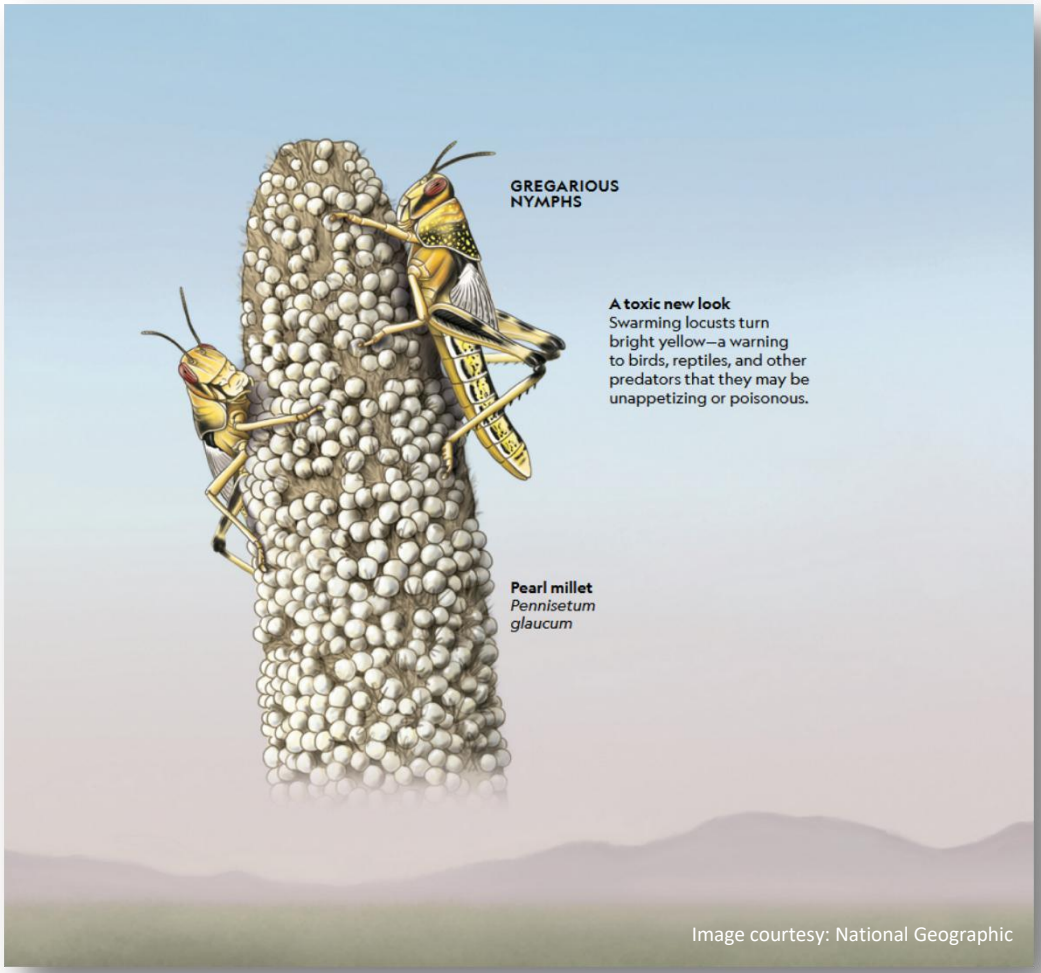
Locust Surveillance Using Geospatial Technology

No. 9
24th July, 2020



Locust Surveillance Using Geospatial Technology Bulletin is issued weekly by Regional Remote Sensing Centre (West), NRSC/ISRO – Jodhpur. RRSC-W continuously monitors the weather and ecology to provide early warning based on survey and control results from Locust Warning Organisation (LWO), Jodhpur combined with remote sensing inputs.

