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Maharashtra Drought Declaration Highlights India's Growing Water Stress and Need for Proactive Drought-Proofing

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Recent Developments:

- The **Maharashtra Government** has declared **265 of 358 talukas drought-affected**, covering about **74% of the state**, following deficient monsoon rainfall and prolonged dry spells. The declaration was made under the state's **Drought Management Code**, with **Trigger-I** conditions activated in the affected areas.
- The state has initiated measures including **crop-loss assessment, crop-loan restructuring, land-revenue concessions, deferment of agricultural-loan recovery and electricity concessions for agricultural pumps**. District authorities have also been directed to document crop damage using photographs and GPS coordinates.
- The development is significant because drought is no longer confined to traditionally arid regions; **rainfall variability, prolonged dry spells, groundwater depletion, changing cropping patterns and climate change** are increasing water stress across diverse parts of India.
- India supports nearly **18% of the global population with around 4% of global freshwater resources**, making drought management central to **food security, livelihood security, water security and sustainable development**.

What is Drought?

Definition and Characteristics:

- **Drought** is a prolonged period of abnormally low precipitation that creates a water deficit relative to the requirements of ecosystems, agriculture, livestock, households and economic activities.
- Drought differs from an ordinary **rainfall deficit** because its impacts depend on rainfall distribution, soil moisture, groundwater availability, reservoir storage, cropping patterns and water demand.
- Therefore, drought should be understood as a **multidimensional phenomenon** involving interactions between climate, hydrology, agriculture and human water use.

Drought Scenario in India:

- The **Drought Atlas of India** demonstrates substantial spatial and temporal variability in drought occurrence across India, with drought frequency becoming more apparent when assessed at finer district and taluka scales.
- The severe **2002 drought** illustrates the socioeconomic consequences of drought: around **56% of India's area** experienced moderate to exceptional drought conditions, affecting approximately **300 million people and 150 million cattle**.
- Crop damage during the 2002 drought was associated with an estimated **USD 8.7 billion economic loss** and a **3.1% reduction in agricultural GDP**, demonstrating that drought can generate economy-wide effects beyond agriculture.

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Changing Nature of Drought:

- Historically, drought was primarily associated with **arid and semi-arid regions**, but changing rainfall patterns and rising water demand have expanded the geographical and socioeconomic dimensions of water stress.
- Even high-rainfall regions can experience seasonal water scarcity when rainfall becomes concentrated into short periods, surface runoff increases and **groundwater recharge remains inadequate**.
- Thus, annual rainfall totals alone cannot adequately explain drought vulnerability; **rainfall timing, intensity, distribution and water-storage capacity** are equally important.

Classification of Drought in India:

Meteorological Drought:

- **Meteorological drought** occurs when precipitation remains significantly below the long-term climatic average for a specified period.
- It is generally the **initial stage of drought**, and persistent meteorological drought can subsequently develop into agricultural and hydrological drought.
- Under the traditional Indian classification, a **26–50% rainfall deficiency** is associated with moderate drought, while a deficiency exceeding **50%** represents severe drought.

Agricultural Drought:

- **Agricultural drought** occurs when available soil moisture and rainfall become insufficient to meet crop water requirements, resulting in **crop stress, reduced yields and crop failure**.
- It depends not only on rainfall but also on soil characteristics, evapotranspiration, irrigation availability, crop type and the stage of crop growth.
- Agricultural drought therefore provides a stronger indication of the actual impact of rainfall deficiency on **farm livelihoods and food production**.

Hydrological Drought:

- **Hydrological drought** occurs when water availability in rivers, reservoirs, lakes and aquifers becomes insufficient to meet normal water requirements.
- It can develop even during periods of near-normal rainfall when **water withdrawal exceeds natural replenishment**, causing declining reservoir storage, river flows and groundwater levels.
- This makes groundwater over-extraction a major factor in converting temporary rainfall variability into **persistent water stress**.

How is Drought Declared in India?

Drought Assessment:

- Drought declaration is primarily a **State Government responsibility**, while the Union Government provides technical and financial frameworks for assessment and relief.
- The **Manual for Drought Management, 2009** provides a framework for objective assessment using multiple indicators rather than relying exclusively on post-harvest crop assessment.
- States may use a combination of **rainfall deficiency, sowing extent, vegetation condition and moisture availability** to identify drought conditions.

Major Indicators:

- **Rainfall Deficiency:** Persistent rainfall deficiency during the monsoon can trigger drought assessment, particularly when seasonal and intra-seasonal rainfall falls substantially below normal.

