

# Drought

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# Introduction

- “An extended period of months or years when a region notes a deficiency in its water supply (surface or underground)”.

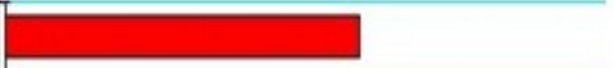
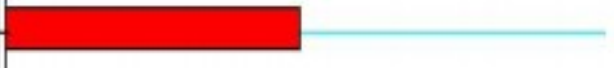





**OR**

- “A natural shortfall of precipitation and water resources to levels that do not meet the uses established for normal conditions”.

- **Concerns:**

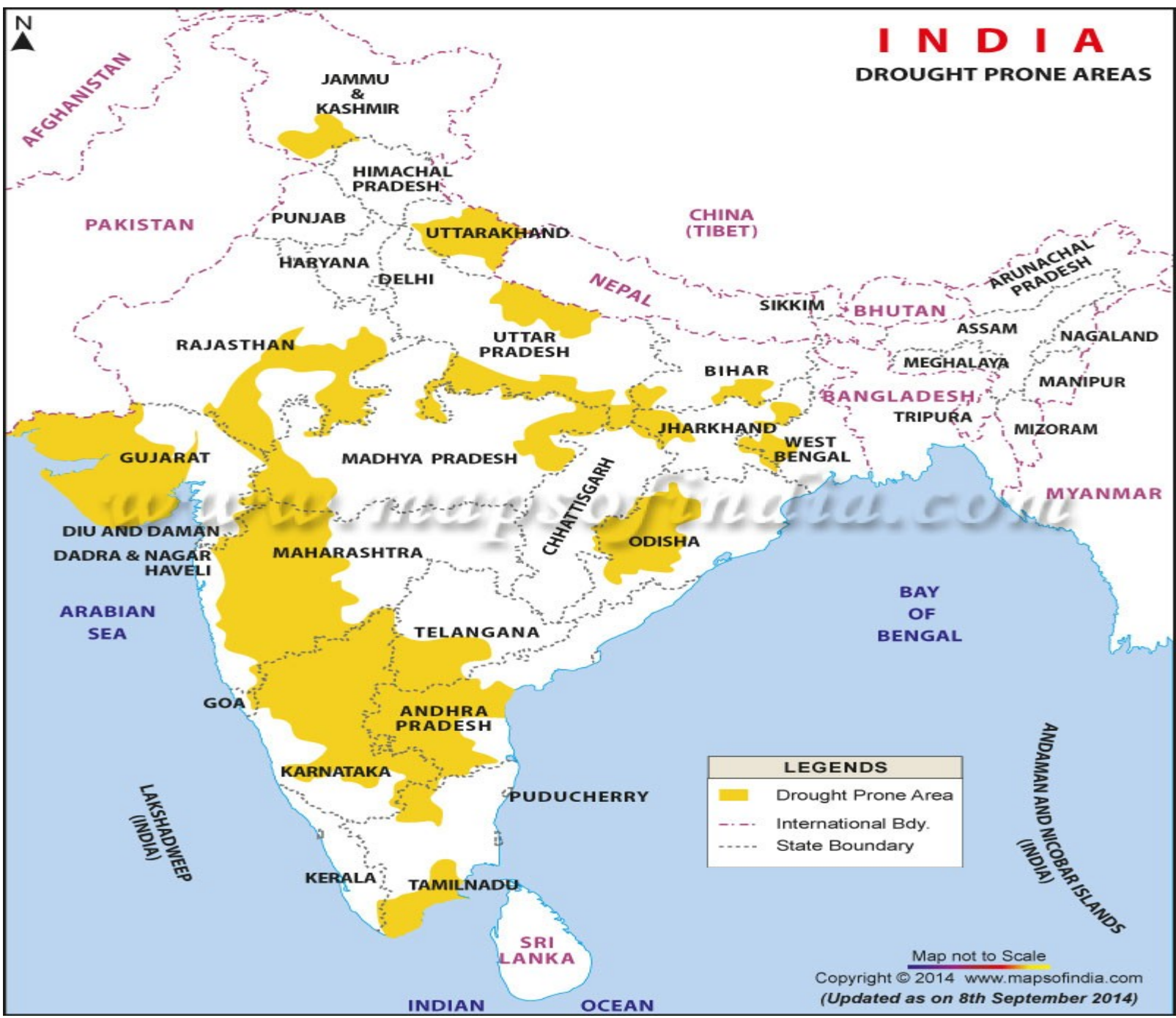
- ✓ It affect ecosystem and agriculture.
- ✓ It affect food production, reduce life expectancy, and economic performance of entire country.

