Agrometeorological Risks and Coping Strategies—Perspectives from Indian Subcontinent

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Critical issues on Indian Agriculture
Indian agriculture is passing through a critical phase. The rate of increase in crop production in the country is barely keeping pace with the increase in population rates. Prime Minister of India has rightly called for a doubling of crop outputs in 10 years’ time. As more land cannot be diverted to agriculture, increase in productivity of crops is called for. Among other resources, exploitation of meteorology for more production is the need of the hour.
FOOD DEMAND IN INDIA

30% increase

Production (m. tons) in 2000
Demand of food (m. tons) in 2010
Demand of food (m. tons) in 2020

Rice  Wheat  Coarse grains  Total cereals  Pulses  Food grains

Demand of food (m. tons) in 2010
Demand of food (m. tons) in 2020

Production (m. tons) in 2000
Current Issues in Agriculture

STABILISATION OF FOOD PRODUCTION
Vulnerability of production due to climate variability

DIVERSIFICATION
Multi crops, cropping pattern - to increase resilience within the system

NATURAL RESOURCE MANAGEMENT
Water, Nutrients, Genetic base, etc
FUTURE CHALLENGES IN INDIAN AGRICULTURE

DEMAND FOR (QUALITY) FOOD

INEQUITABLE DISTRIBUTION OF RESOURCES
Availability of Water, required seed quality, finance

PRESERVATION OF ENVIRONMENT
Sustainable agricultural development
ADAPTATIONS TO CLIMATE CHANGE

To create new genetic resources

NEW VARIETIES
DROUGHT/HEAT
RESISTANT

NEW FARM
MANAGEMENT
PRACTICES

AGRI INSURANCE

CHANGE IN LAND USE

To cover Risk
CONSTRAINTS ON FOOD PRODUCTION

- **LAND**
- **WATER**
- **CAPITAL**
- **LABOUR**
  (Migration from rural to urban)
- **TECHNOLOGY ADOPTION**
- **AGROMETEOROLOGICAL RISK**
  (Drought, flood, heat wave, cold wave, fog, frost)
Vulnerability due to natural disasters

- India is vulnerable to natural disasters on account of its unique geo-climatic conditions
  - 60% of the landmass prone to earthquakes of various intensities
  - 40 million hectares prone to floods
  - 8% of the total area is prone to cyclones
  - 68% of the area is susceptible to drought
Important adverse weather affecting agriculture in India

- Cyclonic storms / Depressions.
- Floods / heavy rains.
- Severe thunderstorms, hail storms, tornadoes and squalls.
- Drought and heat waves.
- Cold spells, low temperature, frost, snow and ice-storms.
- Pest and diseases incidences on crop and livestock.
Crop damage due to extreme events

- Andhra Pradesh
- Maharashatra
- Uttarakhand
- Uttar Pradesh

Area affected in 10^5 ha

Year
Area affected in $10^5$ ha

- Bihar
- Gujarat
- Kerala
- Karnataka
- Punjab
- Tamil Nadu

Year

- Bihar
- Gujarat
- Kerala
- Karnataka
- Punjab
- Tamil Nadu
Periodes of extreme temperature i.e. low temperatures below the threshold value and high temperatures above the maxima are hazardous to plant development and growth.

Extreme temperature conditions during cold spells cause stress and frost; high temperatures lead to heat stress and both affect agricultural production.

Extremes of moisture conditions namely drought episodes and low moisture conditions as well as very humid atmospheric conditions including wet spells tend to affect agriculture.

Dry desiccating and strong winds reduce agricultural production as a result of very high evapotranspiration rates.
High soil moisture in situations of water logging and flooding associated with heavy rainfall and tropical storms has adverse effect on plant growth and development.

High soil moisture influences the rate of transpiration, leaf area expansion and ultimately plant productivity.

Drastic changes in rainfall variability can have very significant impact, particularly in climatically marginal zones such as arid, semi-arid and sub-humid areas where incidence of widespread drought is frequent.

It also causes mechanical damage to plants with weak stems by lodging such as the sugarcane and the banana.
Statistics on occurrences of Extreme Events in India
## Major cyclones of India and Neighbourhood

<table>
<thead>
<tr>
<th>Year</th>
<th>Name of the country</th>
<th>No. of deaths</th>
<th>Storms surge (height, in ft)</th>
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<tbody>
<tr>
<td>1737</td>
<td>Hoogli, West Bengal (India)</td>
<td>3,00,000</td>
<td>40'</td>
</tr>
<tr>
<td>1876</td>
<td>Bakerganj (Bangladesh)</td>
<td>2,50,000</td>
<td>10'40''</td>
</tr>
<tr>
<td>1885</td>
<td>False point (orissa)</td>
<td>5,000</td>
<td>22'</td>
</tr>
<tr>
<td>1960</td>
<td>Bangladesh</td>
<td>5,490</td>
<td>19'</td>
</tr>
<tr>
<td>1961</td>
<td>Bangladesh</td>
<td>11,468</td>
<td>16'</td>
</tr>
<tr>
<td>1970</td>
<td>Bangladesh</td>
<td>2,00,000</td>
<td>13'17''</td>
</tr>
<tr>
<td>1971</td>
<td>Paradeep, Orissa (India)</td>
<td>10,000</td>
<td>7'20''</td>
</tr>
<tr>
<td>1977</td>
<td>Chirala, Andhra Pradesh (India)</td>
<td>10,000</td>
<td>16'18''</td>
</tr>
<tr>
<td>1990</td>
<td>Andhra Pradesh (India)</td>
<td>990</td>
<td>13'17''</td>
</tr>
<tr>
<td>1991</td>
<td>Bangladesh</td>
<td>1,38,000</td>
<td>7'20''</td>
</tr>
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<td>1998</td>
<td>Porbander cyclone</td>
<td>1173</td>
<td>-</td>
</tr>
<tr>
<td>1999</td>
<td>Paradeep, Orissa (India)</td>
<td>9,885</td>
<td>30'</td>
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<td>2000</td>
<td>Meghalaya, Tamil Nadu (India)</td>
<td>12</td>
<td>-</td>
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<td>Andhra Pradesh (India)</td>
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<tr>
<td>2002</td>
<td>West Bengal, Orissa</td>
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</tr>
<tr>
<td>2003</td>
<td>Andhra Pradesh</td>
<td>81</td>
<td>-</td>
</tr>
<tr>
<td>2004</td>
<td>Gujarat</td>
<td>9</td>
<td>-</td>
</tr>
</tbody>
</table>

*Data are available upto 2004.*
Frequency of cyclones over Indian Seas

- Bay of Bengal
- Arabian Sea

The chart shows the frequency of cyclones by month and sea.
**Cyclone Ioons over Kutch region**

**High alert sounded, coast guard warns fishermen**

Ahmedabad: A high alert was sounded in Kutch and the coastal districts of Jamnagar and Porbandar as a cyclone emerged from the Arabian Sea. The coast guard warned fishermen not to venture into the sea. The system, which was located about 250 km south-southwest of Nalia town in western Kutch on Saturday evening, was expected to advance toward a north-easterly direction and cross the coastal areas of north Gujarat by Sunday morning. The system, which is likely to intensify further and move in a north-easterly direction, poses a threat to the coastal areas of north Gujarat.