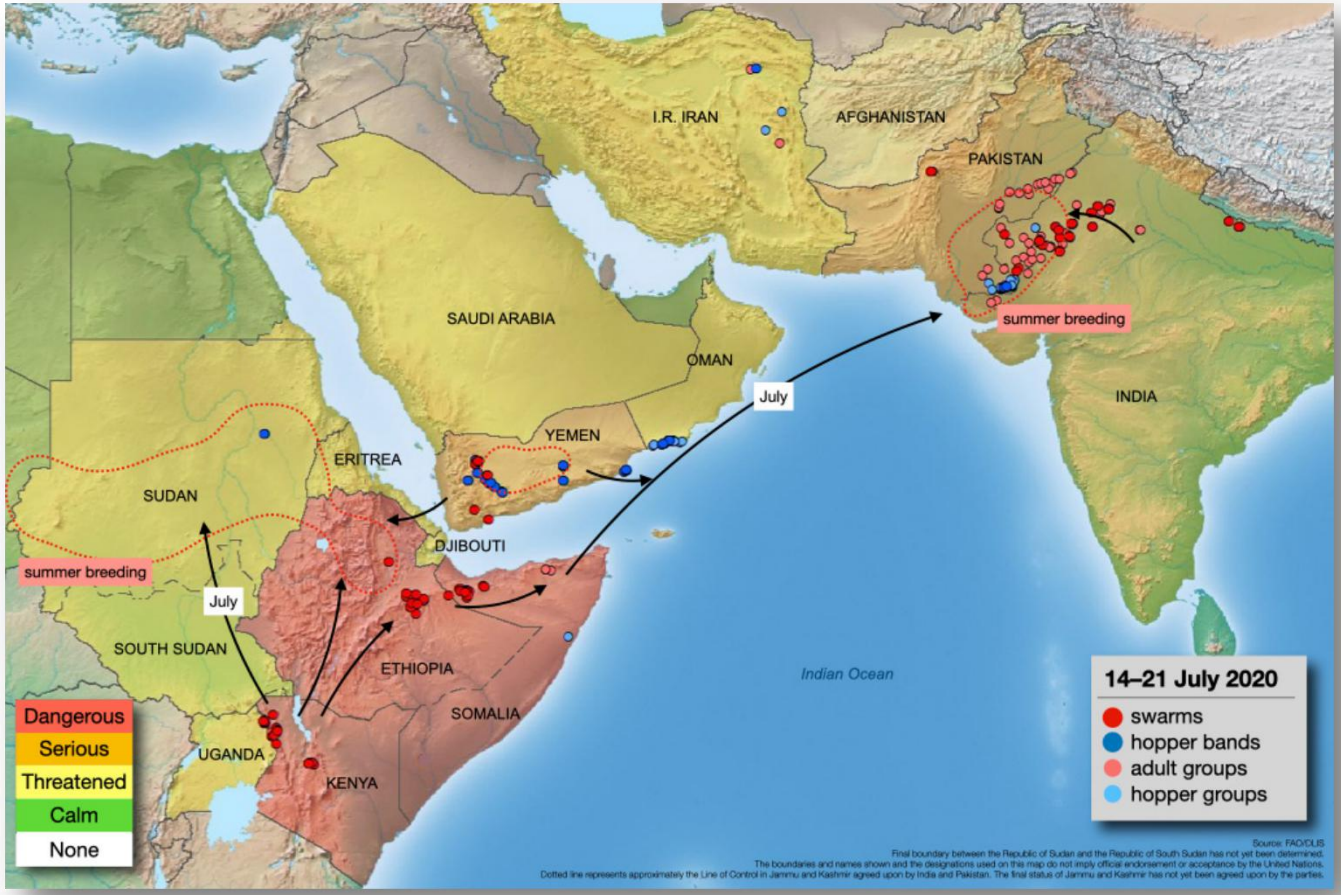
Contents

Locust Update

Risk of swarm migration from Horn of Africa prevails

In India, adult groups and swarms are maturing throughout Rajasthan where laying is underway in many areas. So far, a few hopper groups and bands have formed but substantial hatching is expected in the coming weeks. Control operations are in progress. There have been no recent reports of additional locusts in the northern states as most of the adult groups and swarms have returned to Rajasthan as expected.

There remains a risk that a limited number of swarms could migrate from northeast Somalia to the Indo-Pakistan border area during the remainder of this month.



Source: Desert Locust situation update 21st July 2020 by Food and Agriculture Organisation, UN.

Relevant Weather Conditions for Locust Development and Migration

Egg Development Phase (10– 65 days)

- Laying when soil is moist 0 cm–15 cm (rainfall 25 mm/month for 2 months)
- Soil temperature range for egg viability 15°C–35°C
- Egg development rate increases with temperature
- Air temperature range of 20°C–35°C for egg and hopper development
- Eggs die if flooded or exposed to wind or high soil temperatures (>35°C)

Hopper (24–95 days; average 36 days)

- Rain needed for annual vegetation for food and shelter
- Development period decreases as air temperature increases from 24°C to 32°C.
- In the early morning and late afternoon, hoppers bask on plant tops or the ground; at midday, they take shelter inside plants.
- Bands march on warm, sunny days; bands do not move on overcast days.
- Band movement is usually downwind.

Adult (2–5 months)