## ***HISTORY OF DROUGHTS IN INDIA***

<b>PERIOD</b>	<b>DROUGHT YEARS</b>	<b>NUMBER OF DROUGHT</b>	
1801-1830	1801, 1804, 1806, 1812, 1819, 1825	6	
1831-1860	1832, 1833, 1837, 1853, 1860	5	
1861-1890	1862, 1866, 1868, 1873, 1877, 1883	6	
1891-1920	1891, 1897, 1899, 1901, 1904, 1905, 1907, 1911, 1918, 1920	10	
1921-1950	1939, 1941	2	
1951-1980	1951, 1965, 1966, 1971, 1972, 1974, 1979	7	
1981-2010	1982, 1987, 2002, 2009	4	

# INDIA

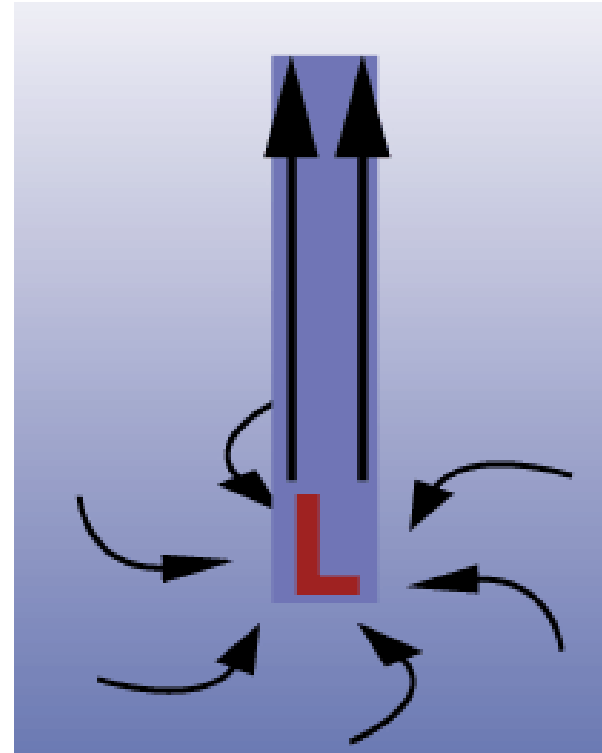
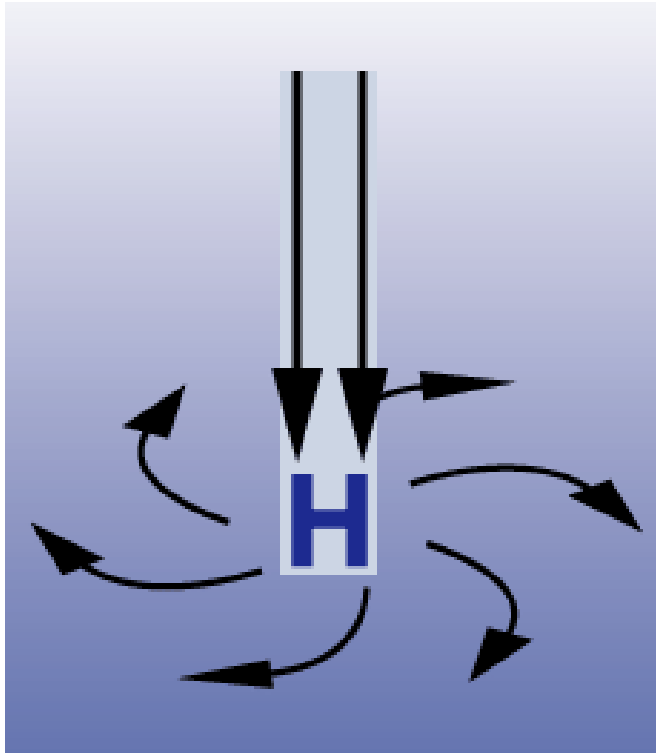
## DROUGHT PRONE AREAS