Even though many fishing boats had started returning home following messages broadcast on radio, the coast guard continued to warn fishermen not to venture into the sea. A total of 1,500 boats had left the coast, and the coast guard had urged them to return immediately. The coast guard also warned fishermen not to venture into the sea, as the system was likely to intensify further and move in a north-easterly direction, posing a threat to the coastal areas of north Gujarat.

**IMD paints alarming picture**

Ahmedabad: A bulletin issued by the Indian Meteorological Department on its website on Saturday evening said the cyclonic storm is likely to intensify further and move in a north-easterly direction. The system is likely to cross the coastal areas of north Gujarat by Sunday morning. The system poses a threat to the coastal areas of north Gujarat.

The IMD warned that the cyclonic storm could cause extensive damage to the coastal areas of north Gujarat. Minor damages to property and infrastructure lines due to uprooting of large trees were also expected. Flooding of escape routes was likely. The department suggested that a suspension of fishing operations and advice to people to stay indoors.

**Cyclonic rains kill 30 in AP**

Hyderabad: The torrential rains triggered by the cyclonic storm which crossed Kakinada on Thursday left behind a trail of destruction, and claimed at least 30 lives. While the situation in Visakhapatnam improved following respite, the regions of Kakinada and Visakhapatnam were still witnessing heavy rainfall.

The Godavari was flowing at the 68.5 feet mark near Dowlasani, even as the officials opened all the crest gates.

The district administration of East Godavari and West Godavari, which had been put on high alert and had deployed two air force helicopters,inaugurated a helicopter hangar to help evacuate stranded people. The helicopter, which had been put on standby, touched the 68 feet mark.

A total of 18,500 people were moved to safer places in coastal districts, while seven villages in Srikakulam were evacuated.

In Srikakulam, the district administration had begun evacuating people from low-lying areas. The districts of East Godavari, Visakhapatnam, and Srikakulam were highlighted.

The streets of Visakhapatnam were flooded as the cyclonic storm hit the region. Andhra Pradesh Chief Minister Y.S. Jagan Mohan Reddy ordered the immediate supply of relief materials to the affected areas.

East and West Godavari, besides Srikakulam in Visakhapatnam, recorded heavy rainfall. Kakinada in Kham- mas also received 125 mm rainfall, while Srikakulam received 121 mm rainfall. Most of the affected districts were cooling under dark skies as the rain continued to pour. Authorities were working on restoring power supplies following damage to infrastructure in several districts. At least 260 substations across the state were affected due to the continuous rain and officials were working to restore power supplies. In 92 mandals, the situation, chief minister Y.S. Jagan Mohan Reddy said on Thursday.

The government had deployed its disaster management teams to assist in rescue and relief operations. Jagan Reddy asked the people to stay indoors and take precautions.
# Flood years and their category

<table>
<thead>
<tr>
<th>Year</th>
<th>Area affected (X10^6 sq. Km)</th>
<th>% of the area affected</th>
<th>Category</th>
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<td>1.795</td>
<td>57.1</td>
<td>Exceptional</td>
</tr>
<tr>
<td>1971</td>
<td>1.427</td>
<td>45.4</td>
<td>Exceptional</td>
</tr>
<tr>
<td>1878</td>
<td>1.513</td>
<td>48.1</td>
<td>Exceptional</td>
</tr>
<tr>
<td>1975</td>
<td>1.268</td>
<td>40.3</td>
<td>Exceptional</td>
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<td>1884</td>
<td>1.175</td>
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<tr>
<td>1933</td>
<td>1.145</td>
<td>36.4</td>
<td>Exceptional</td>
</tr>
<tr>
<td>1959</td>
<td>1.135</td>
<td>36.1</td>
<td>Exceptional</td>
</tr>
<tr>
<td>1983</td>
<td>1.030</td>
<td>32.8</td>
<td>Exceptional</td>
</tr>
<tr>
<td>1916</td>
<td>1.025</td>
<td>32.6</td>
<td>Exceptional</td>
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## Major Rainstorms in India

<table>
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<tr>
<th>S.No</th>
<th>Date</th>
<th>Area</th>
<th>Casualty &amp; Damage</th>
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<tbody>
<tr>
<td>1</td>
<td>01-03 July 1930</td>
<td>Maharashtra</td>
<td>Damage to Agriculture and property was extensive</td>
</tr>
<tr>
<td>2</td>
<td>01-03 Oct. 1961</td>
<td>Bihar</td>
<td>Damage to Agriculture and property was extensive</td>
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<tr>
<td>3</td>
<td>28-30 Aug. 1982</td>
<td>Orissa</td>
<td>Severe flooding to Mahanadi. Considerable damage to crops, property and loss of lives reported</td>
</tr>
<tr>
<td>4</td>
<td>July to Aug.1st week 1988</td>
<td>i) Andhra Pradesh</td>
<td>Paddy crop in 3 lakh hectares completely damaged</td>
</tr>
<tr>
<td></td>
<td>Aug.3rd week to Sept.1988</td>
<td>ii) Assam</td>
<td>Standing Ahu, Sali and paddy crops in 25,000 hec. damaged</td>
</tr>
<tr>
<td>5</td>
<td>June1st &amp; 2nd week 1994 and 14-16 July 1994</td>
<td>Kerala</td>
<td>Crop worth Rs. 1445.0 millions damaged</td>
</tr>
<tr>
<td>6</td>
<td>26-28 Aug. 2000</td>
<td>Andhra Pradesh Hyderabad</td>
<td>Paddy, chilly crop worth Rs. thousands of millions damaged</td>
</tr>
</tbody>
</table>
Floods worsen in Bihar and Assam

Gauhati: The flood situation in Assam and Bihar continued to remain grim with the rivers, including the mighty Brahmaputra, flowing above the danger level as the death toll rose to 58 in Assam.

In one of the worst ever floods gripping Assam, 25 of the state's 27 districts remained inundated, affecting over 75 lakh people.

Heavy rain continued to lash Assam on Friday as 1,500 people living on the hill sides around Guwahati city shifted to safer places, responding to the appeal made by the Kamrup deputy commissioner Anurag Hazarika, following the death of 15 labourers and temporary settlers in the landslides on Thursday.

Meanwhile, the flood situation in 16 north Bihar districts worsened on Friday as swollen rivers inundated fresh areas and overtopped national highways and railway tracks.