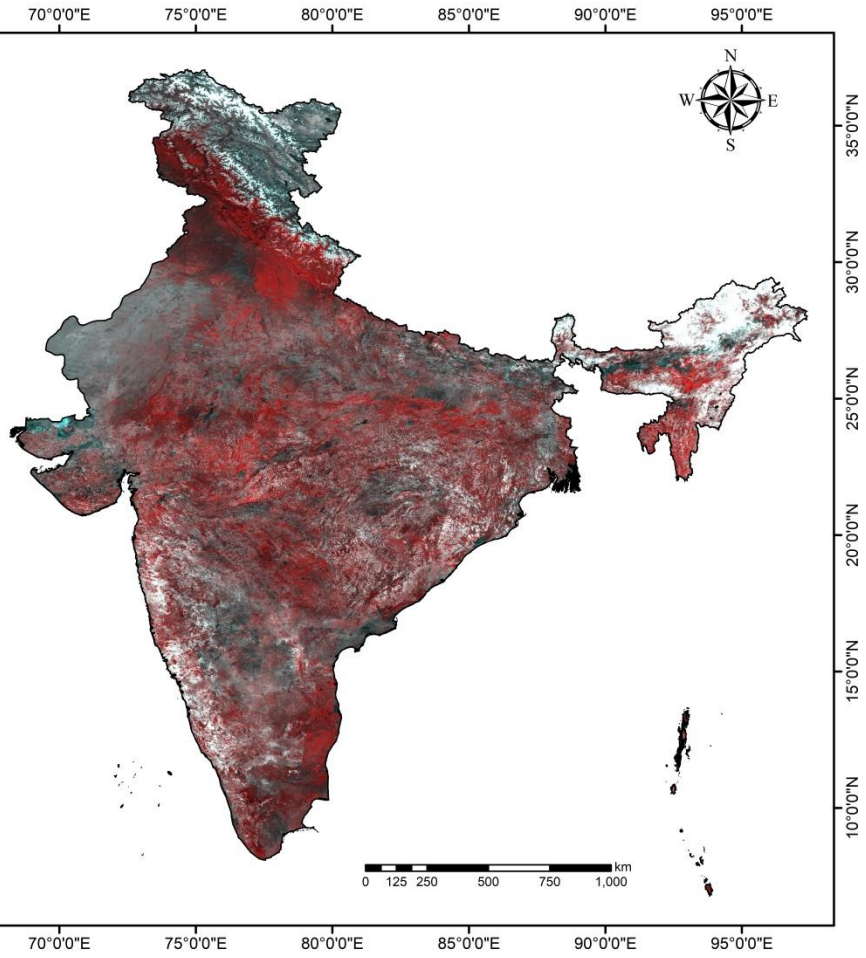
- Adults mature from 3 weeks to 9 months (2–4 months is average).
- Mature rapidly in areas receiving recent significant rains; mature slowly in low temperatures or dry habitats.
- Take-off 20 minutes after sunset above 20°C–22°C and wind < 7 m/s (13.6 knots)
- Fly downwind during the night at heights up to 1 800 m (generally < 400 m) with ground speed of 25–65 km/h for up to 10 hours (2-hour average)
- Sustained flights are rare < 20°C.

Swarm

- Bask to warm up in the sun from sunrise to mid-morning.
- Take off about 2–3 hours after sunrise in warm weather (4–6 hours after sunrise in cool weather) and wind < 6 m/s (11.7 knots).
- Take off in sunny conditions at least 15°C–17°C; in cloudy conditions at 23°C–26°C.
- Fly downwind during the day at heights up to 1 700 m with ground speed of 1.5–16 km/h until 2 hours before sunset or 0.5 hours after sunset.
- Will not take off in winds > 10 m/s (19.4 knots).

Source: Weather and Desert Locusts, WMO- No. 1175, World Meteorological Organization and Food and Agriculture Organization of the United Nations, 2016.

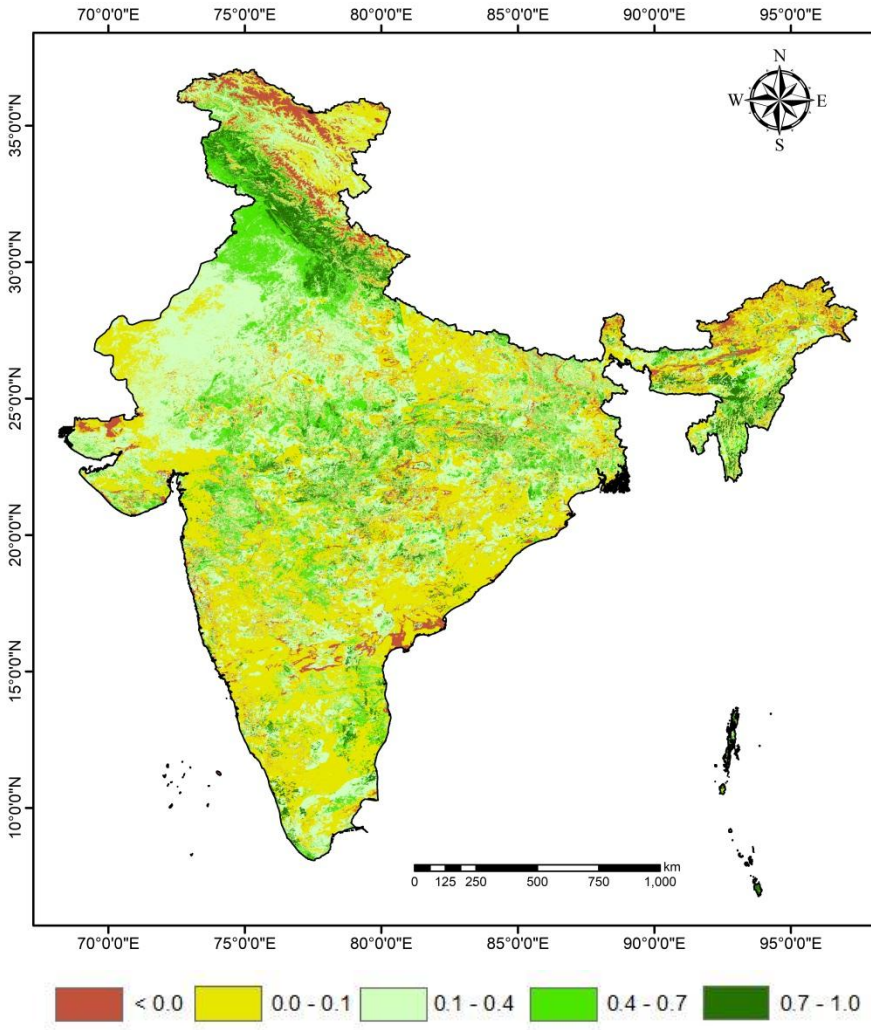
False Color Composite (FCC)