LEGENDS	
	Drought Prone Area
	International Bdy.
	State Boundary

# Causes of Draught

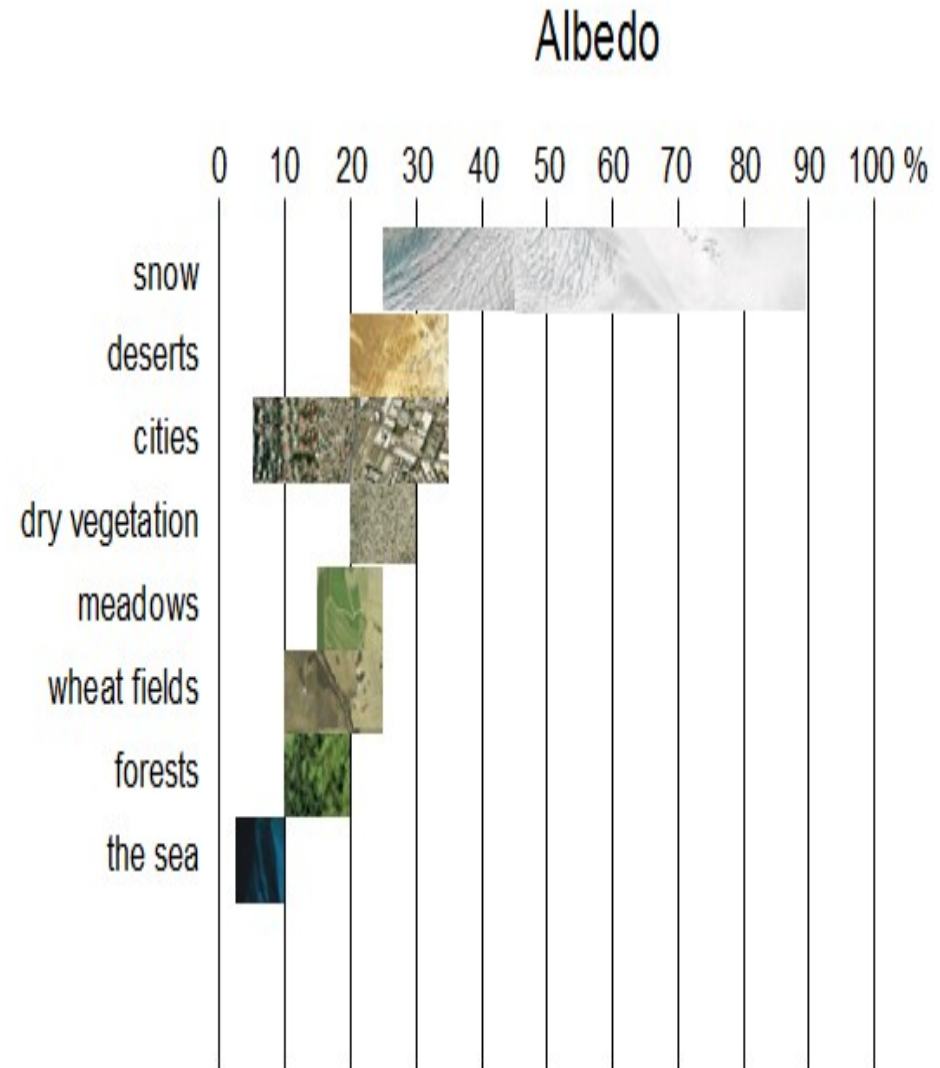
Natural	Human Made
More <b>High Pressure Systems</b>	<b>Overpopulation</b>
Deficiency of rainwater	Over cultivation
<b>High albedo</b> (Reflected radiation)	<b>Deforestation</b>
El-Nino Southern Oscillation ( <b>ENSO</b> )	Over extraction of ground water
<b>Global warming</b>	Overgrazing
<b>Climate change</b>	Over-irrigation
Weather (hot + dry)	Soil erosion