The death toll rose to 60, with six more deaths reported from Sitamarhi and Muzaffarpur districts since Thursday.

 Officials said the water levels of the Burhi Gandak in Indonesia's central area are still high, with water levels in the Bhaba and Ganges rivers in some parts of the state remaining high.

 PM to visit flood-hit Bihar

Times News Network

New Delhi: In keeping with the United Progressive Alliance (UPA) government's accent on domestic issues, and against the backdrop of natural calamities, Prime Minister Manmohan Singh's next visit will be to flood-hit Bihar — on July 27.

This will be the PM's third major domestic visit after Andhra Pradesh and Assam, the first because of the large number of farmers' suicides and the second because the state is reeling under floods.

Government sources said Singh's visit to Bihar would be more on the lines of the one to Andhra Pradesh, where he actually met affected people, rather than Assam, which ended up as series of official meetings.

The PM, these sources said, felt it was important for him to get a first-hand account.

Floods damage 17 lakh hectares of crop

Maharashtra most affected, Gujarat next

New Delhi: In possible the first estimate of the kind, the government says floods are estimated to have affected 17.32 lakh hectares of crop, including paddy, sugarcane, cotton, banana, pigeon pea and ground nut.

The affected districts include Marathwada and Konkan in coastal Maharashtra, where the intensity of agricultural sector's yield drop was most acute.

The MDCA says the state has started mobilising relief materials to the flood-affected areas.

In Gujarat, 49 per cent of the state's 6.20 lakh hectares of crops have been hit, with the worst affected areas being in the Kutch region.

Assam flood toll 177

Gauhati: The death toll in the devastating flash floods in Assam has risen to 177 with the recovery of two more bodies, while road communication between Lower and Upper Assam remained disrupted for the fifth day on Wednesday.

Union home minister Shivraj Patil, who was scheduled to make an aerial survey of the flood-affected areas, cancelled his visit on Wednesday, and has instead sent minister of state Sriprakash Jaiswal, official sources said.

The two bodies were recovered from the Krishani area, and there was a likelihood of more recoveries as rescue operations were continuing in the villages of Krishani, Agia and Dhubni areas of Goalpara district, they said.

Heavy rains and gushing down of water from the neighbouring Meghalaya hills last week caused large-scale flash floods, affecting more than eight lakh people in the state. Inclement rains, large-scale deforestation and earth-cutting in Assam and other parts of the North-East caused the flash floods, said officials.
## Year of Drought in India

<table>
<thead>
<tr>
<th>Year</th>
<th>Area affected (X10^6 sq.km)</th>
<th>% area of the country affected</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1915</td>
<td>2.16</td>
<td>68.7</td>
<td>Calamitous</td>
</tr>
<tr>
<td>1877</td>
<td>2.03</td>
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<td>Calamitous</td>
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<tr>
<td>1899</td>
<td>1.99</td>
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<tr>
<td>1987</td>
<td>1.55</td>
<td>49.2</td>
<td>severe</td>
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<tr>
<td>1972</td>
<td>1.39</td>
<td>44.4</td>
<td>severe</td>
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<tr>
<td>1965</td>
<td>1.35</td>
<td>42.9</td>
<td>Moderate</td>
</tr>
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<td>1979</td>
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<td>1920</td>
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</tr>
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<td>1891</td>
<td>1.15</td>
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<td>1905</td>
<td>1.09</td>
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</tr>
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<td>2001</td>
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<td>-</td>
<td>Moderate</td>
</tr>
<tr>
<td>2002</td>
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<td>-</td>
<td>Severe</td>
</tr>
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<td>2003</td>
<td>-</td>
<td>-</td>
<td>Moderate</td>
</tr>
<tr>
<td>2004</td>
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<td>-</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

Data are available up to 2004.
Crops dry as monsoon plays truant

By Sujata Dutta Sarkar/THN

New Delhi: There is no curse for panic yet... That's the official line on the monsoon. But with rains playing hookey all the time, many cloudmakers are forecasting the worst.

If rains don't keep their date by the third week of July, some parts of India may well face a drought. Thus far, July rains are expected to be slightly below normal. Depending on the dates they fall, they can provide the much-needed water to sustain crops, which would otherwise face a waterlogged situation.

The situation is also bad in western Maharashtra and the Marathwada region. With the state's 222 taluks, it is expected to be very dry from July 7 to 12, while 22 taluks received more than normal rainfall in the last week.

Rain statistics
- Districts with deficient rainfall: Greater Mumbai, Pune, Jalgaon, Nashik, Ratnagiri, Palghar, Ambajogai, Yavatmal, Nagpur, Chandrapur, and Gadchiroli.
- Districts with normal rainfall: Amravati, Latur, Beed, Ambajogai, Sindhudurg, Ratnagiri, Dravida, and Vasai-Virar.
- Districts with excess rainfall: Ratnagiri, Sindhudurg, Kolhapur, Khandoba, and Nandurbar.

Neaper districts, which received normal rainfall and 10 taluks received less rain than normal, have been highlighted. No rain fell in 24 taluks. According to C M Harling, the Jhunjhunu district of Uttar Pradesh, the situation is very critical.

The rains were deficient in all the monsoon districts of the state and the condition of crops was poor, Gajendran noted. “Further, the lack of rains is leading to increase in the severity of the problem,” he added. Gajendran advised the rains in the state by July and could reverse the situation.

Officials of the Indian meteorological department (IMD) and the monsoon situation was likely to change in the coming days. There has been a long spell of less rainfall and there were reports of drought in the state, ABD Mamanur, director of the weather forecasting.

India Inc fears demand drought

By Kala Vijayaraghavan and Ujjieb Philip

Mumbai: 15.42

The weak monsoon is becoming a worry for FMCG, consumer durables and auto companies, who are relying heavily on rural demand. Industry majors, especially two-wheelers, are hoping that the situation will improve in the coming months.

The government has been providing subsidies to farmers to stimulate demand. However, the situation is expected to improve in the next few months.

Markets & Marketers caught in desert storm

Growing concerns over the delay in the monsoon and the impact on farmers and the agriculture sector are affecting the market. Industry majors have been trying to mitigate the impact of the delayed monsoon.

The government has been implementing various schemes to support farmers and consumers. However, the market is still reeling under the effects of the delayed monsoon.
Drought declared in
2,700 villages in Gujarat

Gandhinagar: In view of the inadequate rainfall received in certain pockets of Saurashtra and Kutch districts of Guj-
arat, the state government has announced drought conditions in as many as 2,700 villages of Kutch, Jamnagar, Banaskantha and Dahod districts, where relief works will start by the first week of November.

State revenue minister Nitin Patel told reporters that a decision to this effect was taken at a cabinet meeting held here. He said that the relief meas-
ures would be provided at Rs 1 per kg in the drought-affected areas.

