with the now available spatial and information technologies. Droughts start due to a deficit or shortage of precipitation resulting in reduced soil moisture. At this stage of drought, crops and vegetation may stand to be affected due to moisture stress. If the drought continues it will also lead to reduced water levels in rivers, aquifers and reservoirs. This can cause more severe crop damage, and in extreme cases total loss of crop harvest and severe casualty in livestock. Droughts also affect the environment, leading to ecological stress and changes in the quality of rivers, lakes and other water bodies. The major reasons for drought occurrence in rainfed areas are scanty rainfall, uneven distribution, continuous dry spells, poor water harvesting and resultant limited scope for protective irrigation depletion of ground water table and absence of soil and water conservation practices.

Following are some of the facts that differentiate drought from other natural hazards such as cyclones, floods, earthquakes, volcanoes etc.:

- There is no universally accepted definition that can encapsulate the complexity of this phenomenon adequately
- It is difficult to determine the beginning and end of a drought episode because of its slow & creepy onset, silent spread and gradual withdrawal
- An episode could spill over months or even years with or without any accompanying shifts in the geographical area
- There is no indicator or index which can precisely forecast the advent and severity of a drought event, nor project for its possible impacts
- Spatial expanse tends to be far greater than in the case of other natural calamities, which when compounded by the difficulties associated with the impact assessment of the disaster, makes effective response highly challenging
- Impacts are generally non-structural and difficult to quantify e.g. the damage to the ecology, the disruption of socio-economic fabric of communities, the long term effects of mal-nutrition on health and morbidity etc.
- The impacts tend to get magnified in the event of successive droughts.

**Typologies of drought:**
Droughts can be classified in five categories:

1. Meteorological drought
2. Hydrological drought
3. Agricultural drought
4. Socio-economic drought
5. Ecological drought

### 2.1.1 Meteorological drought:

It describes a situation where there is a reduction in rainfall for a specific period (days, months, seasons or year) below a specific amount (long term average for a specific time). The Indian Meteorological Department (IMD) has defined drought as a situation occurring in any area when the mean annual rainfall is less than 75 per cent of the normal rainfall. IMD has further classified droughts into the broad categories viz., a severe drought when the deficiency of rainfall exceeds 50 per cent of the normal rainfall and moderate drought when the deficiency of rainfall is between 25 and 50% of the normal rainfall.

It is worth noting here that the effectiveness of rainfall is more important than the amount of rainfall so far as meteorological drought is concerned. On an average India receives 118 cm annual rainfall which is considered to be highest anywhere in the world for the country of comparable size. But the uncertain, unreliable and erratic nature of rainfall by south-west monsoons creates drought conditions in different parts of the country. This happens when the actual rainfall in an area is significantly less than the climatological mean of that area. The country as a whole may have a normal monsoon, but different meteorological districts and sub-divisions
can have below normal rainfall. The rainfall categories for smaller areas are defined by their deviation from a meteorological area's normal rainfall –

Excess: 20 per cent or more above normal
Normal: 19 per cent above normal to - 19 per cent below normal
Deficient: 20 per cent below normal to - 59 per cent below normal
Scanty: 60 per cent or more below normal down to -99 percent.
No rain: no rains at all

The major causes of meteorological drought may be summed up as under:

(i) Lean monsoon and below average rainfall due to absence of depressions over India.
(ii) Late onset or early withdrawal of monsoons.
(iii) Prolonged breaks in monsoon.

2.1.2. Hydrological drought:
Hydrological drought is associated with reduced availability of water. A meteorological drought often leads to hydrological drought. Generally it takes two successive meteorological droughts before the hydrological drought sets in. There are two types of hydrological droughts viz., (i) surface water drought and (ii) ground water drought.

(i) Surface-water drought:
It is concerned with drying up of surface water resources such as rivers, streams, lakes, ponds, tanks, reservoirs etc. There are many processes, besides meteorological drought, which lead to surface water drought. Large scale deforestation is the main cause of surface water drought.

Some other unwanted human activities have led to the enhancement of flood/drought duo. Important among them are ecologically hazardous mining, indiscriminate road construction, averaging and spread of non-terraced agriculture.
In the Doon valley, limestone quarrying has drastically changed the surface water flow in the valley turning several perennial rivers into carriers of monsoon floods which go dry after the monsoon.

(ii) Ground-water drought:
Ground-water drought is associated with the fall in the ground water level. This happens due to excessive pumping of ground water without compensatory replenishment and creates more or less irreversible ground water drought even in normal rainfall conditions.

Ground water replenishment depends upon the availability of surface water obtained from rainfall and nature of soil. The Northern Plain of India has soft and porous alluvial soils. These soils permit percolation of water and help in ground water replenishment. In contrast, the peninsular plateau area is made up of hard and impervious rocks which hinder the process of ground water replenishment.

2.1.3. Agricultural drought:
Agricultural drought is concerned with the impact of meteorological/hydrological drought on crop yield. When soil moisture and rainfall conditions are not adequate enough to support a healthy crop growth to maturity thereby causing extreme moisture stress and wilting of major crop area, it leads to agricultural drought.

Agricultural drought may occur even when there is no meteorological drought and vice-versa. It is worth noting that agricultural drought is a relative category, depending upon the value of plant and soil. What could be a drought condition for the cultivation of rice could well be a suitable condition for wheat and a condition of excess soil moisture for dry crops like bajra or jowar.

Thus the choice of crops evolves according to variations of climatic and soil conditions. The indigenous dry-crops prove high-yielding when there is optimum use of water. However, under extreme condition of soil water drought, no plant can survive and this condition is termed as desertification.
With the onset of green revolution in India in 1960s, High Yielding Varieties (HYV) of seeds has replaced the traditional drought resisting seeds. The use of fertilisers has also increased the water requirements of different crops. The agriculture based on the Green Revolution technology is precariously dependent on irrigation and any delay in supply of water will cause serious agricultural drought. It has been found that the organic matter content of HYV seeds is quite less. Organic matter input to soil increases its water holding capacity and soils rich in organic content don’t dry quickly. Hence the use of HYV seeds has increased the risk of agricultural drought to a great extent. Recent studies have revealed that with the addition of manure and organic fertiliser, the water retention capacity in the soil increases by 2 to 5 times.

Change in cropping pattern, particularly with the introduction of Green Revolution technology has also led to soil water drought. The indigenous cropping pattern was in tune with the agro-climatic conditions of the concerned region. With the introduction of an alien cropping pattern, more water demanding crops have gained importance which has led to soil water drought. For example, rice cultivation was practically unknown in Punjab, Haryana and Western Uttar Pradesh before Green Revolution and this region is not suitable for rice cultivation considering the amount of rainfall received by this region. The area receives an average annual rainfall from 50 to 75 cm whereas minimum amount of rainfall for any successful cultivation of rice is 100 cm. This change in the cropping pattern has put heavy strain on meagre water resources leading to acute occasional droughts.

