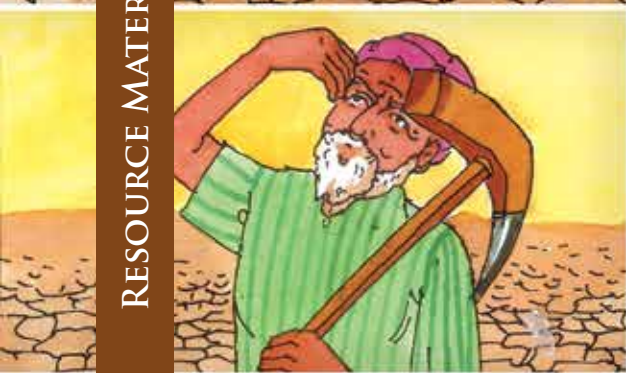
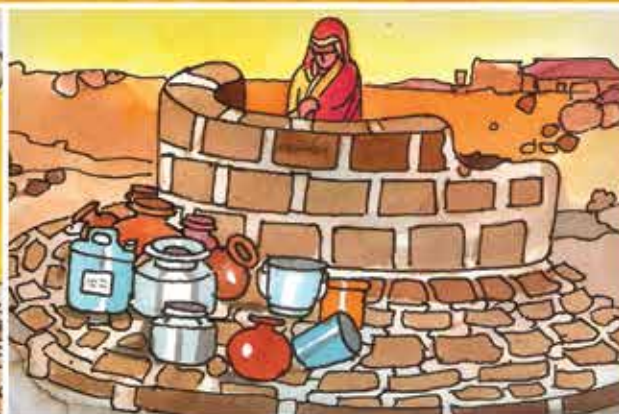


Drought



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About the Series

A disaster is an event caused by the sudden disruption of normalcy within society resulting into widespread damage to life and property. Sometimes we also face accidents that are so serious that they have a long term effect on life and property. To avoid such accidents we need to be cautious in our day-to-day activities.

In this series, an attempt has been made to raise awareness in order to handle these disastrous situations effectively so as to minimise losses.

This series comprises of ten booklets covering different areas such as earthquake, landslide, tsunami, flood, draught, fire and accidents, chemical hazards, epidemics like swine flu, malaria and dengue, food poisoning and cholera. You will notice that the topics selected here do not include all the issues related to disaster. These are only illustrative cases. This is because the idea is to impart necessary information to develop skills to enable people to prevent disasters or to reduce their impact by efficient handling of such situations.

Simple and communicative language has been used in the entire series so that children in the age group of 10–16 years can understand it effectively. We hope that the readers will benefit from this material and have confidence to handle such kind of situations proving to be smart and responsible citizens.

It is suggested that the teachers and facilitators use this series as an example to develop related material for school projects. The teachers could also share these projects and hold awareness programmes for the community with an aim to initiate continuous participation when such situations arise.

The Council also welcomes the suggestions from the users of this material.

DROUGHT



Anant



Mr. Taiyab



Grandfather



Riddhi

विद्यया ऽ मृतमश्नुते

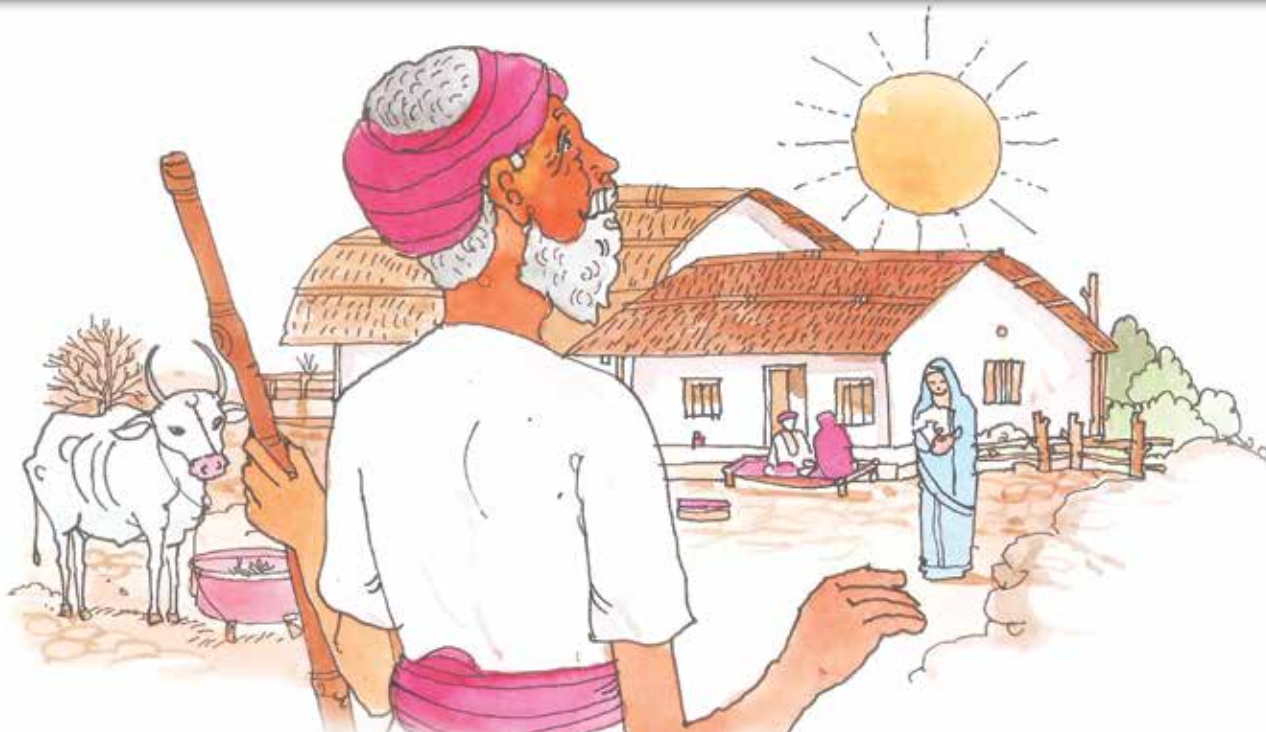


एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

A small village in the Vidarbha area of Maharashtra is facing drought again this year*. Days pass under a scorching sun and a clear sky.

People keep looking up with hope for rain, but see no clouds. They are beginning to get anxious.



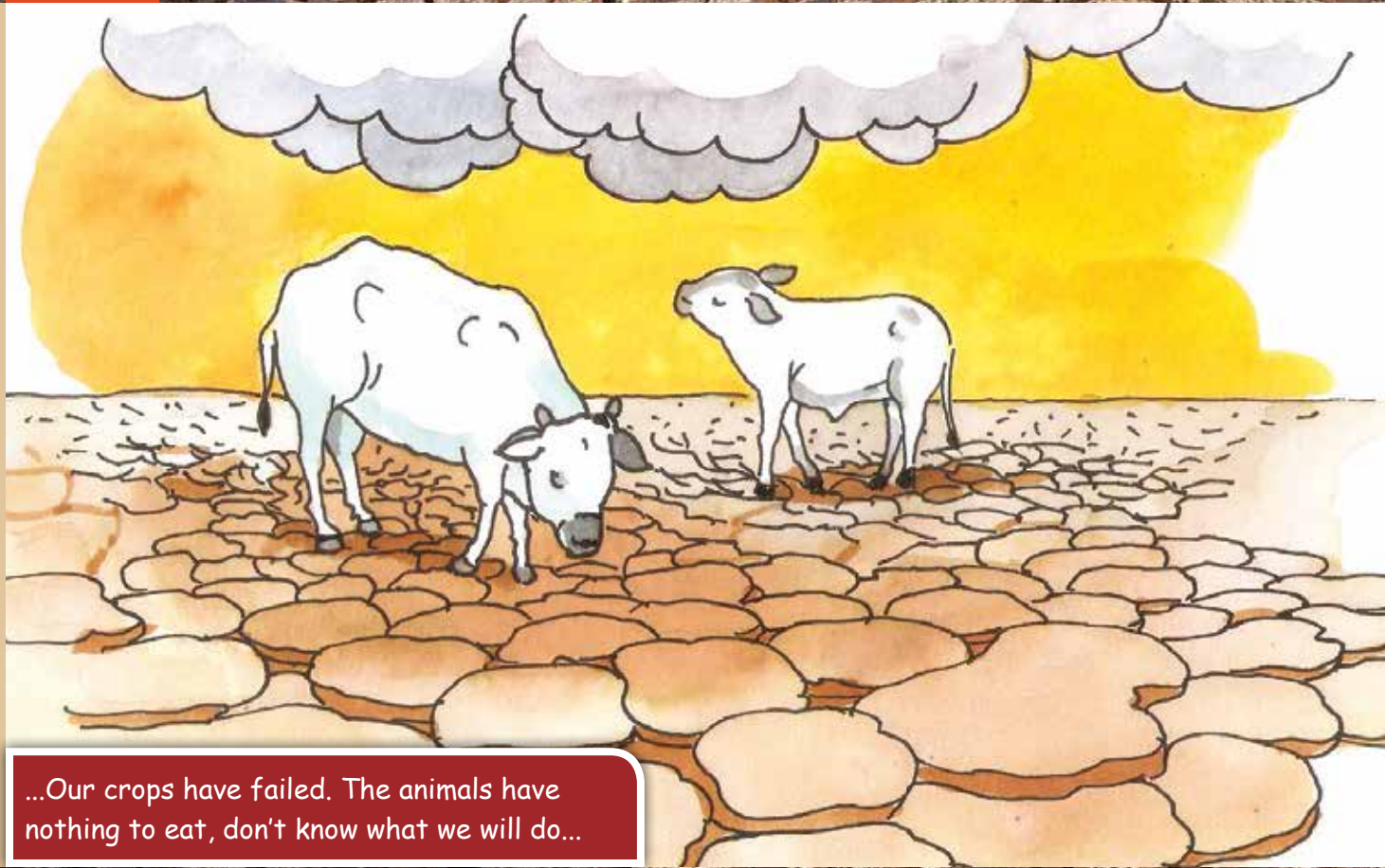
* Maharashtra faces drought frequently —almost every year.