**Cyclone and Anticyclone**

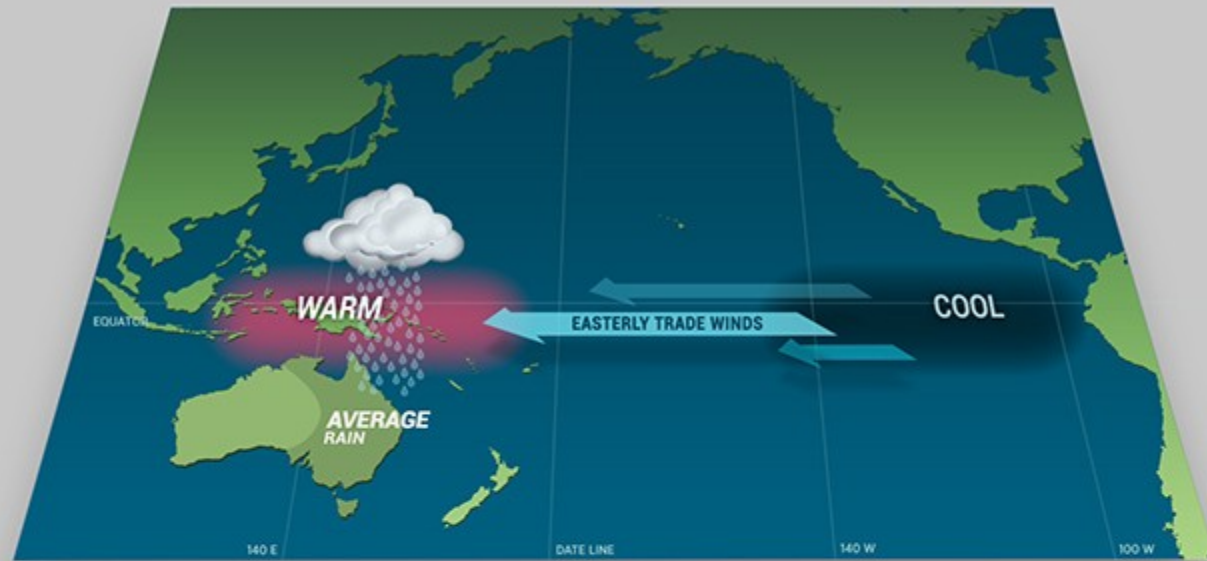
# Changes in Albedo

- **Albedo** - amount of solar radiation (%) reflected from a surface.
- **Earth's** albedo - **30%**, Warms Earth's land, water, and atmosphere.
- **Deforestation** - Higher albedo (less evaporative cooling by **Transpiration**)
- **Reforestation** - Lower albedo
- **Urbanization** - Higher albedo.