In the drought affected areas of Maharashtra, Karnataka and Andhra Pradesh there is a change in the cropping pattern in which cash crops are given more importance than the traditional crops. Thus while the staple crops are denied water, cash crops like sugarcane and grapes are given priority with respect to irrigation. This leads to a condition of soil water drought which is created not by absolute scarcity of water but by preferential diversion of limited sources of water.
2.1.3.1. **Soil moisture drought:**
This is a situation of inadequate soil moisture particularly in rainfed areas which may not support crop growth. This happens in the event of a meteorological drought when the water supply to soil is less and water loss by evaporation is more.

2.1.4. **Socio-Economic drought:**
It reflects the reduction of availability of food and income loss on account of crop failures endangering food and social security of the people in the affected areas.

2.1.4.1. **Famine:**
A famine occurs when large scale collapse of access to food occurs, which without intervention, can lead to mass starvation. Famines were a common phenomenon in pre-independence history of India.

2.1.5. **Ecological drought:**
Ecological drought takes place when the productivity of a natural eco-system fails significantly as a consequence of distress induced environmental damage.

2.2 **Drought in India**
Droughts during the colonial period, tended to degenerate into severe famines causing massive human losses. According to one estimate, in the latter half of the 19th century, there were approximately 25 major famines across India, which killed 30-40 million people. The first Bengal famine of 1770 is estimated to have wiped out nearly one third of the population. The famines continued until Independence in 1947, with the Bengal famine of 1943–44 which affected 3-4 million people, being among the most devastating.

The situation improved remarkably in post-independent India. Investment in irrigation works, promotion and availability of quality inputs, focus on research & extension led to increased agricultural productivity and greater resilience among the farming communities. This development did not only render the country self-sufficient in food production but to a considerable extent, famine proof. Though population quadrupled since Independence, the country did not witness a famine in
the past 69 years and in fact, India has become a major exporter of agricultural produce in the world.

With the liberalization of the Indian economy in the 1990s, accelerated growth in industry and services saw the share of agriculture in Gross Domestic Product (GDP) shrink to less than 15% (half its share from a few decades ago), yet the country continued to be largely self-sufficient in food and agri-commodities, gained greater resilience in absorbing the impact of drought.

2.3. Meteorological history of droughts in India


The frequency of drought has varied over the decades. Between 1899 to 1920, there were seven drought years. The incidence of drought came down between 1941 and 1965, when the country witnessed just three drought years. However, during the 21 years, between 1965 and 1987, there were 10 drought years which was attributed to the El Nino Southern Oscillation (ENSO).

Among the many drought events since Independence, the one in 1987 was one of the worst, with an overall rainfall deficiency of 19 per cent which affected 59–60 per cent of the normal cropped area, and a population of 285 million. This was repeated in 2002 when the overall rainfall deficiency for the country as a whole was 19 per cent. Over 300 million people spread over 18 states were affected by drought along with around 150 million cattle. Foodgrain production registered an unprecedented fall of 29 million tonnes. In 2009, the overall rainfall deficiency for the country as a whole was 22 per cent, which resulted in decrease of foodgrain production by 16 million tonnes. During 2014-15 and 2015-16, large parts of the country came to be affected by drought causing widespread hardship to the affected population, since the calamity encompassed major agricultural states in the country.

2.4 Characteristics of Drought

The occurrence of drought is contingent on a number of factors such as cropping choices and agronomic practices, soil types, drainage and ground water profiles, to name a few. However, rainfall deficiency and spatial and temporal distribution,
duration and dry spells are acknowledged as the most important triggers for drought.

2.4.1 Seasonal characteristics and Intra-Seasonal variability

India receives most of its rainfall (73%) from the South-West or “summer” Monsoon i.e., (the rainfall received between June and September). The summer monsoon sets in during the first week of June in the south-west corner of India and gradually proceeds towards the north-west region covering the entire country by the second week of July. The withdrawal of the Monsoon commences in the first week of September from the west and north and recedes from most parts of the country by the month-end. Even when the overall rainfall in the country was normal, large variations were noticed across regions, within States, and sometimes, even within districts. IMD set up 36 meteorological sub-divisions straddling over the territories of a dozen districts on an average, in each of the subdivisions. Rainfall is categorised as excess, normal, deficient or scanty and the possibility of drought arises in the event of deficient or scanty rainfall.

This pattern of onset (Map 1.1) and withdrawal (Map 1.2) ensures that the duration of the rainy season in the north-west region of the country is less than a month on account of the late arrival and early cessation of monsoon activities. Conversely, Kerala and north-eastern parts of India receive more than 4 months of rainfall due to the wide window afforded by the early arrival and late withdrawal of the monsoons.

Coastal areas of peninsular India and Tamil Nadu, in particular, receive bulk of its annual rainfall from October to December, from the receding monsoon and periodic cyclonic disturbances in the Bay of Bengal, but primarily on account of the North-East monsoons. The broad seasonal distribution of rainfall in India is presented in Table 1.1.

Table 1.1: Seasonal Distribution of Rainfall in India

<table>
<thead>
<tr>
<th>Season</th>
<th>Period</th>
<th>Percentage of Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-monsoon</td>
<td>March-May</td>
<td>10.4</td>
</tr>
<tr>
<td>South-west monsoon</td>
<td>June-September</td>
<td>73.4</td>
</tr>
<tr>
<td>Post-monsoon (Northeast Monsoon)</td>
<td>October-December</td>
<td>13.3</td>
</tr>
<tr>
<td>Winter rains</td>
<td>January-February</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Source: India Meteorological Department, Government of India.
The Table 1.2 below throws light on the spatial and temporal extent of rainfall deficiencies in the South West Monsoon season recorded across meteorological subdivisions in the country during the drought years. It would appear that the geographical spread of the drought over meteorological subdivisions was the maximum in 1987 and 2002 among the drought events in the recent past (Table 1.2). The drought in 2015 too had a very wide coverage, and the impact substantially magnified, by the pervasiveness of the ill effects of a major drought during the immediately preceding year.