Drought





Drought



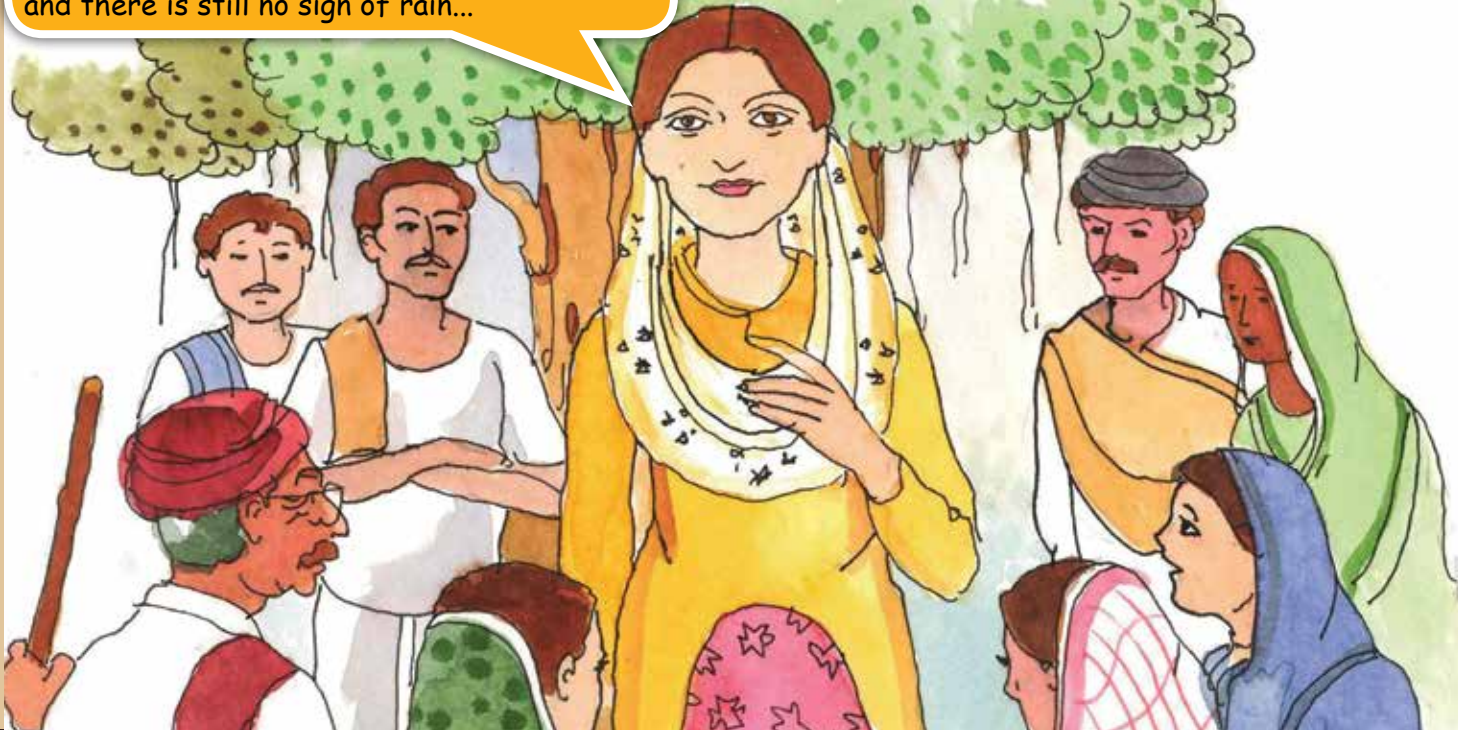
...Our crops have failed. The animals have nothing to eat, don't know what we will do...

Listen! Listen!! Listen!!!
The village Sarpanch has called an
emergency meeting regarding drought. All
villagers need to gather near the central
platform below the banyan tree at
3:00 pm today.



Drought

Later...
We have all gathered here to discuss the problem of the drought we are facing these days. The month of August is about to end and there is still no sign of rain...



Our fields are parched* and crops haven't survived..

Our livestock *** will die due to unavailability of water.

Hardly any water is left, even for our drinking — May be just for two days.

I took loan for digging four tube wells, but only one had water. That too is dry now.

If we do not do something soon, we will face a tragic** situation.

*Parched: dried due to extreme heat

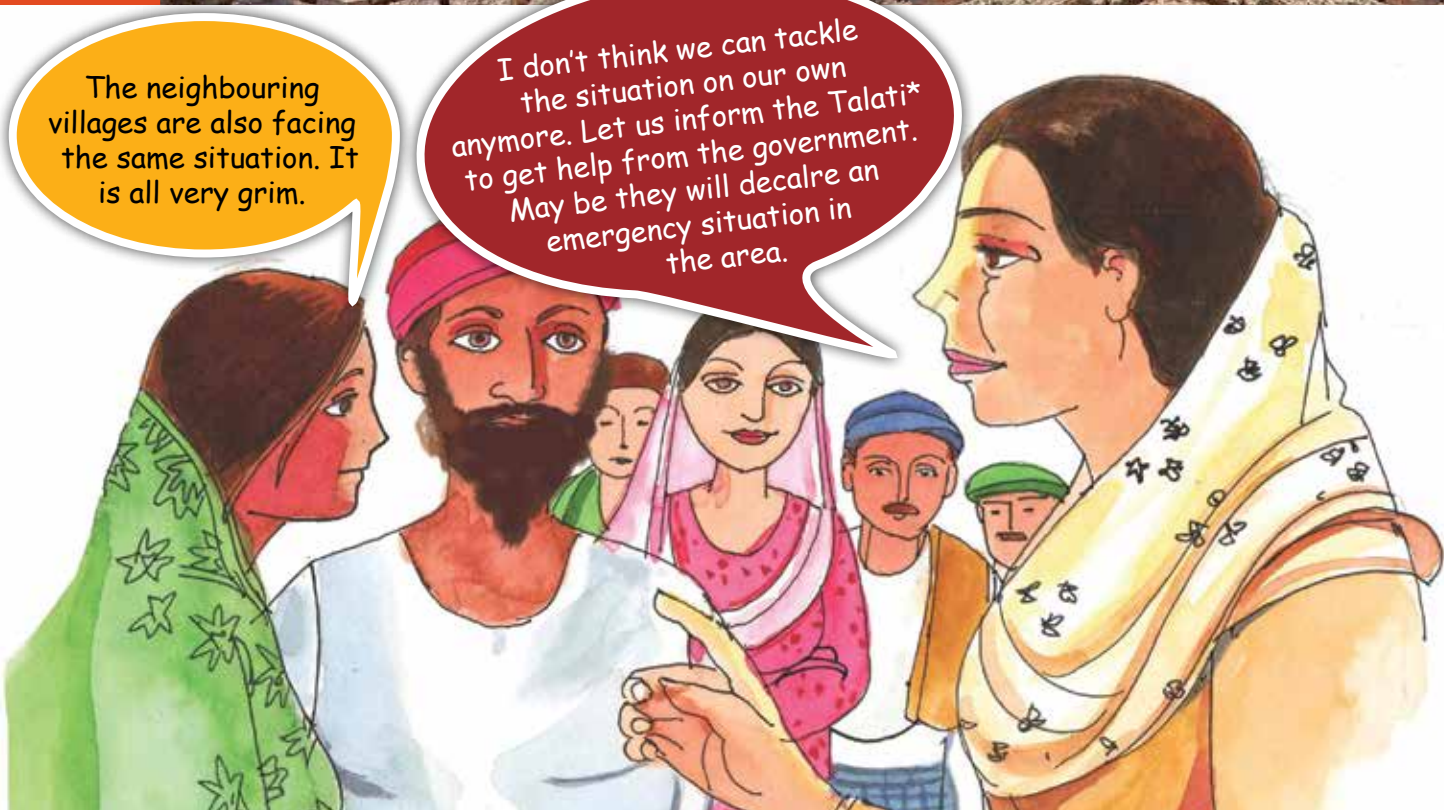
**Tragic: characterised by extreme distress or sorrow