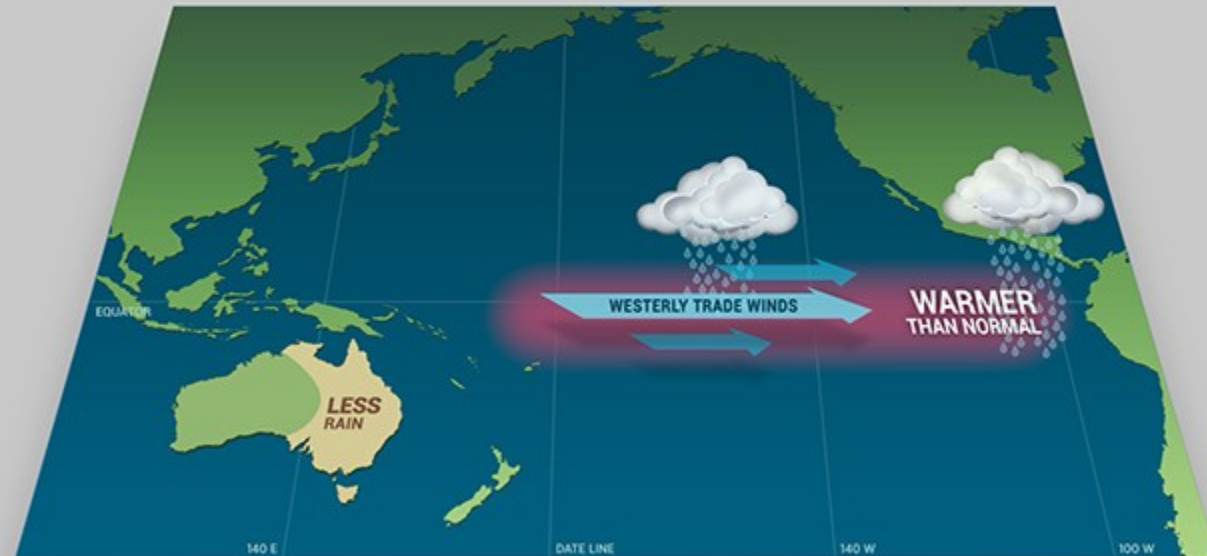


# Elnino- Southern Oscillation



## NEUTRAL

An easterly trade wind stores heat in the western Pacific Ocean, resulting in a rain band off Australia.



## EL NIÑO

The trade winds weaken or reverse into a westerly, allowing warm water to flow across the Pacific Ocean and shifting the rain band towards South America.

[https://  
www.youtube.com/watch?  
v=WPA-KnldDVc](https://www.youtube.com/watch?v=WPA-KnldDVc)

# Drought classification systems

## Meteorological :-

- Normal precipitation below 25%.

## Hydrological :-

- Prolonged meteorological drought and drying of reservoirs, lakes, streams and rivers, cessation of spring flows and fall in groundwater levels.

## Agricultural :-

- Depletion of soil moisture during the growing season. A dry situation with 20% probability and rainfall deficiency of more than 25% in drought-prone states of India.

**Meteorological**

**Rainfall  
Deficiency**

**Hydrological**

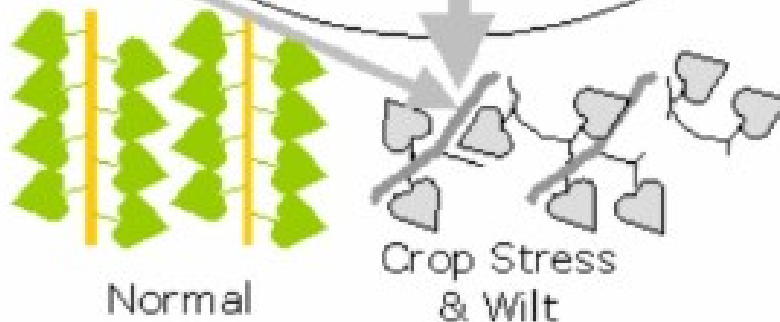
**Water  
Supply  
Deficiency**

**Agricultural**

**Soil  
Moisture  
Deficiency**

**Drought**

Soil moisture cannot support crop growth to maturity



## Impacts of Draught

- Diminished **crop growth or yield** and carrying capacity for livestock.
- Degraded **water quality** because lower water flows reduce dilution of pollutants.
- **Dust bowls** and storms further erode the landscape.
- **Desertification** and **soil erosion**.
- **Famine** due to lack of water for irrigation.
- **Habitat damage**, affecting both terrestrial and aquatic wildlife.
- **Malnutrition**, dehydration and related diseases.
- **Mass migration**: resulting in internal displacement and international refugees.
- **Reduced electricity production** due to reduced water flow.
- **War** over natural resources, including water and food.
- **Wildfires**, such as Australian bushfires.