The minister said the state government has already taken a series of measures to deal with the drinking water problem in these villages.

Paddy trouble

BHUBANESWAR: This year’s severe drought in Orissa will cause a drop in paddy production by about 15 lakh tonnes, according to a white paper published by the Orissa government. Paddy cultivation had been taken up in 22.4 lakh hectares in the state against the usual 30.83 lakh hectares due to lack of rains, the paper submitted in the state Assembly on Monday.

The government had declared 283 out of 314 blocks as drought affected. Through the reconstruction, the relief committee had visited the state between September 16 and 19.

Global rice meet

BANGKOK: The world’s top rice exporters are considering setting up a joint council in Thailand, in a bid to prevent price wars and ensure stability in the industry, said a senior Thai official.

The meeting was attended by representatives of the five main rice exporters: Thailand, Vietnam, India, China and Pakistan. They agreed to set up the Council on October 9, Adasit Parasrampuria, who heads the Thai Rice Exporters’ Association, said.

The council will be a common platform to stabilise global rice prices and create profitable prices for farmers.

Smog cloud delaying rains, taking its toll

and India and the foodgrain output in South Asian region are at risk of falling sharply due to the heavy smog and pollution that have blotted out the region’s skies.

The report, released on Tuesday, said the pollution had caused more than 200,000 premature deaths in the early 1990s. It said a 10 percent drop in crop yields could result in a loss of around 300,000 lives per year.

The report found that air pollution was responsible for about 4 percent of all deaths in India and Pakistan and 6 percent in Bangladesh.

The report also highlighted the need for policies to reduce pollution, such as stricter enforcement of laws and regulations, and more investment in clean technologies.

Driest July in 100 years

New Delhi: Though the monsoon improved over the last week, the number of crops affected by drought has increased to an estimated 40,000,000, according to a report by the Indian Meteorological Department.

At least 15,000,000 hectares of land in northern India has been affected by drought, according to the report. The situation is likely to get worse in the coming months, it added.

Despite the improvements in the monsoon, the situation in the hills and mountains is still critical, the report said.

The scientists believe the worst is yet to come, and that the effects of the drought will only increase over the next few months. They have warned that one in every five lives in India could be affected by the drought.
### Number of Cold Waves

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<td>3</td>
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<td>50</td>
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<td>67</td>
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* data for the year 2006 is upto October only.
Cold wave may take mercury to 5 degrees

PUNE: A cold wave returned to the region with a vengeance on Tuesday, taking the mercury from 11.9 degrees Celsius to 5.4 degrees in just two days. The met office predicted it could drop further to 5 degrees on Wednesday.

"North and central Maharashtra are experiencing a cold wave and the trend may continue for one or two days. It is a combined effect of radiation cooling, a drop in relative humidity and the fact that the wind suddenly turned last night. Dry and cool northwesterlies started blowing," R.R. Lelle, director of forecasting, Indian meteorological department, told TOI.

Pune was the coldest in the region on Tuesday, but Jalgaon (7.7 degrees C), Nasik (6.7), Akola (9), Parbhani (9) and Malegaon (9) are all well below normal. Cities which recorded 11 and 12 degrees on Monday may also record temperatures below 10 degrees on Wednesday, Lelle said.

Interestingly, while north India was freezing in the first week of January and New Delhi recorded a lowest of 0.2 degrees on January 8, the temperature remained normal in Pune.

"That is because of an anti-cyclonic circulation over central India. As a result, dry northerly winds rushed into north India, freezing it, while the southern half was fed by warm, humid currents, evening out temperatures," Lelle said.

Press Report on Cold Wave

North India numb with cold again

SRINAGAR/SHIMLA: The cold spell in north India continued on Thursday. Heavy snowfall and rains lashed Jammu and Kashmir, leading to closure of the Jammu-Srinagar national highway. This left a large number of passengers stranded.

The 350-km-long highway is the only road linking Kashmir with the rest of the country. Heavy snowfall occurred between Qazigund and Jawahar tunnel. Heavy rainfall was recorded in areas beyond Jawahar tunnel, triggering landslides at various places.

Kupwara district received the first snowfall of the season. Its adjoining mountain ranges received heavy snowfall. The famous ski resort of Gulmarg, about 52 km from Srinagar, received about two feet of snowfall. Its peripheral areas received more than three feet of snow, said sources.

The border town of Uri in Baramulla district had also received about 15 cm of snow since Thursday morning, they said.

Pir Panjal range of Himalayas, falling in Pulwama and Anantnag districts, also received heavy snowfall. The Amarnath cave shrine received about two feet of snowfall, the sources said.

The intense cold wave sweeping most parts of Himachal Pradesh continued as well, with the entire tribal belt and other higher and mid-hill areas experiencing moderate to heavy snowfall. The lower areas were lashed by intermittent rains.

Shimla and neighbouring tourist resorts of Kufri, Pashu, Wildflower had another spell of mild snow, while Dalhousie had its first moderate snowfall of the season.

Road traffic on Hindustan-Tibet national highway was disrupted, with overcast sky and heavy snow blocking the highway near Narkanda. Road traffic to Rampur and Jeory was diverted and interior areas of Ghatal in Shimla district and Ani in Kullu district were cut off.

The Dhauladhars, overlooking Kangra valley, Churdhar ranges in Sirmaur, and Pir Panjal ranges on Chamba border border received heavy snowfall and the Rohtang Pass, Kunzam Pass and Sangla and Chansal passes had intermittent heavy snowfall.

Tribal valleys of Lahaul, Spiti, Sangla and Pin received heavy snowfall and avalanche threat loomed large over higher altitude tribal areas.

The twin tribal valleys of Lahaul and Spiti groaned under a piercing cold wave as mercury dipped to between minus 12 to minus 20 degree Celsius.
Press Report on Frost

Frost may play spoilsport at mustard crop party

MUSTARD productivity is likely to be affected this winter due to inclement frost, despite 10% increase in the area under its cultivation in major mustard producing states of Haryana and Rajasthan, a survey said. The historical frost condition that prevailed in January ‘06 in Delhi, Haryana, Punjab and Ut ter Pradesh had broken a 70 years old record. The mustard cultivation has been affected greatly due to harsh weather conditions, mainly because the frost continued for 8-10 days compounding the harm caused to the main oilseed crop in rabi season. Mustard Promotion and Research Consortium said in its latest field report.

The early sowed crop are more affected as the developing seed get frozen as a result of which outer cover of the seed is severely damaged. It is estimated that the overall damage of number of seeds per pod is to the level of 40-50%. However, official estimate put the loss in the range of 10-15%. Interestingly, the crops sown after October 15 is less affected.

Also, the rising day temperature in the first week of February is unfavourable for mustard crop.