***Livestock: farm animals regarded as an asset

Drought

The neighbouring villages are also facing the same situation. It is all very grim.

I don't think we can tackle the situation on our own anymore. Let us inform the Talati* to get help from the government. May be they will declare an emergency situation in the area.

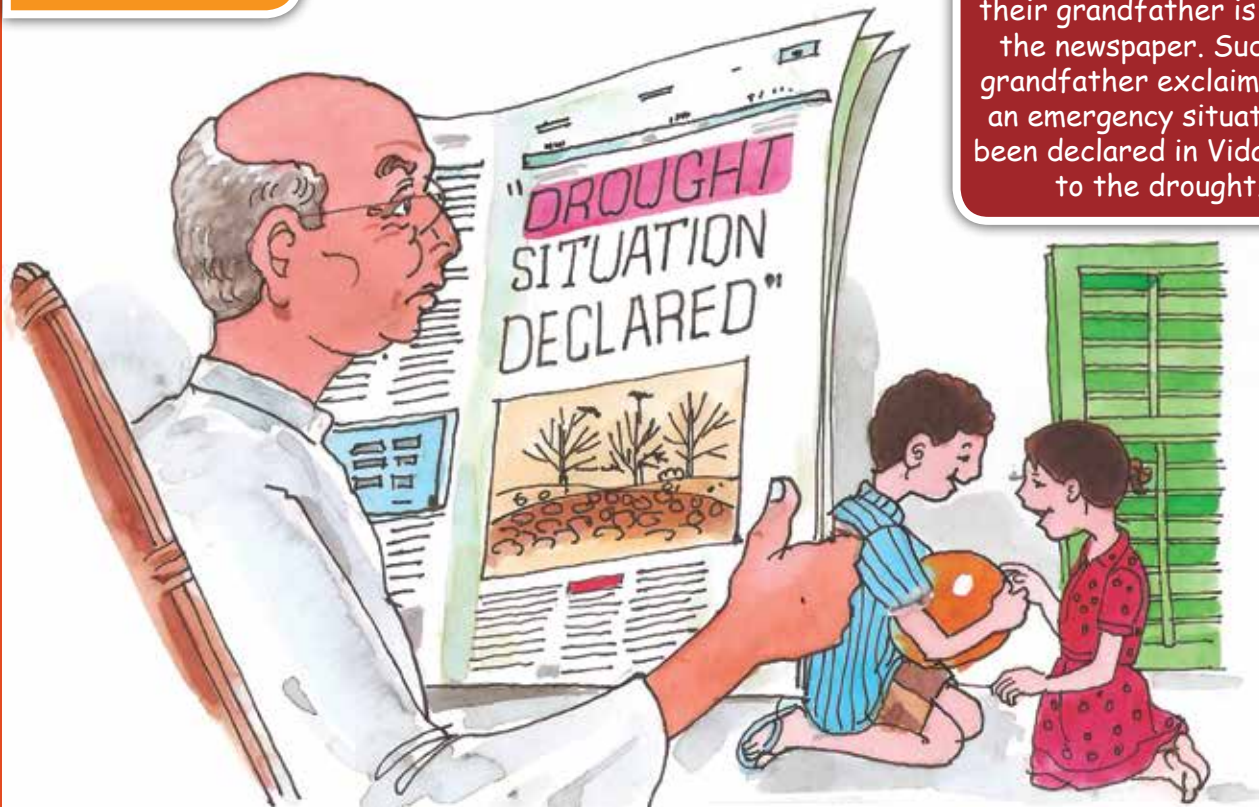


*In Vidarbha Area, the *patwari* is called *Talati*.

Grim: serious worrying situation

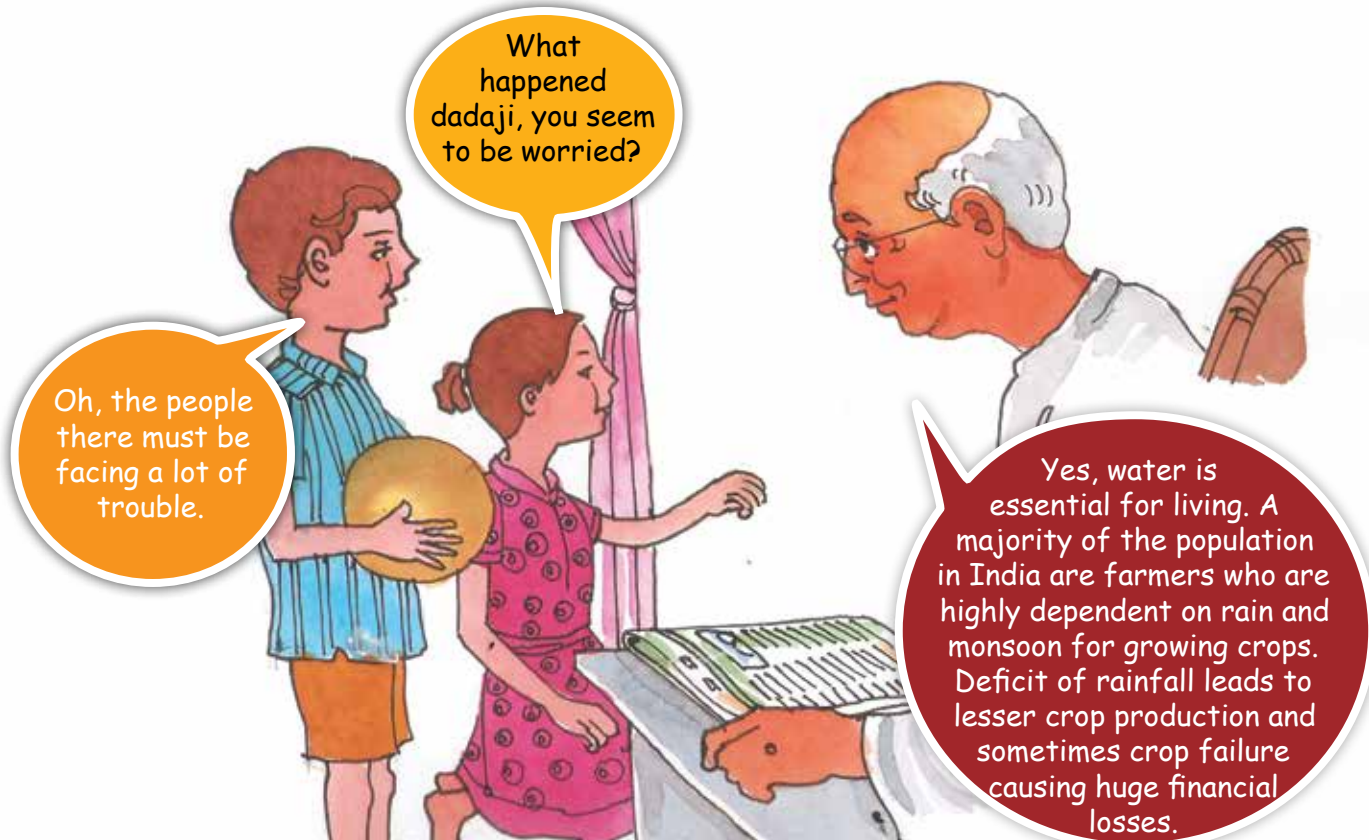
Emergency: serious unexpected and often dangerous situation requiring immediate action

In Mumbai...