- **Area under Sowing:** A substantial decline in the area sown with crops indicates inadequate soil moisture and farmers' inability to undertake normal agricultural operations.
- **Normalized Difference Vegetation Index (NDVI):** NDVI derived from satellite observations provides information about vegetation health and can help identify agricultural stress over large areas.
- **Moisture Adequacy Index (MAI):** MAI compares actual water availability with crop-atmospheric water requirements and helps identify agricultural moisture stress.
- **Ground and Crop Indicators:** Modern drought assessment increasingly combines remote sensing with **ground observations, crop conditions, reservoir levels and groundwater data** to improve spatial accuracy.

Traditional versus Modern Assessment:

- Traditional systems such as **annevari, paisewari and girdawari** depend substantially on field-level crop assessment and post-harvest observations.
- Satellite-based indicators such as **NDVI and MAI** enable earlier identification of vegetation and moisture stress, allowing governments to move from **post-impact assessment to anticipatory drought management**.
- The most effective system is therefore a **multi-indicator approach** combining meteorological, agricultural, hydrological and remote-sensing information.

Legal and Institutional Framework:

Role of State and Union Governments:

- The **State Government is the final authority for declaring an area drought-affected**, while the Union Government provides national guidelines, technical support and financial assistance mechanisms.
- The **Manual for Drought Management, 2009** and the **NDMA Guidelines for Management of Drought, 2010** provide important reference frameworks, while states retain flexibility to account for regional agricultural and irrigation conditions.
- Drought management requires coordination among institutions responsible for **agriculture, water resources, groundwater, disaster management, rural development and local governance**.

Financial Relief:

- Immediate disaster relief is generally financed through the **State Disaster Response Fund (SDRF)**.
- Where additional assistance is required after assessment, the Union Government may provide assistance from the **National Disaster Response Fund (NDRF)** according to applicable procedures.
- Effective drought management should not, however, reduce policy to compensation; relief must be combined with **water conservation, livelihood protection and resilience-building measures**.

Supreme Court and Drought:

- In **Swaraj Abhiyan v. Union of India (2016)**, the Supreme Court addressed the obligations of the State in drought-affected areas and linked effective implementation of food-security measures with the protection of **Article 21 rights**.
- The case established an important constitutional dimension of drought management: prolonged drought can threaten access to **food, livelihood and dignified living**, requiring effective implementation of statutory welfare mechanisms.

Major Causes of Drought in India:

Meteorological and Climatic Causes:

- **Erratic South-West Monsoon:** Since a substantial share of India's annual rainfall occurs during the monsoon season, delayed onset, prolonged monsoon breaks, uneven spatial distribution or early withdrawal

can generate severe rainfall stress.

- **El Niño–Southern Oscillation:** **El Niño** can alter tropical atmospheric circulation and influence Indian monsoon behaviour, increasing the probability of rainfall deficiency in some years, although the relationship is not deterministic.
- **Climate Change:** Climate change can intensify hydro-climatic variability by increasing the likelihood of **extreme rainfall events separated by longer dry spells**, creating a paradox of floods and droughts within the same region or season.
- **Rising Temperature:** Higher temperatures increase **evapotranspiration**, thereby increasing crop and ecosystem water requirements even when rainfall does not decline proportionately.

Human-Induced Causes:

- **Skewed Cropping Patterns:** Cultivation of water-intensive crops such as **sugarcane and paddy** in water-stressed regions can increase pressure on surface and groundwater resources.
- **Groundwater Over-extraction:** India is highly dependent on groundwater for irrigation and domestic use, and excessive pumping can reduce aquifer storage and weaken the natural buffer against rainfall variability.
- **Ecological Degradation:** Deforestation, wetland destruction, soil degradation and encroachment of traditional water bodies reduce **infiltration, groundwater recharge and landscape-level water retention**.
- **Inefficient Irrigation:** Flood irrigation and inefficient water application increase water losses and reduce the amount of agricultural output generated per unit of water.
- **Urbanisation:** Increasing impervious surfaces reduce groundwater recharge while growing urban populations increase demand for water, intensifying competition between agricultural, domestic and industrial uses.

Key Challenges in Drought Management:

Delayed Declaration and Relief:

- Reliance on post-harvest crop assessment can delay recognition of **mid-season agricultural stress**, reducing the effectiveness of timely relief.
- Drought assessment must increasingly use **near-real-time satellite, rainfall, soil-moisture, reservoir and groundwater information**.

Fragmented Water Governance:

- Surface water and groundwater are often managed through different institutional structures, creating a fragmented approach to a resource that functions as an integrated hydrological system.
- The **Mihir Shah Committee** recommended restructuring existing institutions and proposed a **National Water Commission** for integrated water-resource management; subsequent government discussions have examined the proposed institutional restructuring.

Relief-Centric Approach:

- Drought responses frequently emphasise **water tankers, fodder, compensation and loan relief** after conditions deteriorate.
- Such measures are necessary during crises but cannot substitute for long-term investments in **watershed development, aquifer management, crop diversification and drought-resilient infrastructure**.