**Table 1.2: Meteorological Sub-Division wise Distribution of Deficient Rainfall during Major Drought Events (Number of meteorological sub-divisions = 36)**

<table>
<thead>
<tr>
<th>Drought year</th>
<th>Mid-July</th>
<th>Mid-August</th>
<th>Mid-September</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>19</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>1972</td>
<td>13</td>
<td>21</td>
<td>21</td>
</tr>
<tr>
<td>1979</td>
<td>17</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>1987</td>
<td>25</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>2002</td>
<td>25</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>2009</td>
<td>15</td>
<td>19</td>
<td>16</td>
</tr>
<tr>
<td>2014</td>
<td>16</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>2015</td>
<td>23</td>
<td>23</td>
<td>14</td>
</tr>
</tbody>
</table>

*Source: India Meteorological Department*

Table 1.3 provides a comparison of the extent of departure of rainfall from the normal during the recent major droughts in 1972, 1979, 1987, 2002, 2014, 2015. Rainfall variation in 2009 appears to be higher compared to other drought years at an all India level. The South West Monsoon Season in 2009 opened in June with an ominous rainfall deficiency of 47%, which was further aggravated by continuing shortfalls in the remaining months. Earlier, during the drought years of 1972, 1979 and 1987 too, a similar pattern was noticed when each of the four months between June and September recorded deficient rainfall at an all India level. In 2014, the first three months of the South West Monsoon were characterized by deficient rainfall to an extent that the late season rally in September was not sufficient to revive agriculture in most parts of the country. In contrast, the 2015 season started with normal rainfall, prompting farmers to undertake large scale agricultural operations, before the situation turned progressively adverse into a serious drought in the
remaining 3 months, causing serious damage to agriculture and losses to the farmers.

**Table 1.3: Month-wise All India Rainfall Distribution (Percentage departure for the country as a whole in recent major drought years)**

<table>
<thead>
<tr>
<th>Year</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>June-Sept</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>-27</td>
<td>-31</td>
<td>-14</td>
<td>-24</td>
<td>-24</td>
</tr>
<tr>
<td>1987</td>
<td>-22</td>
<td>-29</td>
<td>-4</td>
<td>-25</td>
<td>-19</td>
</tr>
<tr>
<td>2002</td>
<td>+4</td>
<td>-51</td>
<td>-4</td>
<td>-10</td>
<td>-19</td>
</tr>
<tr>
<td>2009</td>
<td>-47</td>
<td>-4</td>
<td>-27</td>
<td>-20</td>
<td>-22</td>
</tr>
<tr>
<td>2014</td>
<td>-42</td>
<td>-10</td>
<td>-10</td>
<td>+8</td>
<td>-12</td>
</tr>
<tr>
<td>2015</td>
<td>+16</td>
<td>-16</td>
<td>-22</td>
<td>-24</td>
<td>-14</td>
</tr>
</tbody>
</table>

*Source: India Meteorological Department*
Map 1.1: Normal Dates for Onset of Southwest Monsoon
Source: India Meteorological Department
Map 1.2: Normal Dates for withdrawal of Southwest Monsoon

Source: India Meteorological Department
2.4.2 Successive droughts

2.4.2.1 Causes of recurring drought in India

A deficiency in rainfall causes depletion of soil moisture, fall in surface and ground water levels which in turn is likely to have a deleterious effect on agricultural operations, due to insufficient availability of water for the crops, especially during the critical stages of plant growth. The correlation between quantum of rainfall and the trigger for drought in India vary across agro-climatic zones. In the semi-arid regions, even a well distributed 400 mm rainfall during a crop season could be adequate for the sustenance of crops, while in high rainfall regions like Assam, an annual rainfall of 1,000 mm could still create a potential for drought like development. Though deficient rainfall is considered to be the primary instigating factor for drought, yet the occurrence, spread and intensity is determined by several factors including susceptibilities introduced by climate change, hydrological and soil profiles, availability of soil moisture, choice of crops and agricultural practices, availability of fodder, socio-economic vulnerabilities etc.

The recurrence of drought in India is owed largely to the unique physical and climatic susceptibilities of the country, which include:

- Considerable annual / seasonal/regional variations in spite of a high average annual rainfall of around 1,150 mm. The mean annual rainfall across the country is shown in Map. 1.4;
- A relatively short window of less than 100 days during the South-West Monsoon season (June to September) when about 73% of the total annual rainfall of the country is received. The normal rainfall in various parts of the country is shown in Map 1.3;
- Uneven distribution of rainfall over different parts of the country in that some parts bear an inordinately high risk of shortfalls, while others tend to receive excessive rainfall. Even though India receives abundant rain on an average, for the country as a whole, much of the excess water, which otherwise could have contributed towards enhancing natural resilience towards drought, gets lost as run-offs. The variability in rainfall exceeds 30% in large areas of the
country when compared to Long Period Average (LPA) and exceeds 50% in parts of drought-prone Saurashtra, Kutch and Rajasthan;

- Low average annual rainfall of 750 mm over 33% of the cropped area in the country heightens the susceptibility to drought; Over-exploitation of groundwater and sub-optimum conservation and storage capacity of surface water leading to inadequate water availability for irrigation, particularly in the years of rainfall deficiency. Steady decline in per capita water availability for humans and animals even in non-drought years;
- Out migration of cattle and other animals from drought hit areas heightens the pressure on resources in surrounding regions.
- Limited irrigation coverage (net irrigated area in the country is less than 50%) exacerbates the impact of drought on account of complete dependence of agriculture in such areas on rainfall (Map 1.6).
Map 1.3: Normal Rainfall for June – September (mm)

Source: India Meteorological Department
Map 1.4: Normal Annual Rainfall (cm) Map of India

Source: India Meteorological Department
2.4.2.2 The scenario
Poor rainfall in successive years tend to compound the adverse effect of drought by reducing scope for the recharge of surface and ground water resources, replenishment of soil moisture and recovery of financial capacity of agriculturists to make investments in agricultural operations. Table 1.4 shows the extent of departure of rainfall in the Kharif season during successive drought years.

**Table 1.4: %age Departure of Rainfall from Normal for Country as a Whole (SW Monsoon) during successive Drought years.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Departure from Normal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1965</td>
<td>-18</td>
</tr>
<tr>
<td>1966</td>
<td>-16</td>
</tr>
<tr>
<td>1985</td>
<td>-7</td>
</tr>
<tr>
<td>1986</td>
<td>-13</td>
</tr>
<tr>
<td>1987</td>
<td>-19</td>
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<tr>
<td>1999</td>
<td>-4</td>
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<td>2000</td>
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<tr>
<td>2001</td>
<td>-8</td>
</tr>
<tr>
<td>2002</td>
<td>-19</td>
</tr>
<tr>
<td>2014</td>
<td>-12</td>
</tr>
<tr>
<td>2015</td>
<td>-14</td>
</tr>
</tbody>
</table>