Riddhi and Anant are playing in the room where, their grandfather is reading the newspaper. Suddenly, grandfather exclaims, "Oh... an emergency situation has been declared in Vidarbha due to the drought..."

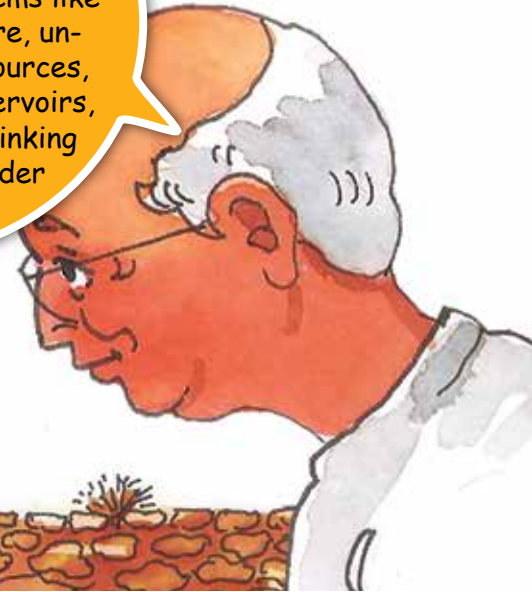
Drought



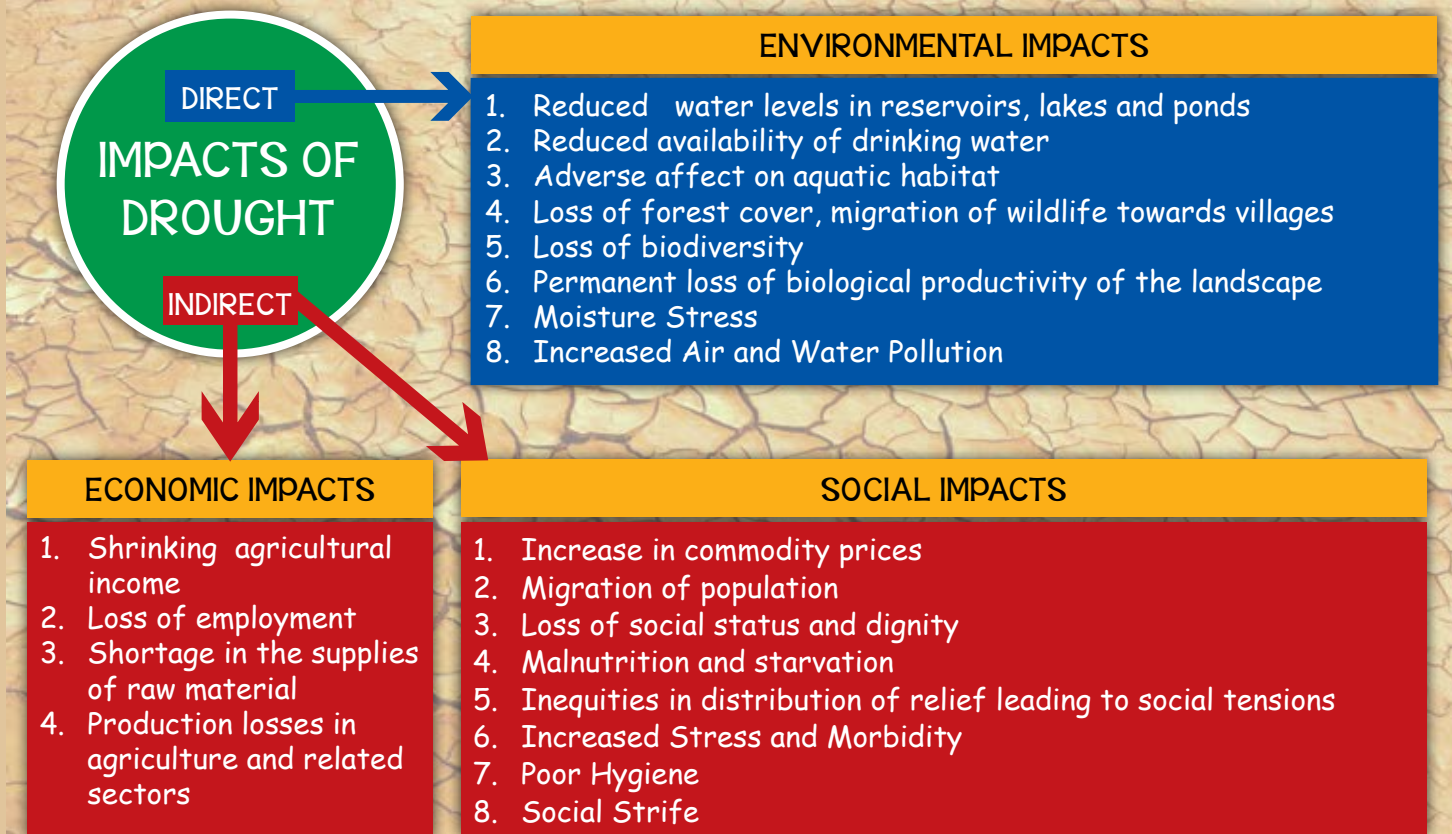
Deficit: the amount available is much lesser than the requirement

Poor farmers! they provide food to all and still they are the ones who bear most consequences of the drought!

Not only farmers, drought affects everyone — including the entire environmental system. Droughts lead to problems like widespread crop failure, un-replenished water resources, depletion of lakes, reservoirs, ponds, shortage of drinking water, reduced fodder availability etc.



Consequences: as a result of



(Source: <http://nidm.gov.in/pdf/manuals/drought-manual.pdf>)

Aquatic : relating to water



But Dadaji, I remember my teacher told me once that the earth is covered with approximately 70 per cent water. Then why are there droughts, when earth has so much of water?

Yes, you are right. Though the earth has a large quantity of water in seas and oceans, a very little portion of it is potable. Most of the water is saline and not fit for usage. Only rain, underground and river water can be used for domestic needs. Whenever, rainfall is very less, it leads to drought conditions.



Drought

Why is the rainfall less during some years?

There are several reasons for that.



CAUSES OF DROUGHTS IN INDIA

India is a vast country with a varied climate. The rainy season in India is restricted to 3 to 4 months. The seasonal rainfall (monsoon rains) over the Indian subcontinent is a global phenomenon associated with large scale hemispherical movement of air masses. Two major atmospheric phenomena are —

- ✧ Sea-surface temperature around the Indian subcontinent in relation to atmospheric circulation, and
 - ✧ Large scale pressure oscillation in atmosphere over Southern Pacific Ocean.
- The El-Nino effect is one such phenomenon which has profound influence on the monsoon activity over the Indian subcontinent.

When there is shortage of rainfall coupled with its erratic distribution during rainy season, severe water deficit conditions arise in some areas, which result in droughts of various intensities. Therefore, one or the other part of the country experiences drought almost every year.

The study of summer monsoon over the country by India Meteorological Department has shown that all drought years were El-Nino years. However, it has also shown that the El-Nino effect is not the only factor responsible for less rainfall. Some other factors such as aberrations in South West monsoon are said to be largely responsible for droughts in India.

Drought

So
this means
that droughts
are basically
a natural
phenomena?

Yes, but human
activities are also contributing
towards it. Now-a-days, we are experiencing
climate change because of the consequence of
unsustainable living practices adopted by humans.
Unpredictable and untimely rains in some
parts and deficit of rain in others is an
outcome of these practices.