Source: MODIS 8 day Composite

12th - 20th July, 2020

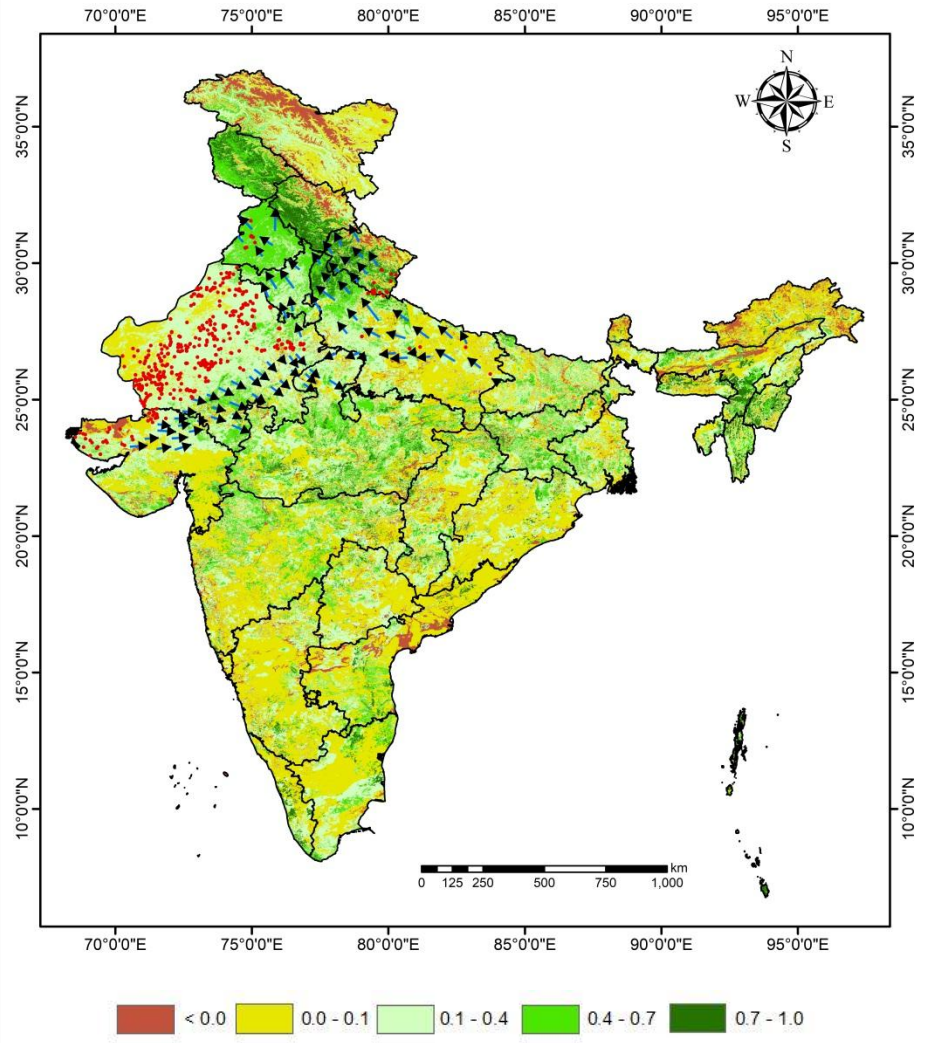
Normalized Difference Vegetation Index (NDVI)