It is evident from Table 1.4 that at the macro-level, the serious droughts in 1966, 1987, 2002 and 2015 were a culmination of the build up of adverse rainfall events of the preceding years. It is worth noting that in several instances, the low rainfall spells have continued over several years e.g. 1985-87 and 1999-2002 periods. The map 1.5 on the next page provides a pictographic representation of the frequency of drought occurrences in districts between 2000-2015. The frequencies are derived from the number of occasions when droughts were declared in such districts by State Governments during the 15-year period. It is hoped that the map will help provide guidance to policy makers in identifying areas that are most susceptible to drought for the establishment of monitoring and early warning systems. In addition, the map will help focus attention of the Central and State Governments to particularly vulnerable areas in order to plan and prioritize mitigation measures.
through urgent execution of District Irrigation Plans, Crop Contingency Plans, Drinking water and MGNREGS related activities etc. It would appear that certain parts of Karnataka, Andhra Pradesh, Maharashtra, Rajasthan have been particularly susceptible to drought episodes.
**Map 1.5: Frequency of Occurrence of Drought (2000-2015)**


Legend

- Frequency of Drought out of 16 Years
  - 0
  - 1-2
  - 3-4
  - 5-6
  - 7-8
  - 9-10
  - 11-12

Data Source: www.farmer.gov.in (Farmers' Portal)

Due to formation of new districts some of the districts are showing zero Drought frequency

Map Prepared by MNCFC
2.4.3 Geographical spread of drought

It has been shown that about 68% of cropped area in India is vulnerable to drought, of which 33% receives less than 750 mm of mean annual rainfall and is classified as “chronically drought-prone” while 35% which receive mean annual rainfall of 750-1125 mm is classified as “drought-prone”. The drought-prone areas of the country are confined primarily to the arid, semi-arid, and sub-humid regions of peninsular and western India.

Table 1.5: Cropped Area Falling Under Various Ranges of Rainfall in India

<table>
<thead>
<tr>
<th>No.</th>
<th>Mean Annual Rainfall Ranges</th>
<th>Classification</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Less than 750 mm</td>
<td>Low rainfall</td>
<td>33%</td>
</tr>
<tr>
<td>2</td>
<td>750 mm to 1125 mm</td>
<td>Medium rainfall</td>
<td>35%</td>
</tr>
<tr>
<td>3</td>
<td>1126 mm to 2000 mm</td>
<td>High rainfall</td>
<td>24%</td>
</tr>
<tr>
<td>4</td>
<td>Above 2000 mm</td>
<td>Very high rainfall</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table 1.6 below indicates that while the droughts in 1965-67 and 1979-80 impacted comparatively high rainfall regions, whereas the droughts during 1972, 1987, and 2002 affected mostly semi-arid and sub-humid regions. In recent years, central, north-west and peninsular India appear to have suffered frequent drought occurrences. These are traditionally low rainfall zones and the frequent failure of monsoons seems to have aggravated the intensity of droughts in these regions.

Table 1.6: Region-wise Percentage of Departure of Rainfall from Long-term Average during SW Monsoon in Major Drought Years

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>All India</td>
<td>-24.9</td>
<td>-18.2</td>
<td>-23.9</td>
<td>-19</td>
<td>-19.4</td>
<td>-19.2</td>
<td>-21.8</td>
<td>-11.9</td>
<td>-14.3</td>
</tr>
<tr>
<td>North-west</td>
<td>-46.9</td>
<td>-35.4</td>
<td>-31.3</td>
<td>-41.7</td>
<td>-43.9</td>
<td>-26.1</td>
<td>-35.5</td>
<td>-21.5</td>
<td>-17</td>
</tr>
<tr>
<td>Central</td>
<td>19.3</td>
<td>1.7</td>
<td>-18.7</td>
<td>-6.9</td>
<td>26.2</td>
<td>-6.7</td>
<td>-24.1</td>
<td>-10.1</td>
<td>-8.4</td>
</tr>
<tr>
<td>East</td>
<td>-31.1</td>
<td>-23</td>
<td>-24.5</td>
<td>-17.9</td>
<td>-29.4</td>
<td>-16.9</td>
<td>-20.1</td>
<td>9.6</td>
<td>-16.3</td>
</tr>
<tr>
<td>Peninsular</td>
<td>-38.7</td>
<td>-8</td>
<td>-19.6</td>
<td>-4.9</td>
<td>-18.9</td>
<td>-32.5</td>
<td>-5.6</td>
<td>-7</td>
<td>-15.4</td>
</tr>
</tbody>
</table>

Source: India Meteorological Department

Irrigation systems are well developed in some parts of the country as depicted in Map 1.6. It has been noticed that regions bestowed with assured irrigation have tended to escape the adverse impact of poor monsoon rainfall to a large extent, as is often the case with many districts of Haryana and Punjab.
Map 1.6: District Level Irrigation Percentage Map (Data Source: DES, DAC&FW)
2.5 Impact of drought

Drought produces wide-ranging impacts that span across many sectors of the economy. The reverberations are felt by the society and economy much beyond the areas actually experiencing the onslights of physical drought because agricultural production and water resources are integral to our ability to produce goods and services. Drought affects the overall economy of the country at macro and micro economic levels, both directly and indirectly. Direct impacts are usually visible in falling agricultural production and heightened food insecurity among poor and vulnerable sections; depleted water levels; higher livestock and wildlife mortality; cattle and animal migration; damage to ecosystem from indiscriminate exploitation; increased fire hazards etc. Indirect impacts of drought can be gauged from the reduction in incomes for farmers and agribusinesses, increased prices for food and fodder, reduction in purchasing capacity and slump in consumption, default on agricultural loans, distress sale of agricultural land & livestock, rural unrest, shrinkage in avenues for agricultural employment etc. These deleterious impulses have huge negative multiplier effects in the economy and society. The impacts of drought are generally categorized as economic, environmental, and social.

**Economic impact** refer to production losses in agriculture and related sectors, especially animal husbandry, dairy, poultry, horticulture and fisheries. It affects livelihoods and quality of life for the majority of farmers, share croppers, farm labourers, artisans, small rural businesses and rural population in general that is dependent on agriculture. All industries dependent upon the primary sector for raw materials suffer on account of reduced supplies and hardening prices. Drought thus causes a dampening impact on the economy by squeezing profit margins, drying up income and revenue streams and constricting employment avenues through disruption caused to supply chain managements, slowing down flow of credit and tax collections, depressing industrial and consumer demand, increased dependence on imports, and lowering of overall market sentiments.

**Environmental impact can be gauged from** low water levels in ground water and surface reservoirs, lakes and ponds, reduced flows in springs, streams and rivers, loss of forest cover, migration of wildlife and sharpening man-animal conflicts and general stress on biodiversity. Reduced stream flow and loss of wetlands may
affect levels of salinity. Increased groundwater depletion rates, and reduced recharge may damage aquifers and adversely affect the quality of water (e.g., salt concentration, acidity, dissolved oxygen, turbidity) which in turn may lead to a permanent loss of biological productivity of soils.