CAUSES OF CLIMATE CHANGE AND WATER DEFICIT

Besides atmospheric phenomenon, air pollution and deforestation etc. are resulting in climatic changes, which affect the rain fall. Some regions face low rain fall and some regions

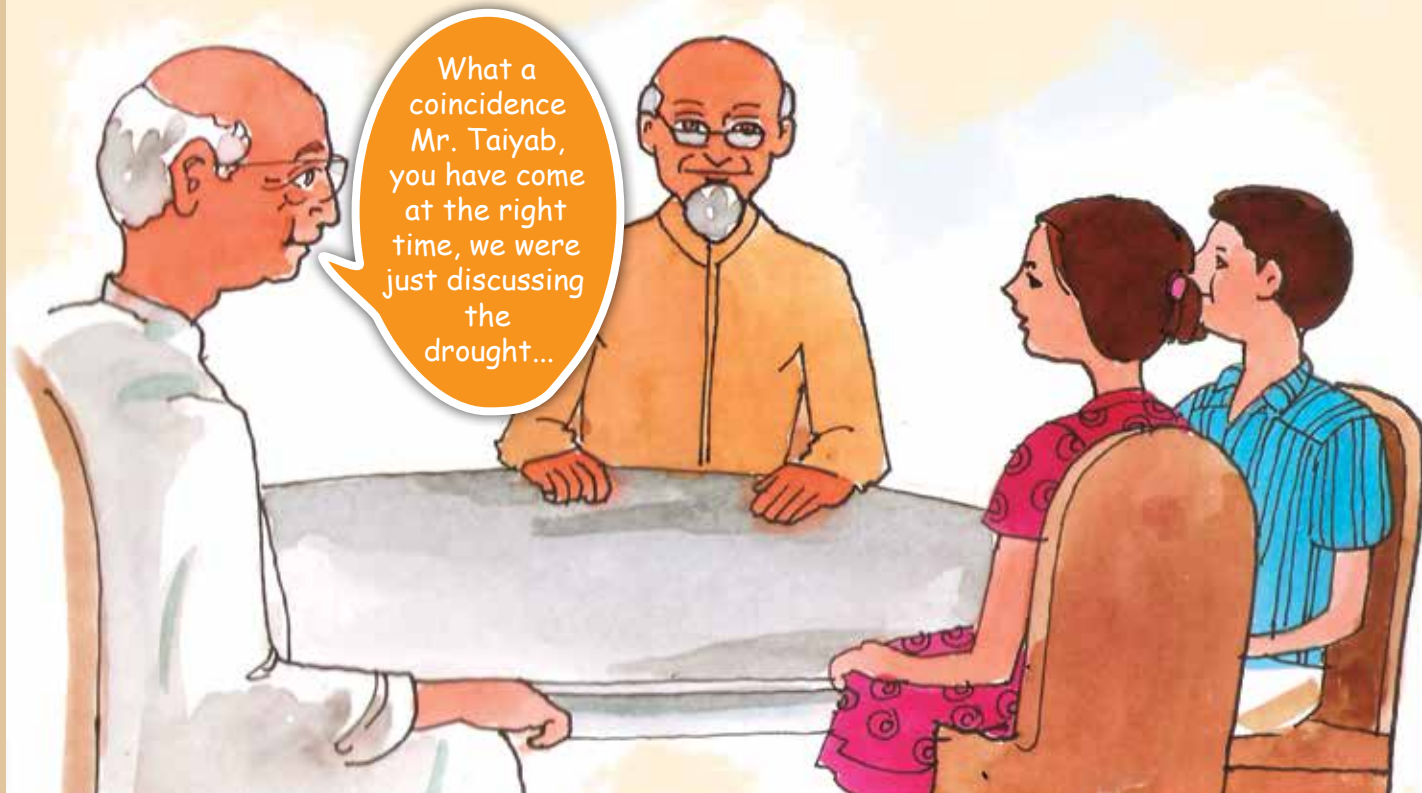
face heavy rain fall for a very short period. The problem is aggravated by the following reasons:

- ✘ Poor catchment and inadequate water availability.
- ✘ Low infiltration of rain water.
- ✘ High temperature and evaporation.
- ✘ High wind speed.
- ✘ Unseasoned rains and fog or snowfall.
- ✘ Heavy water loss during storage and distribution.
- ✘ Over exploitation of surface and ground water.

- ✘ High water-consuming agricultural practices
- ✘ Contamination of water due to pollution.
- ✘ Hard water.
- ✘ Localised use of large amount of water by industry.
- ✘ Crop damage due to rain/snow/hail/pest.
- ✘ High water consumption in semi-arid and arid regions.
- ✘ Increasing population.

Drought

The door bell rings. It's Mr. Taiyab — a neighbour who is a scientist with the Indian Metrological Department (IMD).



Uncle,
Is our state
the only one
suffering from
droughts?

No
Riddhi, droughts
impact several states in India
and our state is one of them. In
fact around 60% of the country is
prone to drought in varying
degrees.

Drought

That means uncle, almost every part of India is prone to drought?

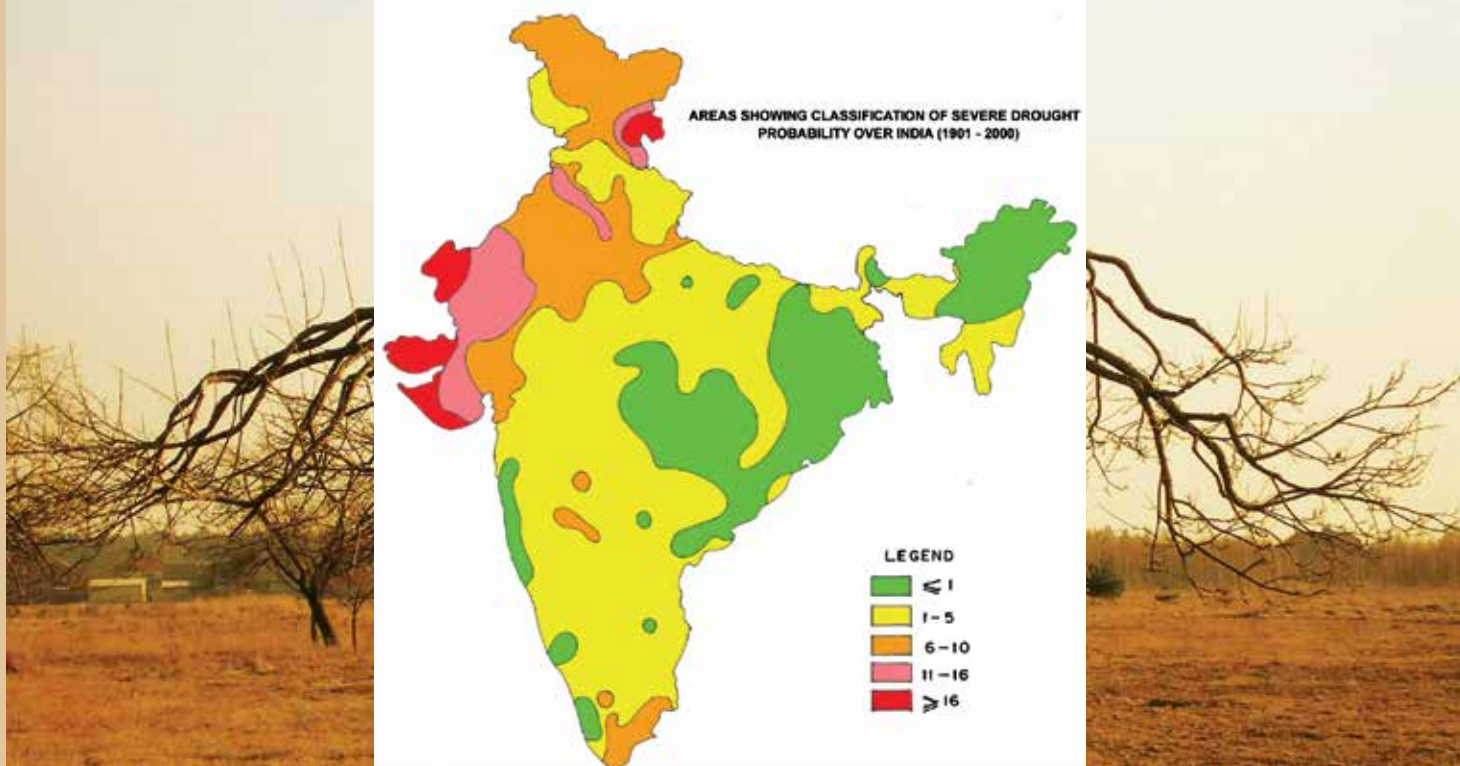


The drought prone areas are mostly confined to the peninsular and western parts of the country. In India, 35% of the area receives rainfall between 750 mm and 1,125 mm and is considered drought-prone area. While another 33% receives less than 750 mm of rainfall, is called chronically drought-prone. A further classification of India's regions has been done as arid (19.6%), semi-arid (37%), and sub-humid areas (21%).