Source: eMODIS Ver. 6

1st - 15th July, 2020

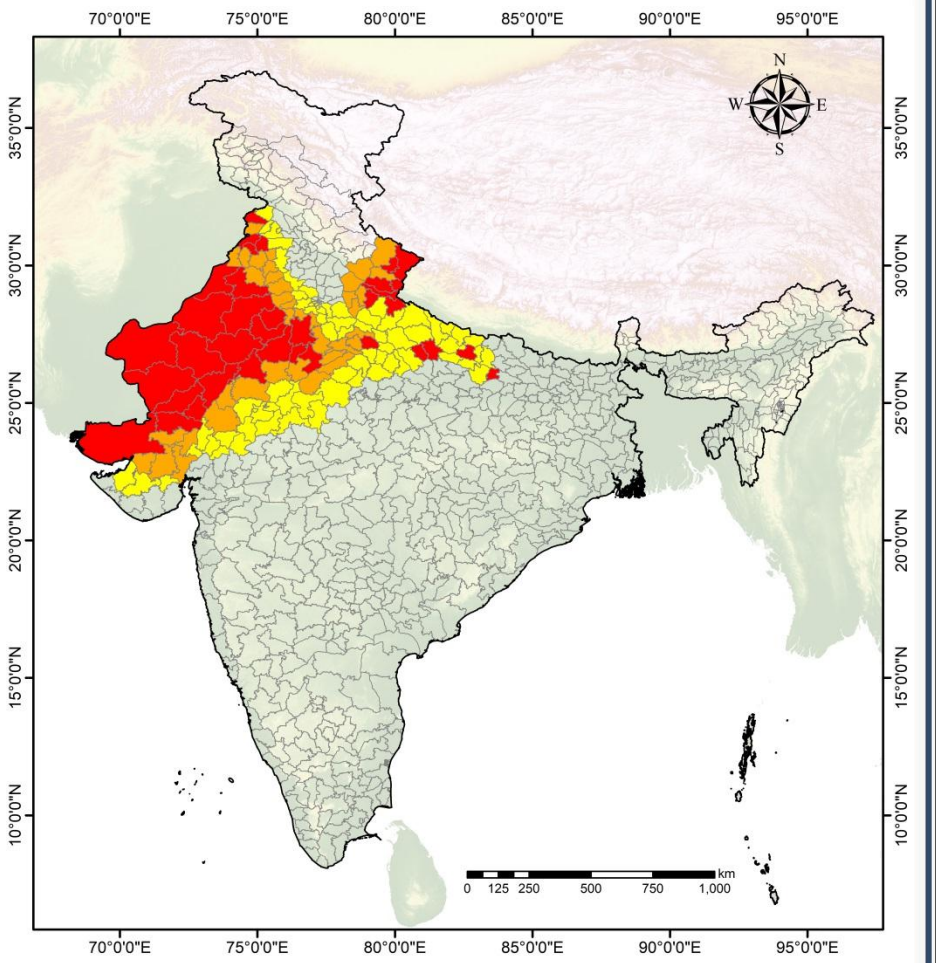
Location Map of Locust Infestation, Surrounding Wind Vectors and Vegetation Status



Source

- **Locust Infestation Point by LWO-Jodhpur**
- **NDVI – EMODIS Ver. 6**
- **Wind Vectors - MOSDAC**