**Social impacts are manifest in widespread disruption in rural society on account of** outmigration of the population from drought affected areas, rise in school dropout rates, greater immiseration and indebtedness, alienation of land and livestock assets, malnutrition, starvation and loss of social status among the most vulnerable sections. The situation of scarcity in some cases may exacerbate social tensions and lead to erosion of social capital.

It is worth mentioning here, that a drop in agricultural production may be a direct outcome of meteorological droughts, but the succeeding hydrological and agricultural droughts have a long range and far reaching impact on agriculture. Such impact may be in the form of changes in the cropping patterns and impoverishment of cattle. The impact of drought on agriculture can thus be summarized as:

- **a.** Non or less availability of water for crops
- **b.** Non or less availability of water for livestock
- **c.** Significant decrease in crop production
- **d.** Less availability of fodder for livestock, limiting their productivity and leaving negative impact on their health
- **e.** Loss of income of farmers and landless labour, who primarily depend on agriculture for rural employment
- **f.** General farm-distress leading to migration of rural population to urban area in search of gainful employment.

The impact of drought on agriculture cannot be totally captured in economic terms as the repercussions are both short-term & long-term, unleashing wider impact on food security and economy of the country in general and rural farm economy in particular.

**2.5.1. Impact of drought on agriculture**

Indian agriculture still largely depends upon monsoon rainfall, with no dependable source of irrigation. The extent of such arable region in India is 53 per cent and is termed as rainfed. The effect is manifested in lower than normal agricultural
production in drought years. There is enough data that demonstrates instances of serious shortfall in cultivated areas and drop in agricultural productivity.

Droughts during the colonial period, tended to degenerate into severe famines causing massive human losses. According to one estimate, in the latter half of the 19th century, there were approximately 25 major famines across India, which killed 30-40 million people. The first Bengal famine of 1770 is estimated to have wiped out nearly one third of the population. The famines continued until Independence in 1947, with the Bengal famine of 1943–44 which affected 3-4 million people, being among the most devastating.

The situation improved remarkably in post-independent India. Planned investments in irrigation works, promotion and availability of quality inputs, focus on research & extension led to increased agricultural productivity and greater resilience among the farming communities. This development not only helped the country to become self-sufficient in food production, but to a considerable extent, famine-proof. Despite population quadrupling since Independence, the country has not witnessed any famine in the past 69 years and in fact, India has become a major exporter of agricultural produce in the world. With the liberalization of the Indian economy in the 1990s, accelerated growth in industry and services saw the share of agriculture in Gross Domestic Product (GDP) shrink to less than 15 per cent (half its share from a few decades ago). However, in terms of absolute figures, the size of agri-GDP has grown substantively. The country’s agricultural production system has gained relatively greater resilience against drought influencing parameters.
3. **Drought proofing** with stable food production at the national level, and adequate buffer stock, the country is able to manage shortfalls that may occur in different regions due to drought and such other natural calamities. However, the new vision today is to realise higher and more equitable growth of agricultural economy across all the regions of the country, with a view to securing higher income and welfare for all those dependent on agriculture. Therefore, the need for prioritising interventions in the less developed and more vulnerable areas like those of drought prone districts.

3.1. **Key principles of drought proofing**

Drought proofing (in the context of agriculture) is the process of making agriculture system (cropping, livestock etc) of the area drought resilient. Drought proofing aims to develop a new “Integrated Agricultural System” encompassing field production systems- agriculture, horticulture and agro-forestry, farming systems-field production system, livestock, poultry and fisheries; and integrating the outputs of these systems with post-harvest management systems- grading, packing, value-addition and linking these with markets. The integrated agricultural system looks at farmer as an entrepreneur and aims to enhance his economic well-being with twin-strategy of improving farm productivity with increased water-used-efficiency and enhancing his income with complementary and supplementary activities. The key principles of drought proofing are: (i) to conserve every drop of water; (ii) to enhance water use efficiency (including change in the cropping system and adoption of integrated agricultural systems); (iii) to conserve every inch of soil and (iv) risk mitigation.

All elements of the strategy and plans which can contribute to any one or more of these objectives will form part of drought-proofing initiative. In the context of national and state level planning and implementation, the drought proofing principles will include:

a. Convergence
b. Innovation
c. Supplementary/ complimentary activities/ programs/ interventions

3.2. **Approach to drought proofing**
Government of India, as also state governments have from time to time adopted many schemes and programs to increase the agriculture productivity and for improving the wellbeing of farmers in the rainfed regions of the country. In spite of these efforts, the deliverables are below expected levels, mainly due to isolated manner of implementation of different schemes/programs, inadequate focus on integration, synchronization or cohesiveness in implementation process. For example, while a water body is created, concomitant changes needed with respect to cropping system that is water use efficient or an irrigation system that uses water rationally are not promoted. In result harvested/stored water gets exhausted with 2-3 irrigation schedules, leaving no water when required during critical dry spells or at critical stage(s) of crop growth. What is, therefore, required for realising optimal outcome of inter-related interventions are micro-irrigation for precision water use, adoption of appropriate cropping system matching with the water availability, and good agronomic practices. Parallelly, integrated farming, quality inputs, post-harvest management, precision farming, technology dissemination etc. are also required to be interlinked for best and optimal use of available natural resources. This approach will bring in resilience and help negotiate risks linked to climatic aberrations. In some integrated development of rainfed ecosystem is only possible if all the concerned elements of development are properly synergized and integrated to deliver the outcomes in a cohesive manner.

3.3. Integrated Farming System (IFS): is integral to drought proofing system and is the most effective coping mechanism in minimising climate related risks. The production environment is an interrelated complex matrix of soil, water, air, plant, animal & environment. The interaction of these factors with one another will impart greater viability & sustainability vis-a-vis conventional farming system. Integration of trees, livestock, vegetable cultivation, dairy, bee keeping and other non-farm production systems introduce multiple activities that can harvest supplementary & complementary relationship between/among one another and result in higher output per unit of revenue (lands water etc.) The farmer is more secure with IFS in comparison to normal cropping system, in terms of gross output & economic returns. A composite system of production divides the risks and offers greater cushion to the farmers against failure of one or two components of an integrated farming system. This is akin to avoiding placing of all eggs in one basket. Success of integrated
farming is feasible, only when all the elements of farming system are taken up in a package approach through a single window delivery system.

3.4 Enhancing Water Productivity
Scarcity of water is the most critical gap in drought prone districts. To illustrate, of the 150 districts, all the 24 identified for the first phase have experienced drought in 5 or more years during the last 10 years (2006-16). This has not only resulted in crop/animal loss during those years, but has also to over-exploitation of ground water in subsequent years. This situation needs to be addressed through crop planning based on availability of water (water budgeting). The proposed interventions in drought proofing action plans to address this issue will include:

(a) Crop alignment (diversification to less water intensive variety/type of crop)

(b) Water conservation (through both engineering & agronomic treatment)
   - adoption of drip irrigation
   - adoption of sprinkler irrigation
   - adoption of other water saving technologies (sensors etc.)
   - in-situ water management (levelling, bunding, mulching, deep ploughing, ridge & furrow etc.)
   - creation of protective irrigation source
   - ground water recharge
   - improving organic carbon and soil fertility (plant residue management, organic farming etc.)