The maximum and minimum temperature during this period should have been 18-20°C and 4-6 °C respectively. While, the rising temperature at seed setting stage this year has resulted in not getting the proper round shape of fully grown size.

In all probability, it will also reduce the critical oil content in the seed this year. The harmful affects of such weather condition could, however, be mitigated by the overall increase in the area of cultivation this year which may also minimise losses incurred by the farmers, the report said.

AGENCIES/NEW DELHI

Frost damage to crops: next 10 days critical

New Delhi: A day after agriculture minister Sharad Pawar’s optimistic prediction for farm sector growth this year on the basis of a good winter crop, the damage caused by continuous frost to certain crops has begun showing up.

From Day 1, farm scientists maintained the freezing weather could damage crops such as tomato, pea and brinjal. Given the heavy frost reported day after day in some parts, some other crops have joined the list — potato and pigeon pea. Pigeon pea may recover, says Indian Council of Agricultural Research chief Mangala Rani.

Potato damage will depend on its maturing stage. If a 90-day variety has completed 90 days, the damage may be less. If it is a 110 or 120-day variety with water to mature, the damage may be more. Estimates from Punjab are that between 20-50% of the nearly 95,000 hectares under potato may have been damaged — early-sown varieties less than the late-sown variety. Early estimates also indicate that tomato, grown over 6,500 hectares in the state, and brinjal may have taken up to a 50% hit.

So far, wheat is not expected to have taken a big hit but its performance in non-irrigated areas needs to be seen. The next 10 days are believed to be critical. If the weather doesn’t let up and the cold spreads further and hits deeper, it could damage winter maize and further east, Assam rice. The picture isn’t entirely clear yet. Farm scientists will be trying to get a picture of how crops in different conditions and different stages of maturity across states have been affected before reaching a final conclusion. Scientists have been warning that there could be damage to other crops if the cold weather lingers for more than a week or spreads further.

ICE AGE? Srinagar experienced the coldest night on Tuesday as temperatures dipped to -6.6°C

Pawar: farm sector will register over 3% growth

New Delhi: Agriculture minister Sharad Pawar says he expects growth in the farm sector to cross 3% this year, settling somewhere between 3.2-3.3%. Riding on a satisfactory winter crop position so far, Pawar’s assessment will be music to finance minister Chidambaram. A stagnant agriculture sector is believed to be holding back the economy, and any growth is good news.

On Tuesday, Pawar said he expected production to be much better this year. Rice procurement is going well, and is 10 lakh tonnes higher than 2005.
Foggy conditions have led to pest attacks on crops

Nidhi Nath Srinivas
NEW DELHI 21 FEBRUARY

All and snow storms in the North are taking their toll on rabi crops.

Isolated rain/snow falls, together with low temperature in some parts of northern states during different crops phenophases have partially affected standing crops' growth, especially the horticultural crops," reported the agriculture ministry's crop and weather watch group, after reviewing the conditions in the first half of February.

Experts say the effect of rains depends largely on when the wheat was sown. In states where the wheat is sown early, like Gujarat and Maharashtra, rains in February can be very damaging. Similarly, February rains in Madhya Pradesh could also damage grain quality. In Rajasthan, rains by the end of February and early March could ruin fortunes of farmers.

However, the major growing areas of Punjab, Haryana and Uttar Pradesh need not worry too much about rains till mid-March. But bad weather after that could lead to poorer grain quality from these states.

Meanwhile, to complicate matters, foggy conditions are just what pests were looking for to attack standing crops. In Rajasthan, mustard has been affected by aphids and cumin by blight. In Madhya Pradesh, gram is battling with katuua caterpillars. In Punjab, gram is suffering from termites.

In Haryana, rabi oilseeds are affected by aphid, termite, alternaria blight, smut, leaf miner, white rust, alternaria leaf spot, hairy caterpillar, alternaria blight, saw fly and pod borer. Gram has been plagued by Helicoverpa, termites, wilt, pod borer, stunt virus, loose smut, termite. Alternaria blight and aphids.

In UP, mango is suffering from mealy bugs and hoppers, while red gram has been affected by pod borer. In Uttarakhand, potatoes are under threat from blight.

In HP, wheat and barley have been hit by powdery mildew. However, none of these attacks have yet reached a critical mass to destroy crops significantly.

In Karnataka, there may be mild incidences of spodoptera, leaf miner, tikka leaf spot, collar rot, rust, aphids, jassids, thrips, white fly, leaf-eating caterpillar, bud necrosis in groundnut; stem borer, leaf folder, grass hopper, green leaf hopper, bacterial leaf blight, rice blast, brown plant hopper, gundi bug, casemworm, whorl maggot and leaf spot.

Fog lifts in North, cold wave on

Chandigarh: After throwing normal life out of gear for five successive days, fog lifted in the northern region today bringing cheer to people's faces but the cold wave continued unabated.

Though the minimum temperatures rose slightly at some places, including Chandigarh, cities like Jalandhar continued to be in the grip of intense cold recording a low of 0.4 degree Celsius.

Ludhiana and Patiala registered respective minimums of 4.9 C and 5.6 C, both down by a degree each. The Jet Airways resumed its flights from Delhi to Chandigarh after the weather cleared up in the national capital, airline sources said.

27.12.05

Fog hits life in northern states

The cold wave on

The cold wave cooled its grip over the northern states. The day, affecting rail, tic
cos and Jet Airways Delhi and Chandigarh and several trains Punjab and Haryana by up to six hours er.

Iloped several areas of Kashmir, Punjab, sindhgar, reducing 2 metres.

In Chandigarh, the thick fog cleared by afternoon and a pale sun appeared from the clouds later in the day. The city recorded a night temperature of 10 degrees Celsius.

There was mist in Srinagar, Palam and Sirsa, the met office said.

The intense cold forced people to remain indoors in several areas of the region, where temperatures dipped by a few degrees in the Kashmir Valley, icy cold winds kept the minimum down to 3 degrees Celsius in Srinagar, while Jammu was colder by two degrees, recording a low of 7 degrees Celsius.

In Rajasthan, the hill resort of Mount Abu recorded the lowest: 1.5 degrees Celsius. Bikaner recorded 6 degrees, Udaipur 6 degrees and Dholpur 7 degrees Celsius.

In Haryana, Prague, the mercury dipped to 1.1 degrees in Bhambore, 1.5 degrees in Sumbernagar, while capital Shimla recorded a low of 4.2 degrees Celsius.

In the plains, Amritsar was the coldest with a minimum of 3 degrees. Patiala and Ludhiana in Punjab recorded a low of 10.1 degrees and 9 degrees respectively. Haryana, too, had cold nights with Hisar recording a low of 9.3 degrees, Rohtak 9.5 degrees and Ambala 10 degrees.

The national capital, which had a thick fog on Friday saw a slight rise in both day and night temperature, recorded at 18 and 10 degrees Celsius respectively.