Alert Map of Locust Infestation



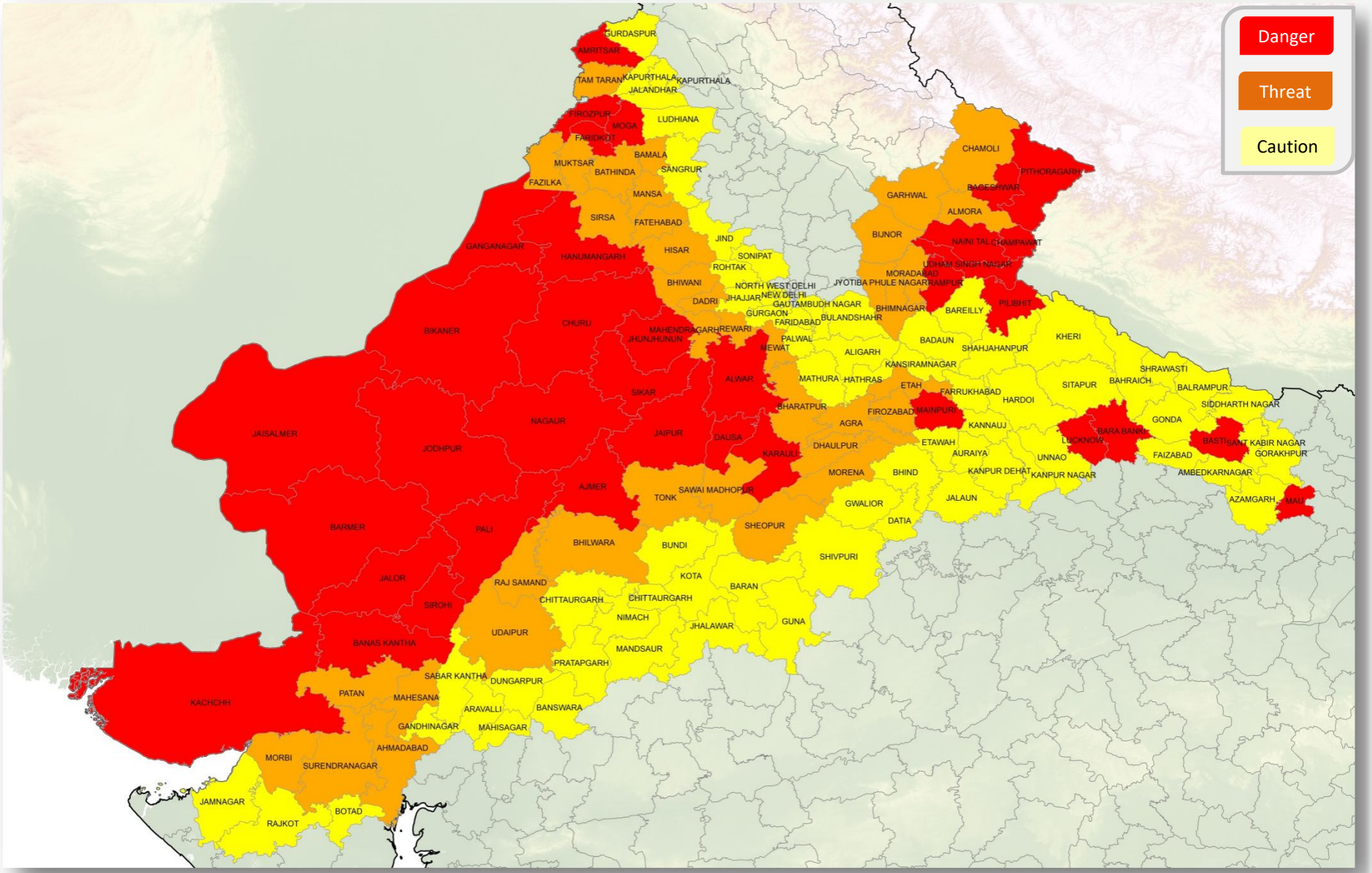
Alert for 25st - 30th July, 2020

Warning Levels

Red : Danger	Significant threat to crops; intensive survey and control operations must be undertaken.
Orange: Threat	Threat to crops; survey and control operations must be undertaken
Yellow : Caution	Potential threat to crops; increased vigilance is required; control operations may be needed

Source: eMODIS Ver. 6

Alert Map of Locust Infestation



Duration: 25th … 30th July, 2020

Details of Locust Alert

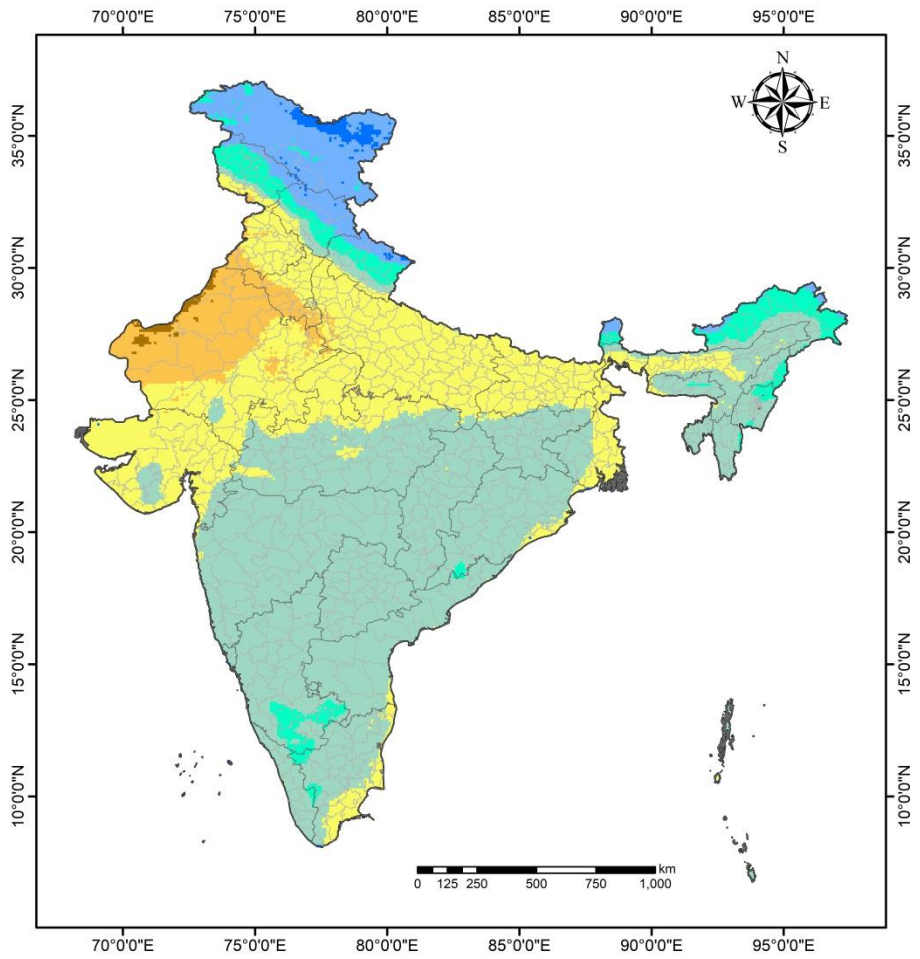
Warning Level

States	Danger	Threat	Caution
Rajasthan	Bikaner, Churu, Jhunjhunun, Jaisalmer, Sikar, Jodhpur, Nagaur, Karauli, Ajmer, Barmer, Pali, Jalor, Sirohi, Alwar, Ganganagar, Hanumangarh, Dausa, Jaipur	Bharatpur, Dhaulpur, Tonk, Bhilwara, Udaipur, Raj Samand, Sawai Madhopur	Chittaurgarh, Bundi, Jhalawar, Dungarpur, Banswara, Kota, Baran, Pratapgarh
Gujarat	Banaskanta, Kachh	Surendranagar, Ahmedabad, Patan, Mehsana, Morbi	Sabarakanta, Gandhinagar, Rajkot, Jamnagar, Botad, Mahisagar
Haryana	—	Sirsa, Mahendragarh, Mewat, Fatehabad, Hisar, Bhiwani, Rewari, Dadri	Jind, Sonipat, Gurgaon, Rohtak, Jhajjar, Faridabad, Palwal
Punjab	Amritsar, Faridkot, Moga, Firozpur	Fazilka, Muktsar, Bathinda, Mansa, Tam Taran, Bamala	Gurdaspur,Kapurthala,Ludhiana,Sangrur,Jalandhar
Uttar Pradesh	Rampur, Pilibhit, Mainpuri, Bara Banki, Lucknow, Basti, Mau	Bijnor, Etah, Firozabad, Agra, Moradabad, Jyotiba Phule Nagar, Bhimnagar	Auraiya, Bareilly, Kheri, Badaun, Shahjahanpur, Aligarh, Etawah, Balrampur, Mathura, Sitapur, Hardoi, Siddharth Nagar, Sant Kabir Nagar, Unnao, Kanpur Dehat, Kanpur Nagar, Azamgarh, Jalaun, Gonda, Hathras, Bulandshahr, Gautambudh Nagar, Shrawasti, Bahraich, Gorakhpur, Faizabad, Ambedkarnagar, Farrukhabad, Kannauj, Kansiramnagar
Madhya Pradesh		Morena, Sheopur	Bhind, Datia, Shivpuri, Nimach, Mandsaur, Guna
Uttranchal	Pithoragarh, Champawat, Bageshwar, Naini Tal, Udham Singh Nagar	Garhwal, Chamoli, Almora	
NCR			Delhi and Surroundings