3.5 Risk mitigation
The farmers in rainfed areas not only face a number of risks, but also their risk bearing capacity is highly limited. It therefore becomes important to hedge the farmers against these risks. Some risk mitigation strategies will include:

a. Integrated farming system (inclusion of additional activities like livestock, fisheries, horticulture, agro-forestry apart from crop/cropping system)

b. Replicating useful indigenous practices

c. Establishment of seed and fodder banks

d. Post-harvest management and value addition

e. Safety net (crop insurance)
f. Training and skill development to enhance income from other sources

g. Secondary agriculture by using unutilised manpower and by-products generated on the farm and in the neighbourhood.

3.6 Objectives of drought proofing

The key objectives for success of Drought Proofing Action Plans are to enhance the ability of the farming system to cope with expected climate-variations more effectively by adopting resilient technologies and practices. Some important indicators which will determine the success of a drought proofing action plans will include:

a. Reduction in loss of yield and damage to production environment by improved resilience during drought periods of similar intensity

b. Increase in water productivity

c. Reduced ground water draft for agriculture use

d. Increase in crop productivity

e. Higher adoption of crop alignment and diversification

f. Improvement in resource use efficiency

g. Integration of secondary agriculture for value addition

h. Increased employment opportunities – on farm & off-farm

i. Decrease in distress migration from rural area

j. Steadiness in income of farmers

All these parameters will need to be observed over time to capture the success of drought proofing action plans. A data base (at national level) will be developed by NRAA to capture these parameters for all the 150 drought prone districts of the country.
4. Process of developing and approval of Drought Proofing Action Plans

The process of development and approval of drought proofing action plans will include:

- Draft Plan preparation by NRAA, CRIDA and District Officials through a joint effort
- Selection of pilot taluka/block/mandal by district officials for a universal treatment
- Identification of a cluster of villages for intensive implementation
- Cluster as sub-set of main district plan and block sub-plan
- Detailed Project Report (DPR) template for cluster of villages
- DPR to include more innovative activities including contingency plans and agro-advisory to farmers
- Approval of district drought proofing plan by Collector/ Dy. Commissioner/CEO, ZP
- Approval of district drought proofing plans by State Level Sanctioning Committee (SLSC) of the state.

4.1 Draft plan preparation by NRAA, CRIDA, district officials including KVK scientists: The basic framework of the drought proofing action plan will be prepared by NRAA & CRIDA based on secondary information collected from concerned district and state. The basic data about the geography, land-use, population, livestock and cropping pattern will be accessed from official sources, for latest available data. Data about the central/ state schemes and programs (related to agriculture, soil conservation, livestock and forestry etc) currently under operation will be taken from state department of agriculture. The water-budgeting and secondary agriculture chapters will be enhanced by district level officials of agriculture and line departments, when the NRAA team visits them for the 2-day training-cum-orientation programs. Concerned SAU/SAMETI and KVK will also be taken on-board, so as to ensure inclusion of latest recommended package of practices for various crops and enterprises. The district level officials of agriculture and all other line departments will work-out a plan of interventions for five-year period to achieve drought resilience upto an extent of atleast 30 per cent (the plan may ensure that farmers, with recommended interventions and
practice are able to achieve same or more production/income in case of rain deficiency upto 30 per cent).

4.2 Selection of pilot taluka/block/mandal (to be identified by district/state):
One taluka/block/mandal will be identified by the concerned state/ district for close monitoring by NRAA. The district drought proofing action plan will be distributed (component-wise) among all the talukas/blocks/Mandals for ease of implementation and reporting. Concerned line departments will be responsible for planning and implementation of block level interventions. Block level drought proofing interventions will be prepared for all the blocks in the district (as sub-set of approved district drought proofing action plan).

4.3 Identification of a cluster for intensive implementation (to be done by district officials):
One cluster of 2-4 villages will be identified at the start of the project in the pilot block. NRAA will depute its own personnel to develop DPR (detailed Project Report) for the identified cluster in partnership with local officials. NRAA will be involved in supervision of all the interventions in the identified cluster of villages. NRAA will develop a detailed project report for this cluster and facilitate interventions to cover universally the farmers in the cluster. NRAA will introduce as many innovative interventions as possible in this cluster to pilot test their efficacy. On successful testing of these interventions, the same will be recommended for up-scaling in the next phase of the project.

4.4 Cluster as a sub-set of main district plan and the taluka/block/mandal plan:
This cluster of villages will be a sub-set of district drought proofing action plan, and accordingly will access resources from identified central/ state schemes for implementation of proposed activities/ works (as per district drought proofing action plan).

4.5 Detailed Project Report (DPR) template for Cluster of villages (District officials):
A data template will be designed and circulated to the cluster of villages to collect key baseline data about natural resources, population, agriculture (including all allied activities) and livelihood, so as to plan innovative interventions to address critical needs of the community, in the context of drought proofing.
4.6 DPR to include more innovative activities including contingency plans and agro-advisories to all farmers on integrated farming systems/ crop management / water conservation/ market-prices and weather advisories through NICE platform.

4.7 Approval of district drought proofing action plan by Collector/ Dy. Commissioner/CEO, ZP: The district drought proofing action plan prepared by the district officials will be thoroughly discussed in the District level implementation committee, and will be approved by Collector/ Dy. Commissioner of the district on the recommendation of the district head of department of agriculture.

4.8 Approval of district drought proofing action plans by SLSC of the state: On approval of the Collector/ Dy. Commissioner/ CEO, ZP the district drought proofing action plans will be forwarded to Commissioner / Director of Agriculture of the concerned state, who will recommend these plans to State Level Sanctioning Committee (SLSC) of the state for their approval. On approval of SLSC, the drought proofing action plans will be implemented in the concerned districts. NRAA will facilitate/coordinate timely release of central share (as approved by SLSC) for implementation of drought proofing action plans.
5. Institutional arrangements, fund flow and implementation mechanism:

Drought Proofing Action Plans will developed and implemented by district and state level functionaries under close supervision of Ministry of Agriculture and Farmers’ Welfare. At National level National Rainfed Area Authority (NRAA) will oversee and coordinate the monitoring and supervision and at the state level State Level Sanctioning Committee (SLSC) of Rastriya Krishi Vikas Yojana (RKVY) will oversee approval and implementation of drought proofing action plans.