Bad weather affected the timings of the Amritsar-Bahauli Express, Amritsar-Burai Express, Amritsar-Sunny Express, Malwa Express, Amritsar-Bahauli Express, Lucknow-Chandigarh Express, Frontier Mail and the Amritsar-Shahibad.
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* data for the year 2006 is upto October only.
Press Report on Heat Waves

Rabi wheat crop feels the heat this winter

The current dry spell has affected the yield of rabi wheat crop across the state. The crop is already suffering from heat stress, with temperatures rising above 45°C in most areas. The heat wave has led to a reduction in the yield of wheat, with reports indicating a decline of 20% to 30% in some areas.

Dry monsoon spell endangers rabi crop

The ongoing dry spell has affected the growth and development of rabi crops, particularly in the rain-fed areas. The lack of rainfall has resulted in stunted growth and reduced yield potential. The state government has urged farmers to take immediate action to mitigate the effects of the heat wave on their crops.

Heat wave claims 13 in Vidarbha

Nagpur: The extreme summer heat has taken a toll of 13 lives in the last two days in the heat wave that has swept the city as well as the Vidarbha region. Most of those dead from the searing heat are unidentified vagrants and shelterless people, which the police have recorded as accidental deaths.

The delay in arrival of the monsoon by over a week has extended the agony of the people in central India, as the temperature remained around 45 degrees Celsius in most places. In fact, for the first time in the recorded history of the city, the mercury touched 47.7 degrees Celsius in the month of June on Thursday. The previous day temperature of 47.2 degrees Celsius was recorded on June 10, 1951, officers of the meteorological department said.

After that all-time high, temperature has come down to 45 degrees Celsius and below, but hot winds have continued all through the day and till late in the night without any let up in the heat wave conditions. Bodies of at least ten of the unidentified people were found around the railway, bus stations and busy market areas in the last two days, the police said.

Rainfall figures during July 4 to 10 showed that a major proportion of the areas in Konkan and Nashik divisions received only 1 to 10 mm of rainfall across several districts, apart from 75 to 100 mm of rain in the second week.

In Kolhapur, rainfall was slightly better and distributed between 1 and 150 mm in most areas. Very scanty to no rainfall was reported in Aurangabad, Amravati and Latur divisions.

Meanwhile, officials in the meteorological department said the current break in monsoon was quite unusual and was experienced frequently. The break was not universal and many parts of the country continue to receive normal rainfall, officials said.

About the few rainfall figures in Pune, Dr. A.B. Mane, superintendent of Central Industrial Meteorological Centre which monitors rainfall over the region, said that rainfall recorded since June 1 in Pune was 20.6 mm, which was seven mm less than the normal rainfall. Rainfall recorded at Sanganer was 191 mm while Peshawar had 245 mm.
First white aphid rage hits cane belt

By Kamlesh Dhavalkar
TIMES NEWS NETWORK

Satara: Sugarcane crops in western Maharashtra are facing a severe “white woolly aphids” infection.

As the cash crop supports distilleries (ethanol), paper and other factories, besides the sugar industry, the infection has started affecting both rural and urban economies of the region.

Another disturbing fact is that the pest has never before been reported in the state. First reported in Sangli district in July 2002, the aphid is now in its epidemic form. Meanwhile, it has practically reached all standing crops in the district as well as neighbouring districts.

B.A. Kore, a lecturer of botany at the Yashwantrao Chavan Institute of Science here, says the pest (ceratovacuca graminum) spreads rapidly and is capable of locking up the sugarcane economy. It sucks up the cell sap of cane leaves but does not feed on the stems or other parts of the crop. Colonies of thousands of aphids are confined to the lower surface of the leaves. As the upper surface is free from infection, the infected cane field appears quite similar to a healthy one. The whitish appearance of the leaves, however, is a giveaway.

Chief of the botany department at the institute, Vijay Khandekar, adds that out of three stages in the life cycle of the pest, nymphs and adults are active and keep moving continuously. Both of them affect the food synthesis of the crop. Effectively, the cane remains stunted and reduce weight and recovery of sugar. Cloudy weather, low temperature and high humidity are favourable factors for the pest to multiply.

It is not only difficult to detect the pests, it is cumbersome and hazardous to apply pesticides on the lower surface. The only possible control measure is the collection and destruction of infected leaves. That too is not practicable. The leaves are useless as cattle fodder and have been giving labourers allergic disorders.

In summary, there seems to be no solution in sight. Even experts are counting on heavy rains to wash away the infection and control it for a while.

Untimely rains, pests halve AP grape exports

M Enosh Jeremiah
HYDERABAD 3 MAY

FOR the first time in five years, grape exports from Andhra Pradesh showed a decline to just around 70 containers, down from over 135 containers last year. Each container carries 16 tones of grapes, mostly Thomson seedless variety. The grape exporting season ended last week.

The grape exporters attribute the drop in exports to a number of reasons, such as unseasonal rains in January that damaged many vineyards, pest attacks in the following month, and tough EU regulations on usage of pesticides.

“We never had it so bad. A variety of reasons contributed to the drop in exports this season,” said C. Kanaka Reddy, president, Andhra Pradesh Grape Exporters Association. Andhra Pradesh is the second largest exporter of grape in the country after Maharashtra. It recorded impressive growths ranging from 60 to 100% over the last five years, and touched a high of 135 containers of exports, mostly to the UK and other EU countries, last year.

The exports, however, suffered a setback last year, when a few EU countries rejected at least two to three containers that originated from Andhra Pradesh after finding high pesticides residues on the grape berries.

In order to help the local farmers compete in the EU markets, the Apeda conducted special programmes for them on how to produce grapes that conform to the tough EU regulations.
Monsoon delay holds up kharif sowing

Agriculturists said Kolhapur division could go in for sowing because of good pre-monsoon showers. “The sowing in Konkan and Pune is as less as both are paddy growing belts, which commences in August,” they explained.

According to officials in the state agriculture commissioner’s office, there was a delay of about six days in the onset of monsoon. “While Konkan and western Maharashtra got satisfactory rainfall after the onset of monsoon on June 12, the districts under Marathwada and Vidarbha had negligible showers,” said B.S. Nitawar, technical officer in the statistics department.

However, situation in Vidarbha and Marathwada improved after June 13. Officials said the sowing of short-term crops like moong, udud and bajra had been delayed as rains were either scant or infrequent in many regions. A delay in the sowing of short-term crops generally has an effect on its yield, said officials.

Although the latest figures were not available, agriculture department authorities said only maize sowing had touched double-digit figures. While 12 per cent of the total land under maize has been sown with the crop, paddy is limited to 5 per cent, followed by 1 per cent each of jowar and bajra.

In case of pulses, the sowing of moong and udud has been restricted as of now. Udud sowing of 4 per cent is the highest in pulses after almost a fortnight of monsoon.