Limited Micro-Irrigation:

- **Drip and sprinkler irrigation** can improve water-use efficiency, but adoption remains constrained in several regions by initial investment requirements, fragmented landholdings, technical limitations and inadequate maintenance capacity.

Groundwater–Agriculture Nexus:

- Free or highly subsidised electricity can reduce the marginal cost of groundwater extraction, encouraging pumping beyond sustainable recharge levels in some regions.
- Drought policy therefore requires simultaneous reform of **cropping incentives, irrigation pricing, groundwater regulation and electricity policy**.

Measures Needed to Strengthen Drought Management:

Climate-Resilient Agriculture:

- Promote **agro-climatic zoning** so that crop choices correspond to local water availability, soil conditions and climatic suitability.
- Encourage diversification from highly water-intensive crops towards **millets, pulses, oilseeds and other climate-resilient crops**, supported by appropriate procurement, market access and value chains.
- Strengthen **climate-resilient seed systems**, contingency crop planning and weather-based agricultural advisories.

Water-Use Efficiency:

- Expand **micro-irrigation, precision irrigation and water-saving agronomic practices** under programmes such as the **Pradhan Mantri Krishi Sinchayee Yojana**.
- The principle of “**Per Drop More Crop**” should be linked with crop diversification so that efficiency gains do not simply encourage expansion of water-intensive cultivation.

Groundwater Governance:

- Move from individual well-based extraction towards **aquifer-level groundwater management**.
- Strengthen community participation through **Gram Panchayats, Water User Associations and local groundwater budgeting**.
- Experiences under the **Atal Bhujal Yojana** demonstrate the importance of community participation, groundwater measurement and water-use planning.

Watershed and Ecosystem Restoration:

- Restore **tanks, ponds, johads, baolis, eris, wetlands and traditional drainage systems** to improve local water retention and groundwater recharge.
- Promote watershed development through **check dams, contour trenches, farm ponds, recharge structures and soil-moisture conservation**.
- Integrate watershed programmes with rural employment programmes to generate both **ecological assets and rural employment**.

Technology and Early Warning:

- Strengthen satellite-based drought monitoring through systems such as **National Agricultural Drought Assessment and Monitoring System (NADAMS)**.
- Integrate **rainfall forecasts, soil moisture, NDVI, groundwater levels, reservoir storage and crop-condition data** into a unified drought-monitoring platform.
- The NDMA’s **SACHET platform** demonstrates how geo-targeted, multi-hazard early-warning systems can disseminate government alerts in near real time.
- Early-warning systems should be connected to **pre-agreed triggers for action**, including fodder planning, drinking-water arrangements, crop advisories and livelihood support.

Value Addition for UPSC:

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Key Conceptual Linkages:

- **Drought ? Agriculture ? Food Security ? Inflation ? Rural Demand ? Economic Growth**
- **Groundwater Depletion ? Irrigation Vulnerability ? Crop Failure ? Rural Distress**
- **Climate Change ? Extreme Rainfall + Longer Dry Spells ? Hydro-climatic Uncertainty**
- **Water Scarcity ? Inter-State River Disputes ? Federalism ? Cooperative Water Governance**
- **Drought Management ? Disaster Risk Reduction ? Article 21 ? Social Protection**

Relevant SDGs:

- **SDG 2:** Zero Hunger — protecting agricultural productivity and food security.
- **SDG 6:** Clean Water and Sanitation — improving sustainable water-resource management.
- **SDG 12:** Responsible Consumption and Production — promoting efficient water use.
- **SDG 13:** Climate Action — strengthening climate adaptation and resilience.
- **SDG 15:** Life on Land — restoring degraded ecosystems and improving land-water interactions.

Mains-Ready Framework:

- **Problem:** Rainfall variability + groundwater depletion + water-intensive agriculture + fragmented governance.
- **Impact:** Agricultural losses + food insecurity + livelihood stress + rural migration + ecological degradation.
- **Reform:** Early warning + crop diversification + micro-irrigation + aquifer management + watershed restoration.
- **Governance Principle:** Shift from **crisis relief to risk reduction and drought-proofing**.
- **Core Objective:** Build **water-resilient agriculture and communities** rather than merely compensating for drought-induced losses.

Conclusion:

- Drought in India is not merely a **rainfall-deficiency phenomenon**; it is the outcome of interactions among climate variability, rising water demand, agricultural practices, groundwater extraction and institutional weaknesses.
- Maharashtra's recent drought declaration demonstrates the need for **early identification, targeted relief and long-term resilience-building**.
- India's drought strategy should therefore shift from **reactive relief to proactive drought-proofing**, combining climate-resilient agriculture, efficient irrigation, aquifer management, ecosystem restoration, scientific monitoring and community participation.
- Such an approach is essential for simultaneously protecting **food security, livelihood security, water security and sustainable economic growth**.