Mapping of Drought Areas over India (NCC RESEARCH REPORT)

NATIONAL CLIMATE CENTRE OFFICE OF THE ADDITIONAL DIRECTOR GENERAL OF METEOROLOGY (RESEARCH) IMD, PUNE

http://www.imdpune.gov.in/Clim_Pred_LRF_New/Reports/NCCResearchReports/research_report_12.pdf



DISTRICTS FREQUENTLY AFFECTED BY DROUGHT

STATE	DISTRICTS
Andhra Pradesh	Anantpur, Chittoor, Cuddapah, Hyderabad, Kurnool, Mehboobnagar, Nalgonda, Prakasm
Bihar	Munger, Nawadah, Palamu, Rohtas, Bhojpur, Aurangabad, Gaya
Gujarat	Ahmadabad, Amreli, Banaskantha, Bhavnagar, Bharuch, Jamnagar, Kheda, Kutch, Mehshana, Panchmahal, Rajkot, Surendranagar
Haryana	Bhivani, Gurguaon, Mahendergarh, Rohtak
Jammu & Kashmir	Doda, Udhampur
Karnataka	Bangalore, Belgaum, Bellary, Bijapur, Chiradurga, Chikmangalur, Dharwad, Gulbarga, Hassan, Kolar, Mandya, Mysore, Raichur, Tumkur
Madhya Pradesh	Betul, Datia, Dewas, Dhar, Jhabua, Khandak, ,Shahdol , Shahjapur, Sidhi, Ujjain

DISTRICTS FREQUENTLY AFFECTED BY DROUGHT

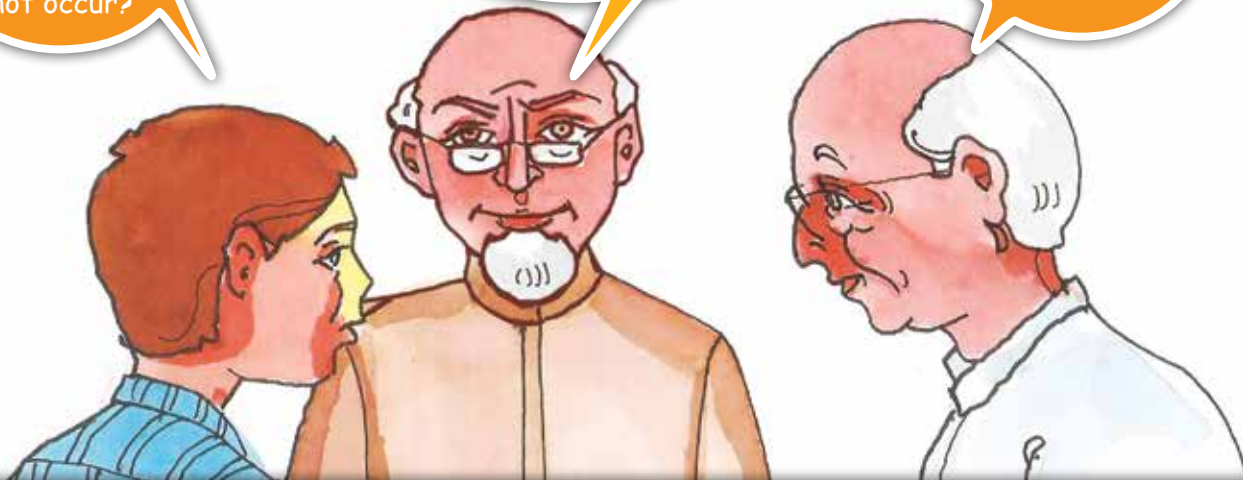
STATE	DISTRICTS
Maharashtra	Ahmednagar, Aurangabad, Beed, Nanded, Nashik, Osmanabad, Pune, Parbhani, Sangli, Satara, Sholapur,
Odisha	Phulbani, Kalahandi, Bolangir, Kendrapada
Rajasthan	Ajmer, Banaswada, Barmer, Churu, Dungarpur, Jaisalmer, Jalor, Jhunjunu, Jodhpur, Nagaur, Pali, Udaipur
Tamil Nadu	Coimbatore, Dharmapuri, Madurai, Ramanathapuram, Salem, Trichurapali, Tirunelveli, Kanyakumari
Uttar Pradesh	Allahabad, Banda, Hamirpur, Jalana, Mirzapur, Varanasi
Jharkhand	Palamu
Chhattisgarh	Khargaoon

Drought

So
uncle, How
many days it
must rain so that
drought does
not occur?

Declaring
a drought year is a
complex process. But to
put it simply, the percentage
deficit of rainfall decides
whether it will be a
drought year or not.

There is
much more
to learn about
drought than I
had thought.

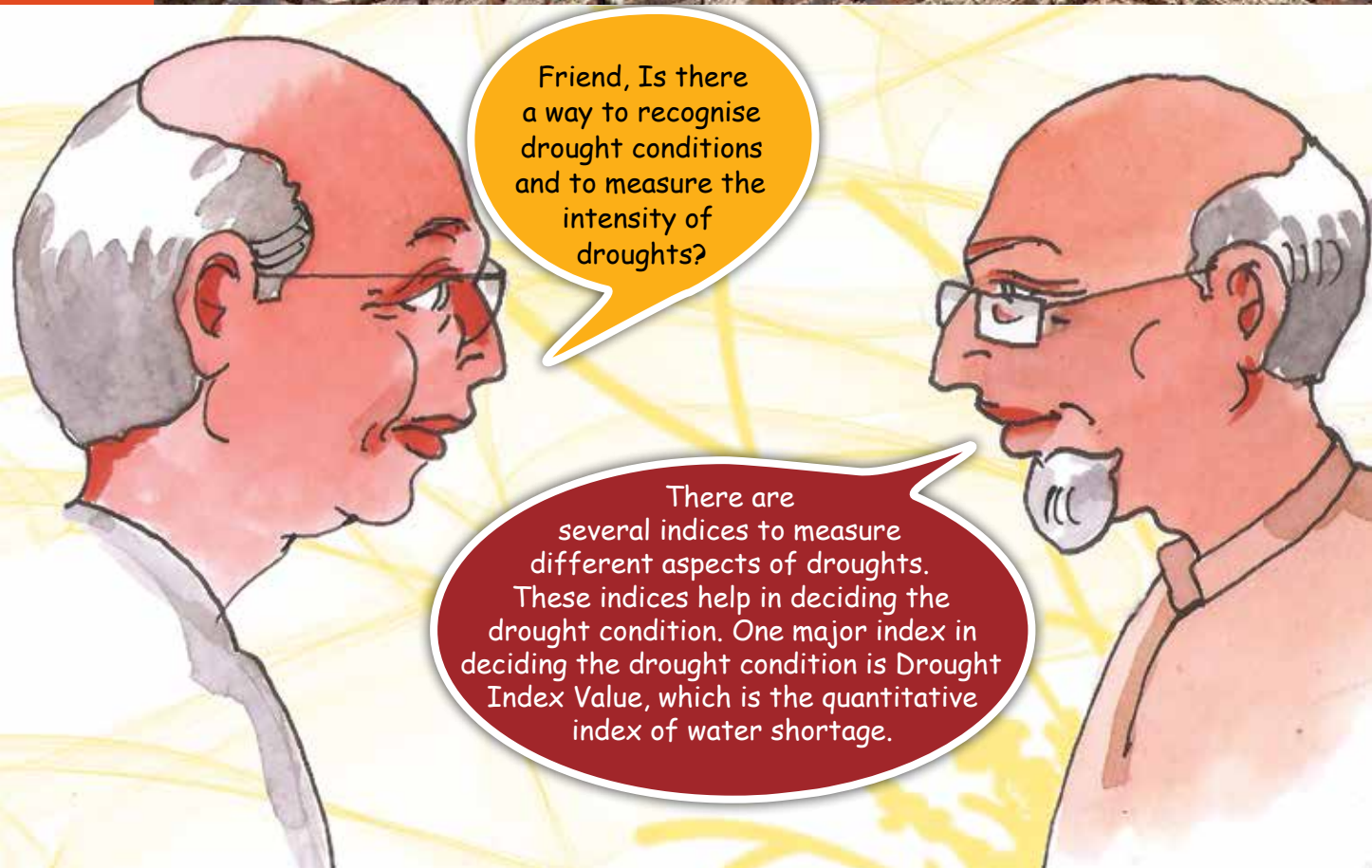


Meteorologically, $\pm 19\%$ deviation of rainfall from long-term average is considered 'normal' in India. Deficiencies in the range 20-59% represent 'deficient', and more than 60% is 'scanty'.