Amongst oilseeds, almost 3,400 hectares out of 4,18,800 under groundnut cultivation has been sown with the crop. It is followed by bajra, where 7 per cent of the land has been sown. But sunflower sowing is at meagre 3 per cent, a case for concern.

Poor rains delay sowing in AP

BARELY recovering from last year’s severe drought, said to be the worst in the last three decades, Andhra Pradesh seems to be set for yet another harrowing year ahead with the state recording deficit in rainfall to the extent of 33% notwithstanding the overcast skies over most of the state.

As a result, less than 6% of the normal cropped area of 81,40,518 hectares has been the period June 1-27, barring the south coastal Andhra comprising the districts of Krishna, Guntur, Prakasam and Nellore, all other regions like north coastal Andhra, Rayalaseema, and north and south Telangana have recorded deficit rainfall.

The deficit ranges from (15%) in the south Telangana region consisting of Ranga Reddy, Hyderabad, Mahabubnagar, Nalgonda and Khammam districts, to the worst of (55%) in north coastal Andhra area that includes agriculturally strong districts like East Godavari and
Impacts of Extreme Events on Agriculture
Impact of cyclone on agriculture

• Losses of cash crops.

• Direct loss of fruits and mechanical damage to the horticultural crops, coffee and banana.

• Winds which blow from coastal seas spray a lot of salt on coastal areas, making it impossible to grow crops sensitive to excessive salt.

• Fields inundated by the storm surge suffer a loss of fertility due to salt deposition, even after the sea water has receded. The affected land takes a few years to regain its original fertility.
Impact of heavy rainfall on agriculture

- Soil erosion
- Disruption to critical agricultural activities
- Water logging of crops
- Increased moisture leading to increased problems with diseases and insects
- Soil moisture saturation and runoff
- Soil temperature reduction
- Grain and fruit spoilage
- Transportation interruption
- Nutrient deficiency
Depletion of oxygen available to the plant root zones.

Creates anaerobic soil conditions that can have significant impacts on vegetation.

Chemical reactions in anaerobic soils lead to a reduction in nitrate and the formation of nitrogen gas.

The denitrification can be a significant cause of loss of plant vigour and growth following flooding.

Causes several physical, chemical and biological changes, some of which are not reversible.
Water logging and its effect on plants

• Produces an oxygen deficiency, causing the death of many roots.

• Growth and development of roots affected.

• In leguminous plants, water logging induces structural changes in the nodules.

• Flooding of the surface layers of soil for even a few days during growth has been found to reduce yield.
Impact of drought on Agriculture

- Drastic reduction in seed reserves
- Migration to nearby cities
- Reductions of stream flow
- Reduction of reservoir levels
- Reduction of irrigation potential
- The acreage planted to food crops is also affected by land quality
- Wind erosion
Impact of Extreme cold weather / frost

- Loss of winter crops, fruit crops and vineyards due to frost injury.
- Low soil temperature at the depth of plant roots cause frost injury.
- Frost damage in winter crops due to low soil temperature at the depth of the tillering node.
- Long (three days or more) and intensive cooling causes complete devastation of the crops.
- Cooling to the critical temperature of frost injury, even for one day, and especially after a thaw, results in thinning out of crops.
Management of Agrometeorological Risk
Cyclone

• Preparedness for cyclone in the agricultural system includes early harvesting of crops, if matured, safe storage of the harvest, etc.

• Irrigation canals and embankment of rivers in the risk zone should be repaired.
Flood and heavy rainfall

- Vegetation that is able to use much of the water and that can act as a barrier to moving water (horizontally and vertically) can reduce flood severity and impacts.

- Water storage systems (rivers, lakes, reservoirs etc.) that are able to capture and hold most of the incoming water will be effective in reducing flood damage.
Drought

- Overall water requirements within an individual agroclimatic zone need to be worked out.
- Short duration and little water requiring crops need to be encouraged in drought prone areas.
- Irrigation, through canals and groundwater resources, needs to be monitored with optimum utilization avoiding soil salinity and excessive evaporation loss.
- A variety of policy decisions on farming, human migration, population dynamics, livestock survival, ecology etc. must be formulated.
Cold injury and frost

- The prevention of crop damage by frost can be controlled by breaking up the inversion that accompanies intense nighttime radiation. This may be achieved by heating the air by the use of oil burners which are strategically located throughout the agricultural farm.

- Other methods of frost protection include sprinkling the crops with water, brushing (putting a protective cover of craft paper over plant) and the use of shelterbelts (windbreaks).
Operational Aspects of Management of Agrometeorological Risks in India
Nodal agencies for monitoring and early warning of disasters

- Forecasts / Warnings relating to major Natural Disasters are being provided by:
  - India Meteorological Department (Cyclones, Floods, Drought, earthquakes)
  - Central Water Commission of the Ministry of Water Resources (Floods)
  - Geological Survey of India (Landslides)
  - Department of Ocean Development (Tsunami)
Early Warning System - Cyclones

India Meteorological Department has the mandate to monitor and issue warnings regarding Tropical Cyclones over the NIO

Organizational setup

- Cyclone Warning Division (New Delhi)
- 6 Cyclone Warning Centres
- Satellite Division in IMD Hq
- 11 Cyclone Warning Radars (4 Doppler Weather Radars)
- 350 Cyclone Warning Dissemination System receivers (100 Digital CWDS)
Early Warning System for Floods

Flood Forecasting

- Coordination through 10 Flood Meteorological Offices of IMD
- 166 Flood Forecasting Centres of Central Water Commission --- {134 level forecasting & 32 inflow forecasting}
IMD is mainly concerned with the operational aspects of drought by computing aridity index (which basically is the ratio of water deficit to water need).

The departure of aridity index from the normal value is expressed in percentage and accordingly drought is categorized as severe (more than 50%), moderate (26-50%) and mild (up to 25%).
Drought Monitoring

• Real-time monitoring of Rainfall on daily and weekly basis for the Meteorological subdivisions in the country

• Weekly briefings in the Crop Weather Monitoring Group meetings in Ministry of Agriculture

• Special briefings to concerned ministries of central & state governments
### Drought Monitoring

**Monsoon 2002**

![Map of India showing rainfall distribution for June-September 2002](image)

**Monsoon 2004**

![Map of India showing rainfall distribution for June-September 2004](image)

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<td>Departure of Rainfall from LPA (%)</td>
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LRF for relatively long term management of Agrometeorological Risk

• IMD issues Long range forecast for Southwest Monsoon Season (June – September) Rainfall for the entire country as well as for the four homogeneous regions of the country and also July rainfall for the entire country.