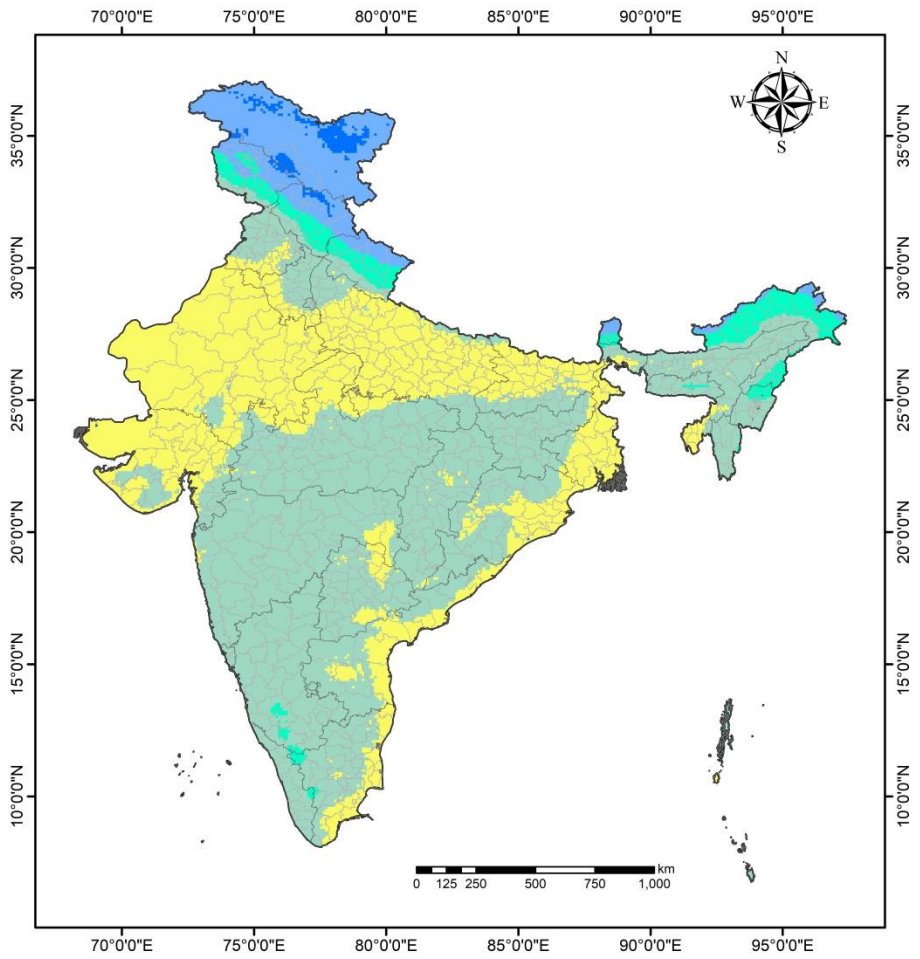
Districts with Locust Alert

Warning Level	No. of Districts		
	11th – 17rd July	18th – 24rd July	25th – 30th July
Danger	35	45	36
Threat	31	48	38
Caution	49	45	69

Land Surface Temperature (^{0}C)