5.1 National level:

5.1.1 Role of NRAA: National Rainfed Area Authority (NRAA) would be responsible for:

i- Supporting the process of preparation of drought proofing action plans for all the identified drought-prone districts in the country.

ii- Developing guidelines for preparation of drought proofing action plans.

iii- Assisting states in the preparation of state-specific technical manuals (if needed) for a multi-disciplinary and integrated approach required for implementation of the drought proofing action plans together with quality standards and specifications.

iv- Supporting State Level Sanctioning Committees (SLSCs) in identifying resource organizations and ensuring capacity building arrangements.

v- Facilitating convergence of all central schemes and program with similar objectives.

vi- Facilitating action research relevant to drought proofing in different agro-ecological regions.

vii- Conducting studies, monitoring, evaluation and impact assessment from time-to-time so that the benefit of these are available for improving the quality of future drought proofing plans.

viii- Accessing additional funds from other sources including private sector, foreign funding agency, etc and facilitate its use to fill up critical gaps in the program as well as in scaling up of successful experiences through innovative organizations, interventions at field level.
ix. Acting as an effective coordinating institution between among all bodies/organizations/agencies/ departments/ ministries who are involved in drought proofing action plans.

x. Organizing regional, national and international conferences, seminars, workshops, study tours and information sharing as found necessary.

xi. Providing technical knowledge inputs and expertise.

xii. Such other activities as may be assigned by Government to NRAA from time to time.

5.1.2. National Steering Committee: A national steering committee will be set up at national level with CEO, NRAA as chairman to oversee planning, development and implementation of drought proofing action plans in all the 150 identified drought-prone districts of the country. The Committee will have representatives from MoAFW (DACFW and ICAR/DARE), MoAHF, CRIDA, MNCFC, IMD, MANAGE and a few representatives from states. The Technical Expert (TE), NRAA will be the member secretary of the National Steering Committee.

5.1.3. National level Data Centre and National Portal: A national level data centre and national portal under the aegis of NRAA would serve as a national level facility for collating, storing, analysing and generating drought proofing information, data and knowledge. The national data centre (NDC) would collate summary data for the entire country, data archive, data for program implementation and fund-flow management. The centre will be equipped with various GIS thematic layers for cadastral, district, soil, land-use, socio-economic parameters, habitations etc. It shall have application support for area development programs, soil-conservation works, land use planning, master data for integrated layers and high end GIS data for district level planning and monitoring.

5.2. State, District, Block and village Level:

5.2.1 State Level Sanctioning Committee (SLSC): State Level Sanctioning Committee (SLSC) already operational for Rashtriya Krishi Vikas Yojana
(RKVY) will act as SLSCs for considering and approving drought proofing actions (works and funds) also.

5.2.2. **District Level Implementation Committee (DLIC):** This Committee will be the executive body for the drought proofing plans—development, implementation, monitoring and supervision. All the project funds will be allocated to concerned departments with specific targets/activities and stakeholders. The DLIC will be chaired by District Collector/Dy. Commissioner and co-chaired by CEO, Zilla Parishad, with district head (Joint Director of Agriculture or Dy. Director of Agriculture, as the case may be) of department of agriculture as member secretary. All the heads of line departments—Horticulture, Animal Husbandry, Dairying, Forestry, Sericulture, Minor Irrigation and Program Coordinator of KVK and others concerned will be the members of DLIC. The DLIC will regularly monitor the project implementation and develop M&E reports and submit progress in appropriately MIS to SLSC through SLNO/Commissioner Agriculture. The Committee may also involve non-government organizations (NGOs) for entry-point activities, group formation, capacity building and training etc. as also in implementation as needed. DLIC may sign an MoU with the concerned agencies for specific works/assignment. The District level implementation committee will meet once in a quarter. Project will support hiring of one person for each district to provide support in the project reporting. This will be charged under administrative cost. 10% of district funds are be kept-aside outside of state software system, so that these funds can be allocated to the innovative activities and interventions in the cluster of villages, where NRAA will facilitate and monitor the project implementation closely. These funds may be approved separately and put at the disposal of Joint Director of Agriculture (JDA) of the concerned district.

5.2.3 **Block Level Implementation Committee (BLIC):** On the lines of District level Implementation Committee, a Block level implementation committee will be constituted to plan, execute, monitor and report the drought proofing action plans. The BLIC will have members from all the line departments working at the block level and will be headed by the senior most official at the block level preferably the BDO. The BLIC will meet every month.
5.2.4 **Cluster Level Implementation Committee:** A cluster level Implementation committee will be constituted at the pilot cluster to be closely monitored by NRAA. This committee will have representatives from all line departments and KVK and will be coordinated by Agriculture Officer of concerned block/circle/taluka. This Committee will keep the BLIC and DLIC informed on any issues, progress of implementation at the village level.

5.3 **Funding mechanisms and fund-flow:**
The drought proofing action plans will be implemented in a convergence mode. The funds available at the district level under various schemes of central/state/district level will be accessed first and the remaining funds will be drawn from funds of RKVY under up-scaling activities. Any requirement of funds for capacity building, coordination and monitoring and evaluation of the plans will be met by NRAA. Thus the funding will be from four sources:

- **a.** Convergence with ongoing central, state and district schemes
- **b.** Additional funding from RKVY for up-scaling under drought proofing (60:40)
- **c.** Flexi-Funds from RKVY on specific recommendations by NRAA (60:40)
- **d.** Grants by NRAA for capacity building (100%)

5.3.1. **Convergence with on-going schemes and programs:** Once the overall annual plan is approved by SLSC, the same will be shared with all concerned departments by Agriculture department immediately. Thereafter respective departments will allocate funds to district concerned from the allocation made for that scheme under CSS or state plan in relation to scheme on priority basis to these districts. Concerned departments will implement the works/programs/activities following the scheme specific guidelines. This component will cover works/programs/activities in such a way that the outcome and outputs are optimized. These departments will report the progress of the concerned works/programs/activities in the usual prescribed manner under the scheme and also to NRAA through District level implementation committee (DLIC). Close liaison shall be maintained between GoI and State Government (HOD & Secretariat) for effective communication of all the correspondence without any gap in implementation. At each level (e.g. GoI,
State, District, Block/Taluka/Mandal and village level), point of contact will be identified for establishing effective communication.

5.3.2. Additional funds from RKVY for up-scaling under drought proofing (as approved by SLSC): Under this stream, additional funds will be approved for the drought proofing districts by SLSC from RKVY allocation of the state. The release of additional central component will be facilitated by NRAA. This fund will be allocated to the districts identified for drought proofing, and as per the approved action plans. No deviation in implementation shall be permitted under this. The line departments will implement the works/ programs/ activities following the scheme specific guidelines, if any. These departments will report the progress of the concerned works/ programs/ activities in the usual prescribed manner under RKVY and also to NRAA through District level implementation committee (DLIC).