• These forecasts are also used for planning of agriculture for the Monsoon Season.
IMD also forecast

- Heat Wave
- Cold Wave
- Fog
- Frost
Agromet Advisory Services of IMD for Agrometeorological Risk Management

• Agromet Advisory Service (AAS) bulletins are being issued to the farming community of the country from 22 State Agromet Advisory Service Units of IMD.

• These are disseminated through All India Radio, Doordarshan, Newspaper, Internet etc.

• Different weather based advisories including mitigation of prevailing agrometeorological risk like pests and diseases forecasting, frost, fog etc. are being issued regularly.
Newwork of Agromet Advisory Service Units of IMD
There are 127 Agroclimatic Zones in the country.
Proposed Plan to upgrade the Agromet Advisory Service for Agrometeorological Risk Management
Upgradation of Agromet Advisory Service in India

- Establishment of Integrated System involving a number of Stakeholders
- Application of latest technology (GIS, Remote sensing etc.) for preparation of advisories
- Complete Automation
- Dissemination even upto village level
Participating Organisation under Integrated AAS

- India Meteorological Department
- National Centre for Medium Range Weather Forecasting
- Ministry of Agriculture
- State Departments of Agriculture
- State Agricultural Universities
- Department of Space
- Indian Council of Agricultural Research
- M.S. Swaminathan Research Foundation
- Other NGOs
Integration of System - to meet users’ requirements

- Apex Body consisting of Ministry of Earth Science, Department of Agriculture, Indian Council of Agricultural Research, Department of Space Science, State Departments of Agriculture, M.S. Swaminathan Research Foundation and other concerned Agencies.

- Co-Ordination Cell at Ministry of Earth Science.

- Head Quarter of Agromet Advisory Service.

- State Agromet Advisory Service Units at Regional Meteorological Centres/Meteorological Centres of IMD at State Capitals (28).

- Agrometeorological Field Units at Agroclimatic Zones (127).

- District Level Offices of State Departments of Agriculture (600).

- Village Knowledge Centres at taluka place (M. S. Swaminathan Research Foundation & Alliance Partners (3342)).
Data processing unit in Agrimet Division
AGRO-MET DATA COLLECTION FROM Agromet Observatories/AWS STATIONS THROUGH SATELLITE
Weather & Climate information needs for AAS

Weather Forecast
- Medium Range, District Level, Quantitative Terms, All Parameters
- Extended Range, Agroclimatic Zone Scale, Rainfall, Tx and Tn
- Seasonal Scale, Met Sub-Division, Rainfall

Climatic/Agroclimatic Information
- Climatic/Agroclimatic Normals, District Level
- Probabilities of R/F, District Level
- Probabilities of Wet and Dry Spells, District level
Vegetation Index image of agricultural area of India from June to September, 2004

June 2004

July 2004

August 2004

September 2004
### Integrated and Holistic Approach to Agrometeorological Services

<table>
<thead>
<tr>
<th>Historical Data</th>
<th>Real Time Crop &amp; Agrometeorological Data</th>
<th>Agrometeorological Data (Forecast)</th>
</tr>
</thead>
</table>
| Probabilities (Rainfall, Dry & Wet Spells) | Onset of rainfall
Degree Days
Phenology
Pest & Disease
Water balance
Water Requirements
Soil moisture, Soil temperature, Air temperature, humidity, Evapotranspiration, Sunshine
Agroclimatic Classification
Agroclimatic Information
Regression etc | Rainfall
Temperature
Humidity
Evapotranspiration
Sunshine
Soil Moisture
Soil Temperature
Leaf Wetness
Leaf Temperature |

- **Simulation**
  - **Remote Sensing**
    - **GIS**
      - **Agromet Products**
        - **Agromet Advisory**
          - **Communication**
            - **End Users**
Display of Agromet Product through Websites of AAS

MAP SHOWING DISTRICTS & RAINFALL
RAINFALL: continuous

SELECT STATE
MAHARASHTRA
SHOW MAP

SELECT PEST TYPE
pink boll worm
SHOW MAP

SELECT RAINFALL TYPE
continuous
SHOW MAP

SELECT RAINFALL TYPE TO VIEW THE DISTRICTS OR AREA UNDER SAME RAINFALL IN SELECTED STATE
Complete Network diagram among the AAS centres of IMD with connectivity bandwidth details
Mega Plan for outreach of advisories at Village level

• Set up of linkages between DAO and village level for effective dissemination of advisories.
• In the first phase a mechanism would be set up to reach at taluka level.
• For this Village Knowledge Centers at taluka place which are about 3342 places and proposed to be opened by M. S. Swaminathan Research Foundation & Alliance Partner may be involved to strengthen the outreach mechanism for the service to the farming community.
Communication link with Village Knowledge Centre

Jamsetji Tata National Virtual Academy for Rural Prosperity [NVA]

ICT-enabled knowledge flow
Lab to Lab, Lab to Land, Land to Lab, Land to Land

Hub and Spokes Model

Information Users (Rural families)

Data Generators & Providers

Web based interactive portal

State Level Hub (MSSRF)
Data Managers (both connectivity and content)

Block level hubs

ISRO Uplink/Downlink Satellite

Internet
Mechanism of Preparation and Dissemination of Agromet Advisory at Village Level

**Head Quarter of Agromet Advisory Service**
- Processing of data and generation of agromet products for preparation agro-advisory

**State Agromet Advisory Service Units**
- Preparation of agro-advisory after the discussion with the experts of State Department of Agriculture and experts of SAU
- Dissemination of agro-advisory through different communication channels

**Agrometeorological Field Units**
- Participate and communicate advise/suggestions for preparation of advisories

**District level Office of the State Department of Agriculture**
- Collection and communication of crop information (state & stage) and pest and disease information from taluka and village level office of State Government and Village Knowledge Centre of M.S. Swaminathan Foundation
- Dissemination of agro-advisory through the extension wing

**Village Knowledge Centres at taluka place**
- Collection and communication of crop information (state & stage) and pest and disease information from villages to District level Office of the State Department of Agriculture
- Dissemination of agro-advisory to the villages
Feedback from the users Interaction of Officers of Agrimet Division, IMD, Pune with farmers at Krishi Vigyan Kendra, Baramati
Dissemination of advisories to farmers through multiple channels

- All India Radio (AIR) and Doordarshan
- Private TV radio channels
- Mobile phone / SMS
- Newspaper
- Internet
- Virtual Academy / Virtual Universities / NGOs
- Kisan Call Centres / ICAR and other related Institutes / Agricultural Universities / Extension network of State / Central Agriculture Departments
- KVKs

Advisories should be delivered to the end users without any delay. In cases, where intermediate agencies are involved in dissemination, the delivery scheduling must not compromise on “timeliness” of delivery.

- Efforts should be made to incorporate interactive tuning of advisories with the farmers / managers as frequently as possible.
- Agromet Advisory should be disseminated in Hindi / English and local languages / dialects and be easily understandable by farmers.
Thanks