# Prevention and Mitigation

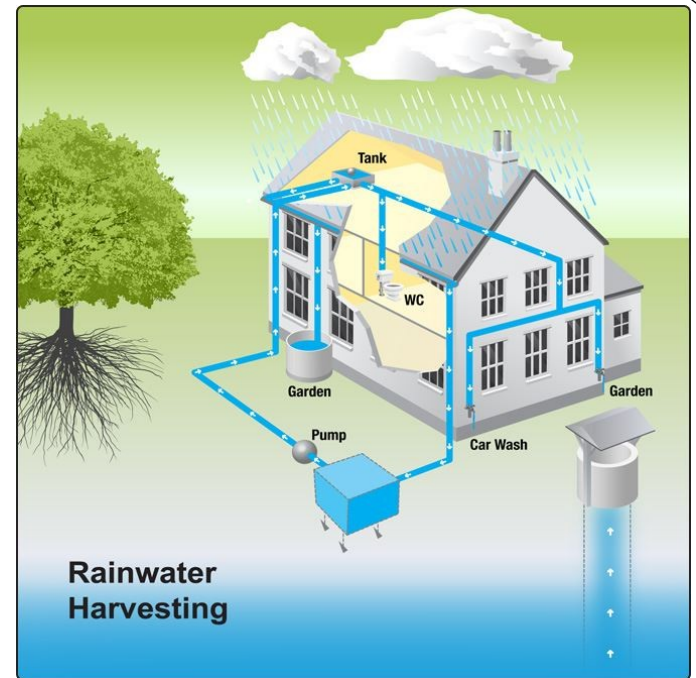
- **Dams** and reservoirs construction and restoration of **Wetlands**.
- **Cloud seeding** - artificial rainfall.
- **Desalination** of sea water.
- **Drought monitoring** – rainfall levels and water usage.
- **Crop rotation** - minimize erosion and maintain soil fertility.
- **Outdoor water-use restriction** - sprinklers, car washing, pools etc.
- **Rainwater harvesting** - ground water recharge.
- **Wastewater recycling**
- **Interconnecting of rivers**

## Continued.....

- **Water conservation**
- **Education and training**
- **Soil conservation**
- **Economic and social empowerment**
- Proper **selection of crop** for drought affected areas.
- Reduce **deforestation** and discourage **fire-wood** use.
- Check **migration** and provide alternate **employment (NREGA' 2005)**.
- **Joint forest management**
- Integrated wastelands development program (**IWDP**)



**Check Dam**



**Rainwater Harvesting**



**Contour Bunding**



**Afforestation**

## Further Readings

1. Drought, <https://en.wikipedia.org/wiki/Drought>.
2. Melissa Denchak, Drought: Everything You Need to Know, <https://www.nrdc.org/stories/drought-everything-you-need-know>.
3. Droughts 101, Resource Library, National Geographic, <https://www.nationalgeographic.org/video/droughts/>
4. El Nino - What is it?, <https://www.youtube.com/watch?v=WPA-KpldDVc>



# References

1. N. Sai Bhaskar Reddy, Management of drought, <https://www.slideshare.net/saibhaskar/management-of-drought>.
2. Avinash Sahu, Drought monitoring and water resources management, <https://www.slideshare.net/AvinashSahu22/drought-and-its-management>.
3. C. Harilal B., Drought management, <https://www.slideshare.net/vivek6002/drought-management>.
4. Muhammad Usman et al., Drought, <https://www.slideshare.net/usmanwaheed14/drought-94333278>.

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