You will be surprised to know that Indian National Commission on Agriculture (1978) classifies drought under following categories:



DROUGHT CATEGORIES	CONDITIONS AND EFFECTS
Meteorological	Meteorological drought usually precedes other kinds of drought. Meteorological drought is said to occur when rainfall deficiency of an area with respect to normal (long term average precipitation) is less. It is classified as moderate drought if the deficiency is 26%-50% and severe drought when the deficiency exceeds 50% of the normal. In a situation when the rainfall deficiency exceeds 10% and when the area under drought exceeds 20% of the total area of the plains in the country, it is considered as drought for the country as a whole. When the spatial coverage of drought is more than 40% it is called as all India severe drought year.
Hydrological	Prolonged meteorological drought resulting in depletion of surface water from reservoirs, lakes, streams, rivers, cessation* of spring flow and fall in groundwater levels causing severe shortage of water for human, livestock and specific needs. Such conditions may arise, even in times of normal precipitation when increased usages of water diminishes the reserves.
Agricultural	Agricultural drought, usually triggered by meteorological and hydrological droughts, occurs when soil moisture and rainfall are inadequate during the crop growing season causing extreme crop stress and wilting.



KEY DROUGHT INDICES

Normal Rainfall (Quantity, Intensity, Timing)

- Normal Infiltration
- Normal Runoff
- Normal Groundwater Recharge
- Normal Stream Flow
- Normal Inflow (Reservoir/Lakes/Ponds)

- Normal Soil Moisture
- (Seed germination, Growth reproduction of crops)

Normal
Agricultural
Production

No Drought

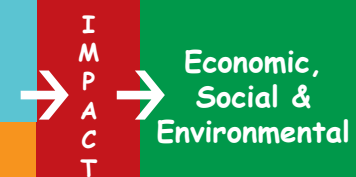
Deficient Rain Fall (Quantity, Intensity, Timing)

- Reduced Infiltration
- Reduced Runoff
- Reduced Groundwater Recharge
- Reduced Stream Flow
- Reduced Inflow (Reservoir/Lakes/Ponds)
- Increased Evaporation & Transpiration Loss (due to high temperature, wind, sunshine and low humidity).

- Soil-Water Deficiency
- Plant Water Stress
- Reduced Biomass

Decreased Agricultural Production

Drought-affected



Drought



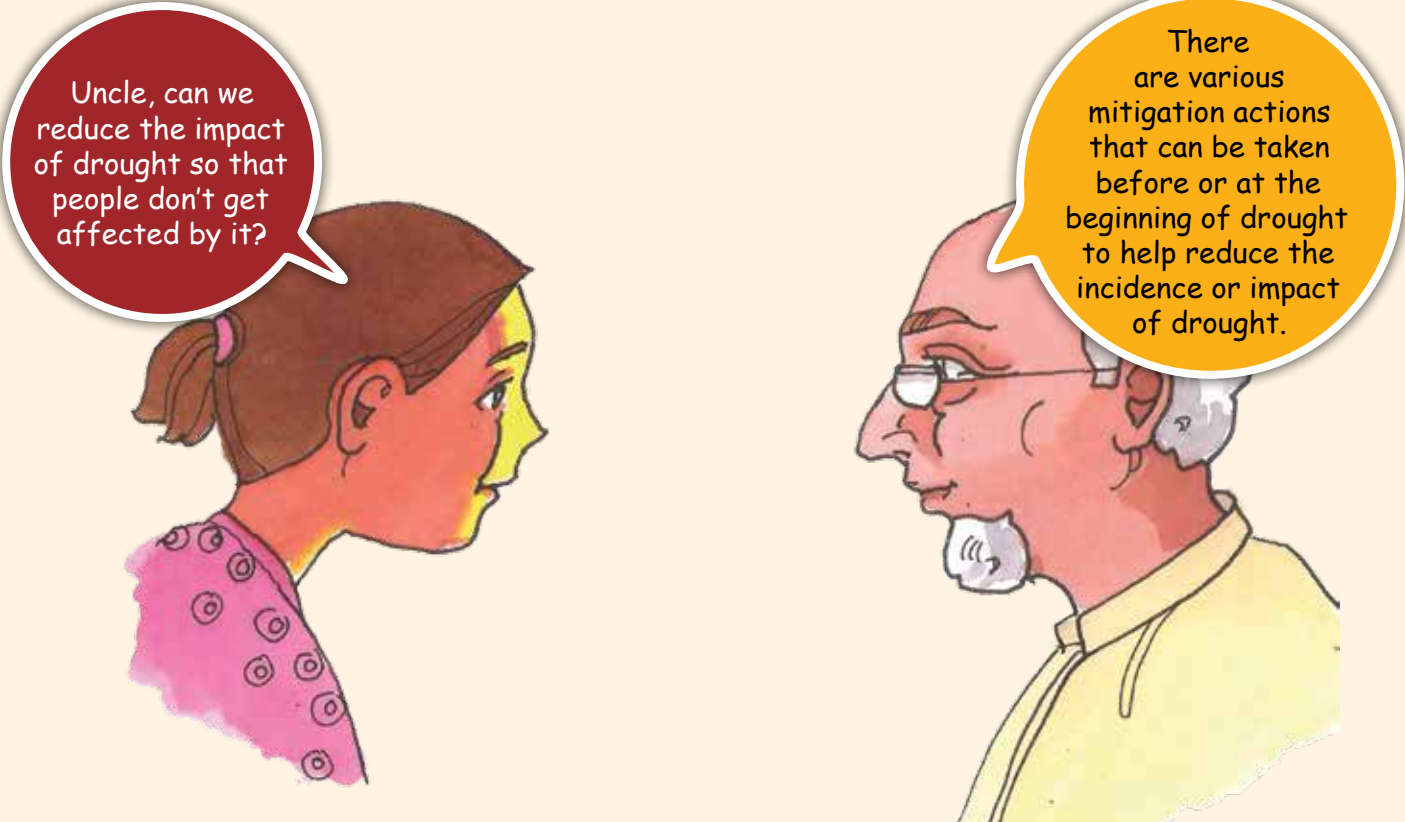
To reduce the serious consequence of drought, a drought prone nation should establish comprehensive and integrated early warning systems. These include climate, soil and water supply factors such as precipitation, temperature, soil moisture, snow fall, reservoir and lake levels, ground water levels, and stream flow.

DROUGHT ASSESSMENT PARAMETERS, TOOLS MEASUREMENT AND DATA USE

PARAMETER	MEASURING INSTRUMENT	USE OF DATA IN DROUGHT DECLARATION
Rain fall	Recording and non-recording rain gauges	Indian meteorological Department declares an area/region of moderate drought if the deficiency is 26%-50% and severe drought when the deficiency exceeds 50% of the normal.
Temperature (maximum and minimum)	Thermometers	Information is used in estimation of evaporation from the surface water storage reservoirs, except to indicate the sweat factor or chillness of a place.
Evaporation and evapo-transpiration	Pan evaporators and percolation gauges and lysimeter	Data are used in water loss estimation from the reservoirs and plants, and demand and supply analysis.

DROUGHT ASSESSMENT PARAMETERS, TOOLS MEASUREMENT AND DATA USE

PARAMETER	MEASURING INSTRUMENT	USE OF DATA IN DROUGHT DECLARATION
Soil moisture	Estimation from change in weight of native soil and after removal of water through oven- heating	Information is used by the Irrigation Department /water authorities in water release scheduling.
Reservoir water level and river flow	Calculation of volume in reservoir by daily water-level measurement. River gauge stations to monitor river flow between two stations	During the low-rainfall year threshold level and the volume of the previous drought events are taken into consideration prior to stoppage /cut in water release or supply from the reservoir. Flow level at a station is compared with the previous records, in deciding the imminent drought situations over the adjoining areas.
Crop area and yield	Healthy vegetation assessment carried out on ground level as well as through remote sensing methods	The shrinkage in the area of vegetation covers, vegetation vigour status, phonological conditions, etc., are considered as indirect evidence of drought situation.



Uncle, can we reduce the impact of drought so that people don't get affected by it?

