

# Drought Management

Water scarcity = an excess of water demand over available supply. • It can result from - Prevailing institutional arrangements, -prices – Overdevelopment or over allocation of the water resource •

Indicators = mining of ground water, increasing conflicts between water use sectors, streams becoming intermittent or permanently dry, land degradation – Scarcity may be a social construct, i.e., product of affluence, expectations – Altered supply (e.g., climate change)

- ★ a deficiency of precipitation (intensity) from expected or “normal” that extends over a season or longer period of time (duration)
- ★ slow onset, “creeping phenomenon”, a nonevent • difficult to determine drought onset and end • absence of a precise, universal definition • impacts are nonstructural and spread over large areas • severity and impacts best defined by multiple indices and indicators
- ★ no consistent methodology for assessing impacts or a data base for archiving impacts • impacts are complex, affect many people, and vary on spatial and temporal timescales, multiple and migrating epicenters • mitigation interventions are less obvious • water shortages increase conflict—regulatory, legal authority (interstate and transboundary issues) • makes monitoring, early warning, impact assessment, response, mitigation, and planning difficult! Comparing drought to other natural hazards– Source: Wilhite - NDMC 12 WMO OMM • Causal factors • Multiple – Regional in scale – Forcing functions not well understood • Impacts • Institutional structure for monitoring, mitigation, response, and planning/policy • Societal coping capacity (vulnerability/resilience) • Government policies (e.g., data sharing across ministries, response measures) • Government/donor response

### ❑ **Definition of Drought**

- Drought is a period of below-average precipitation in a given region, resulting in prolonged shortages in its water supply, whether atmospheric, surface or ground water.
- ❑ **A drought can last for months or years, or may be declared after as few as 15 days.**
- It can have a substantial impact on the ecosystem and agriculture of the affected region and harm to the local economy.

## **TYPES**

- 1) **Meteorological**:- Meteorological drought is brought about when there is a prolonged time with less than average precipitation.
- 2) **Agricultural** :-It is drought occurs when there is not enough water available for a particular crop to grow at particular time. it doesn't depend only on the amount of rainfall but also on the correct use of water. it is affected crop production.

3) **Hydrological**:- drought is brought about when the water reserves available in sources such as aquifers, lakes and reservoirs fall below the statistical average. It is associated with the effects of periods of precipitation shortfall on surface and sub surface water supply rather than with precipitation shortfall.

4) **Socioeconomic** :- it is associated with the supply and demand of sum economics good or service with element Hydrological, Meteorological, Agricultural.

## causes

- **Amount of water vapor in the atmosphere** :-if there is an above average presence of dry, high pressure air system, less moisture is available for produce rain.
- **Shifting of air mass**:-when winds shift air masses and warm, dry, continental air moves over and area as opposed to cooler, moist oceanic air masses , the area suffered a drought.
- **Human activities**:-
  - Deforestation for agriculture
  - Over farming
  - Excessive irrigation construction of building



- Global warming :- overall global warming will result in increased world rainfall along with drought in some areas .
- Other causes  
Cold and warm water ocean currents  
Mountains

Drought is a regional natural phenomenon with periodic reoccurrence, which can be regarded as an extreme climatic event associated with water resources deficit [45]. The main feature of droughts is a deficiency or lack of precipitation in a region over an extended period. Droughts can occur in both high- and low-rainfall areas and in virtually all climate regimes. Drought is considered as one of the major natural hazards with significant impacts on the environment, society, agriculture, and economy, among others [26]. Specifically, the impacts of droughts may be severe and are neither immediate nor easily quantifiable. It is difficult to determine the effects of drought as it constitutes a complicated phenomenon, evolving gradually in any single region. Indeed, drought impacts are very critical and especially costly, affecting more people than any other type of natural disaster universally [48]. All of this may lead to difficulties in drought assessment and response, which may result in a slow progress on drought preparedness plans and mitigation actions. There is, thus, a need to establish the context in which the drought phenomenon and its associated impacts are described.

Drought indicators are variables that describe drought features. Several indicators can also be combined into a single quantitative indicator, namely, a drought index [102]. For monitoring drought, drought indices are used based on several drought features, such as severity, duration, onset, end time, areal extent, and periodicity [28]. Moreover, for drought assessment through drought indices, the focus is on the estimation of precipitation shortage and water supply deficit; however, evapotranspiration or temperature may also be included [84,97].

In terms of climate variability, there is medium confidence that since the 1950s, some regions of the world have experienced more intense and longer droughts [45]. Land-use changes have potential impacts on droughts [5], and anthropogenic forcing has contributed to the global trend toward increased drought in the second half of the twentieth century. Extreme climate variables and climate extremes, such as droughts, are projected to experience significant changes over the twenty-first century, just as they have during the past century, in many areas, including Southern Europe, among others [58,82]. There is also medium confidence that the duration and intensity of hydrological droughts will increase in the twenty-first century in some seasons and areas due to reduced precipitation and/or increased evapotranspiration, although other factors, such as changes in agricultural land cover and upstream interventions, will lead to a reduction in river flows or groundwater recharge. Moreover, climate variability and change may affect drought preparedness planning and mitigation measures [45,69]. Thus, climate change has to be considered in all aspects of drought analysis.