5.3.3. Additional flexi-funds: This fund shall be used for programs of innovative work/ activity/ complementary work in the district as per the approved plan. The works and activities will be undertaken on 100% subsidy basis for the ultimate beneficiaries i.e. farmers. But the funding pattern will be on 60:40 basis. These additional funds will also be routed to state on the specific recommendations of NRAA. The reporting of this component will be done by the implementation agency to DLIC and NRAA. Guideline for respective component (if any exist in the concerned state) will be followed. Project will support hiring of one person for each district to provide support in the project reporting. This will be charged under administrative cost. 5% of district funds be kept-aside outside of state software system, so that these funds can be allocated to the innovative activities and interventions in the cluster of villages, where NRAA will facilitate and monitor the project implementation closely. These funds may be approved (by SLSC) separately and put at the disposal of Joint Director of Agriculture (JDA) of the concerned district.

5.3.4. Grants by NRAA for capacity building (100%): District authority in consultation with local KVKs and state SAMETI will assess the overall training needs of the district and formulate a training plan. This training plan will be shared with MANAGE and NRAA. MANAGE will be conducting all the training
programs as per the need assessed by district and approved by SLSC. MANAGE will co-ordinate all drought proofing capacity building programs for NRAA.

5.3.5. **Fund Flow for the Cluster of Villages:** Exclusive earmarking of the funds to the extent of 5% of the total funds allocated for implementation of centrally sponsored schemes and state sector schemes for the respective district will be made for implementation of drought proofing action plans in the identified cluster of villages, initially for a period of three years (annually). This will facilitate prioritizing and implementation of drought proofing activities / measures on comprehensive basis. The implementation of all drought proofing action plan activities will be done under supervision of NRAA. Clear cut instructions and modalities for exclusive earmarking of 5% funds for identified cluster will be issued by all HODs of participating departments. The remaining 95% funds of the centrally sponsored schemes and state sector schemes funds will be allocated as per the guidelines of the respective schemes.

5.4. **Mode of implementation of Drought Proofing Action Plans**

There will be a three tier implementation approach to drought proofing action plans- District, Block and Cluster of villages.

5.4.1. **District:** The drought proofing action plan will be implemented in the entire project district by agriculture and line departments, with agriculture department as the nodal agency. The fund-flow will be as indicated above (para______). Each district will prepare an annual plan for every year of the project. Annual action plan will be a subset of the approved district drought proofing action plan and shall have approval of SLSC.

5.4.2. **Block:** Block level annual action plans will be prepared as a sub-set of the SLSC approved district drought proofing action plan. Block level action plans will be implemented by agriculture and line departments, with agriculture department as the nodal agency. The fund-flow will be as indicated above (section 9).
5.4.3. **Cluster of Villages:** A detailed plan will be prepared by NRAA (in consultation with agriculture and line departments) for the identified cluster of 2-4 villages in the pilot block /mandal /taluka. Proportionate funds from the drought proofing action plan will be placed for identified Cluster (to be completed within first 3 years of implementation) for 100 per cent coverage of farmers. 10 per cent of the total additional funds from RKVY (approved for the district) are proposed to be channelled to the identified cluster. The NRAA team will closely monitor the planning and implementation of these clusters in all pilot districts for the full project duration.

5.5. **Capacity building strategy and mechanism**

Development and implementation of drought proofing action plans will require a lot of capacity building and orientation-cum-training for various stakeholders at different stages of the project. At the beginning, the concept of drought proofing would have to be internalised by the district level officials of agriculture and line departments including scientists from KVKs. For this a two-day orientation-cum-training program will be organized by NRAA/MANAGE in association with concerned SAMETI/KVK. Besides this, the district team will identify training needs of all the stakeholders including farmers to implement the drought proofing action plan. These trainings (as approved by SLSC, as a part of drought proofing action plan) will be organised/facilitated by NRAA/MANAGE. The funds for all these trainings will be part of drought proofing action plan with 100 per cent funding from NRAA.

5.5.1. **Role of MANAGE:** National Institute of Agricultural Extension Management (MANAGE), Hyderabad, Department of Agriculture, Cooperation and Farmers Welfare (DACFW) has been identified as a knowledge partner of NRAA for the drought proofing action plan project. MANAGE will organize/ facilitate all the capacity building orientation/training programs for the officers of agriculture and line departments, scientists of KVKs/ SAUs and farmers as identified and indicated by drought proofing action plan (as approved by SLSC).

5.5.2. **Role of SAMETIs (State level Institution):** State Agricultural Extension and Management Training Institutes (SAMETIs) will need to play a very important role in development and implementation of drought proofing action plans.
SAMETIs will organize need-based training programs and the programs allotted to them as per the approved drought proofing action plans (by SLSC). SAMETIs will also undertake organization of two-day orientation-cum-training programs for the new districts under drought proofing action plans. Funds for all training and capacity building activities will be provided to SAMETIs by MANAGE.

5.5.3. Role of CCSNIAM: Choudhary Charan Singh National Institute of Agricultural Marketing (CCSNIAM) is the premier national institute for capacity building and linking farmers to markets. CCSNIAM will support drought proofing action plans by implementing new market infrastructure development and hand holding marketing linkage and providing market intelligence to farming community. In addition CCSNIAM will provide capacity building support in northern states of Rajasthan and Gujarat.

5.5.4. Role of KVKs: Krishi Vigyan Kendras (KVKs) of all the drought proofing action plan districts will provide technological back-stopping and technical training support to all technical interventions envisaged in the drought proofing action plans. KVKs will also provide crop-specific, farm-specific, farmer-specific agro-advisories to all the project district farmers using NICE platform. Appropriate training will be given to KVK scientists to undertake this task.
6. Monitoring, Evaluation and Learning Systems
An on-line dash-board based monitoring, evaluation and learning system will be designed and shared by NRAA for this project. All the district drought proofing action plans (as approved by concerned SLSC) will be available on the NRAA web-site. **All the interventions, including capacity building, study visits and works will be captured on-line** and access will be provided to district and state headquarters to generate report at their level. Both physical and financial progress will be tracked on-line, and quarterly consolidate reports will be submitted to states and NRAA.

6.1. **Outcome/measurable deliverables:** As indicated at section 5.1 above the drought proofing action plans will be monitored very closely for gauging the progress on each indicator. The reporting mechanism will be quarterly, season-wise (kharif and rabi) and annually. For the physical progress of the works/activities the reporting (physical and financial) will be done quarterly (or as envisaged under the respective scheme guideline) by district departments to their state head quarters and NRAA. The formats for this reporting will be as per the respective scheme guidelines. To capture the progress of outcome indicators (as in para 5.1 (a to j) a third party monitoring and evaluation agency will be engaged to undertake mid-term and terminal evaluation of the drought proofing action plans.