There are various mitigation actions that can be taken before or at the beginning of drought to help reduce the incidence or impact of drought.

Drought

After facing several drought conditions, especially 1987 drought, we have learnt many lessons. Drought can be mitigated by two ways — (i) by taking risk reducing measures in the situation of drought and (ii) by developing a preparedness plan. Most of mitigation measures are related to integrated soil, water, and forest management and form part of soil conservation, watershed development, and forestry programmes. By adopting the preparedness mechanisms and strategies, impacts of future drought events can be mitigated.'



MITIGATION MEASURES

- ❖ Construction of dams /reservoirs to store water.
- ❖ Watershed management.
- ❖ Alternative land-use models for water sustainability.
- ❖ Water rationing
- ❖ Household and Community based rain water harvesting
- ❖ Proper selection of crop for drought - affected areas.
- ❖ Using soil conservation techniques.
- ❖ Reducing deforestation and firewood cutting in the affected areas.
- ❖ Providing alternate employment to check migration.
- ❖ Participatory community programmes.
- ❖ Cattle management. Management of rangeland by improving the grazing patterns
- ❖ Establishment of mixed fuel, fodder and timber plantation.
- ❖ Develop fodder banks for cattle.
- ❖ Preparing seed stocks and increasing agricultural production.
- ❖ Improvement in agriculture through modifying cropping patterns and introducing drought- resistant varieties of crops and improving irrigation system. Protection of surface water from evaporation and introduction of drop irrigation system.

Drought



Uncle! My teacher also says that by conserving water, saving forests and planting trees we can save our planet. She also insists that we must adopt sustainable living practices in order to combat climate change.

Your teacher is absolutely right. Water, forest, soil and energy conservation, educating people and farmers etc. are not just the ways to mitigate risks of drought but also to conserve our planet's resources for future generations. There are several states which have set an example and where timely mitigation has resulted in successfully overcoming serious implications of drought



WHAT MITIGATION CAN DO?

RAJASTHAN

Rajender Singh is a well-known water conservationist from Alwar District. Drawing from indigenous Indian knowledge of geology, hydrology and ecology, Rajender Singh began building tiny dams with johads (reservoirs) on streams flowing to the river in hopes of reviving the natural water flow of both surface and underground water in the region. It worked wonderfully. The water captured in the Johads during monsoon season rejuvenated vegetation, which helped refill the aquifers (used for local drinking water) and restore the retaining capacity of the hillside. This way he helped to save a watershed. He won the Ramon Magsaysay Award for community leadership in 2001 for his work in community-based efforts in water harvesting and water management. His NGO has helped build over 10,000 johads and other water conservation structures to collect rain water for dry seasons. It has brought water back to over 1,000 villages, over an area of 8600



Drought

square kilometers and revived seven rivers in Rajasthan. One can now see river Arvari flowing which was dead for 40 years. Other rivers which have been revived are Ruparel, Sarsa, Bhagani, Jahajwali, Sabi and Maheshwara. All this happened within the time span of 15 years.

MAHARASHTRA

Ralegan Siddhi is a village in Maharashtra. Twenty years ago the village showed all traits of poverty. It practically had no trees, the top soil had blown off, there was no agriculture and people were jobless. India's most noted social activist Anna Hazare, started his movement concentrating on trapping every drop of rain water. Villagers built check dams and tanks. To conserve soil they planted trees. Ralegan Siddhi has now 1300 acres of



irrigated area which was only 80 acres earlier. Migration for jobs has stopped and the per capita income has increased ten times in this span of time without word bank funding and any government grants.



GUJARAT

River Kali-II is a local small river partly flowing through Dhod Tehsil and partly through Jhlod Tehsil of District Dahod , Gujarat. It is predominantly tribal area. Several tribal villages are located along the banks of this river. Fifty years ago this river was a perennial river and would be dry for about 6-8 months in a year. Recently, a series of small masonry water harvesting structures (small check dams) were built at appropriate distances across the entire length of the river. This has revived the river. Now the river is full of water even during the driest summer months of April-May- June. About 62 local rivers and rivulets have been similarly revived cutting across the borders of 3 states, Gujarat, Rajasthan, and Madhya Pradesh.

You will be surprised to know that even though drought impacts us severely, still there are many positive aspects associated with it.



POSITIVE EFFECTS OF DROUGHT

Productivity of wetlands is maintained by wet and dry cycles. Drought helps in preservation of wetland ecosystem. Plants are key features of all wetlands. They are primary source of food and habitat for ducks and other wildlife that depend on wetland. Plants grow and die, leaving organic material in wetland. The material decomposes and accumulates at the bottom of wetland basin. There the lack of oxygen inhibits further decomposition. Under these conditions fertility of wetland gradually declines. The bottom becomes increasingly soft, so it cannot hold plant roots and the plant growth declines. Open water also increases. This reduces the habitat for waterfowl and other wildlife. Drought plays a beneficial role in rejuvenating wetlands. The loose organic soup that has accumulated over the time gets a chance to firm up. Rapid breakdown of organic matter again starts due to the presence of sufficient oxygen. Nutrients are released. Dormant plant seeds, lying in the soil, get a chance to germinate and grow. Wetland rejuvenates and provides a good habitat for water fowls.

HOW IS DROUGHT DIFFERENT FROM NATURAL HAZARDS?

Drought differs from other natural hazards such as cyclones, flood, earthquakes, volcanic eruptions, and tsunamis in that:

- ❖ being of slow-onset it is difficult to determine the beginning and end of the event
- ❖ duration may range from months to years and the core area or epicentre changes over time, reinforcing the need for continuous monitoring of climate and water supply indicators
- ❖ no single indicator or index can identify precisely the onset and severity of the event and its potential impacts; multiple indicators are more effective
- ❖ spatial extent is usually much greater than that for other natural hazards, making assessment and response actions difficult, since impacts are spread over larger geographical areas
- ❖ impacts are generally non-structural and difficult to quantify
- ❖ impacts are cumulative and the effects magnify when events continue from one season or year to the next.

Source: <http://nidm.gov.in/pdf/manuals/drought-manual.pdf>)

DROUGHT CAN BE –

- A. FIVE DAYS WITH NO PRECIPITATION
- B. THE SHORTAGE OF WATER FOR AN EXCESSIVE PERIOD OF TIME
- C. A YEAR WITHOUT WATER/RAIN
- D. A WEEK WITHOUT RAIN

1. FIND OUT HOW MANY STATES WERE DECLARED TO BE AFFECTED BY DROUGHT THIS YEAR. MARK THEM ON A MAP OF INDIA.

2. LIST WAYS TO CONSERVE WATER IN DAY TO DAY USE AT SCHOOL AND HOME.

DROUGHT

- ❖ Drought is a recurrent feature of climate; and condition of drought appears when the precipitation is deficient in relation to the Long time averages for a region, over an extended period of a season or year. However, it is difficult to provide a precise and universally accepted definition of drought due to its various characteristics and impact across different regions of the world. Hence, drought may be defined in many ways.
- ❖ As a result of prolonged period of dry weather, a condition of abnormal dry weather results in a serious hydrological imbalance and acute water shortage due to lack of rains over extended periods of time affecting various human activities. Hydro-meteorological syndrome of 'prolonged period of water scarcity affect natural resources, environment and thereby the people.
- ❖ Drought is characterised by low moisture content resulting either from below normal rainfall distribution, erratic rainfall, higher water need or combination of all of these. There are several indices to understand drought.

LET US DO SOMETHING TOGETHER

1. **CONSERVE WATER:** Prevent misuse and wastage of water, and encourage recycling of water. Set up a Water Management Committee in the schools and take turns to be members. Can you list three ways of recycling domestic water? (In cities, using water from a washing machine to wash your home and car is an example. In rural areas, directing water from the wash area to the fields of garden is another)
2. **HARVEST RAIN WATER AT HOME AND IN SCHOOLS:** Find out how you can collect rain water and store it, or use it to recharge a well, bore-well source or sump. Can you use your school as a model for roof-top rain water harvesting in your area?
3. **PLANT TREES AND CARE FOR THEM:** Carry out campaigns for plantations. Find out the right trees for your area. This information will be available with the horticulture, forest or agriculture department or VAW if in rural areas. E.g. Eucalyptus trees must never be planted in dry areas, since they absorb all the water around them.



(Source: <http://cbse.nic.in/Disastermgmt8th.pdf>)



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