The present study explores these critical aspects and adds value to the existing knowledge on the subject. Noticeably, in India, Department of Agriculture,

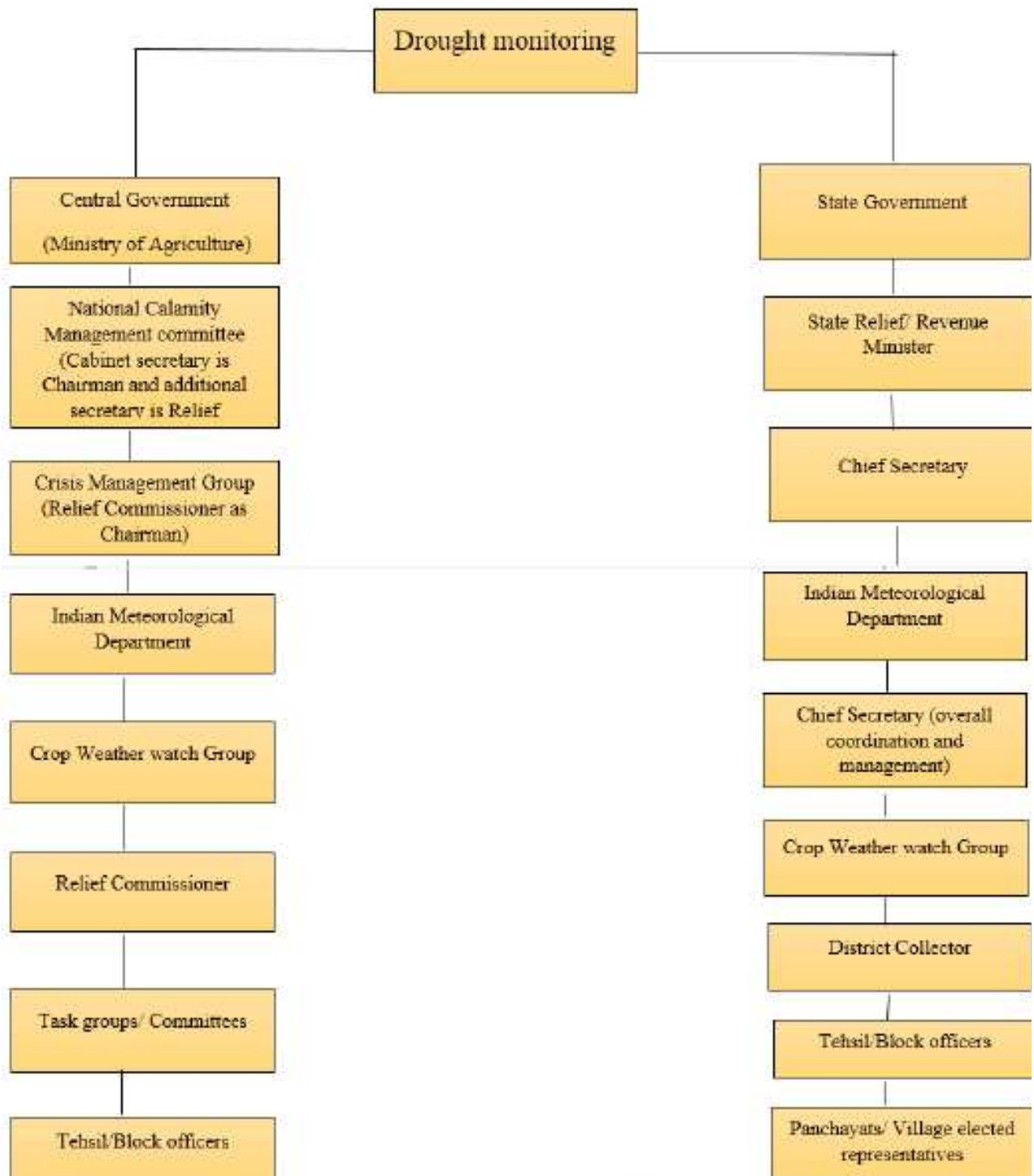
Cooperation and Farmers' Welfare (DACFW) frames and monitors the drought policy. The department is also entrusted with the responsibility to set up the institutional mechanism at all the three levels of government i.e. central, state and district. The policy aims to manage drought at two stages. First, at the pre-drought stage, it focuses on the mitigation<sup>6</sup> and prevention measures. Linking rivers, canals, irrigation expansion, watersheds developments are some of the examples of infrastructural measures to be developed in the long duration. Secondly at the post-drought stage, the policies are mostly reactive, financially assisting to the drought-affected individuals for a short period.

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### Preventive measures

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- Dams/reservoirs and wetlands to store water
  - Watershed management
  - Water rationing
  - Cattle management
  - Proper selection of crop for drought-affected areas
  - Levelling, soil-conservation techniques
  - Reducing deforestation and fire-wood cutting in the affected areas
  - Alternative land-use models for water sustainability
  - Checking of migration and providing alternate employment
  - Education and training to the people
  - Participatory community programmes
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**Figure 3: Drought monitoring and management at the state and central level in India**

- ▶ **WMO and the Global Water Partnership** have established the **Integrated Drought Management Programme**. Similar to APFM
- ▶ **Targeting intergovernmental, governmental and non-governmental organizations** involved in drought monitoring, prediction, drought risk reduction and management.
- ▶ Primary beneficiaries are expected to be **governmental institutions, agencies** responsible for developing **drought management policies** and/or implementing systems for **drought monitoring, prediction, preparedness and mitigation**.
- ▶ The principal approach to **develop global co-ordination** of efforts to **strengthen drought monitoring, risk identification, drought prediction and early warning services** and development of drought management knowledge base.