19:30 Hrs. of 15th July 2020

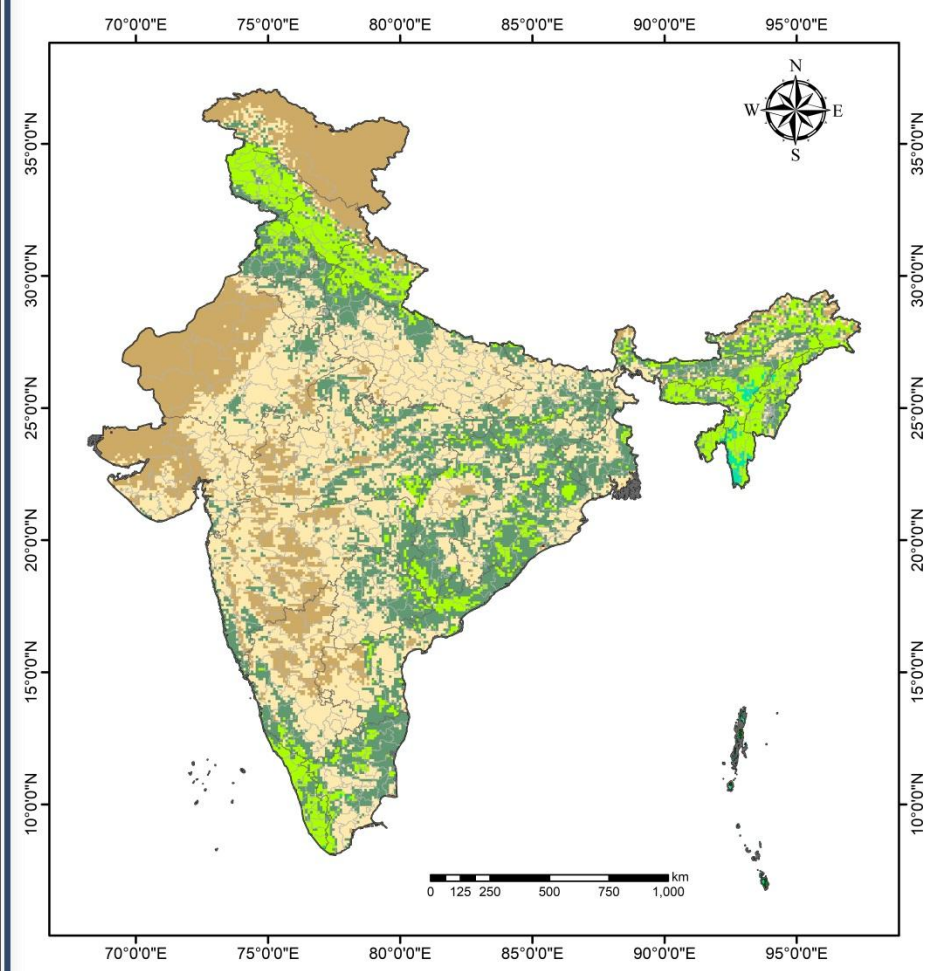


19:30 Hrs. of 21st July 2020.

< 0 | 0 - 10 | 10 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50

Source: SMAP Enhanced L4 Global 3 Hourly 9 km Product

Leaf Area Index (LAI)



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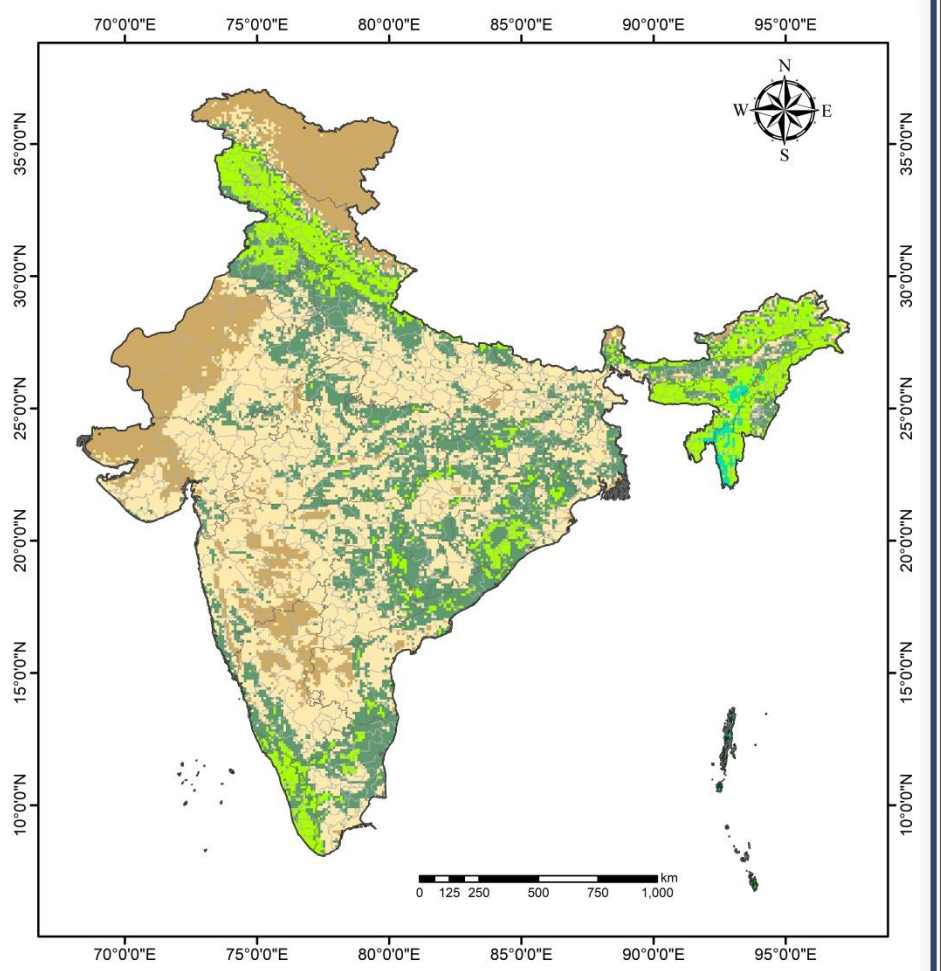
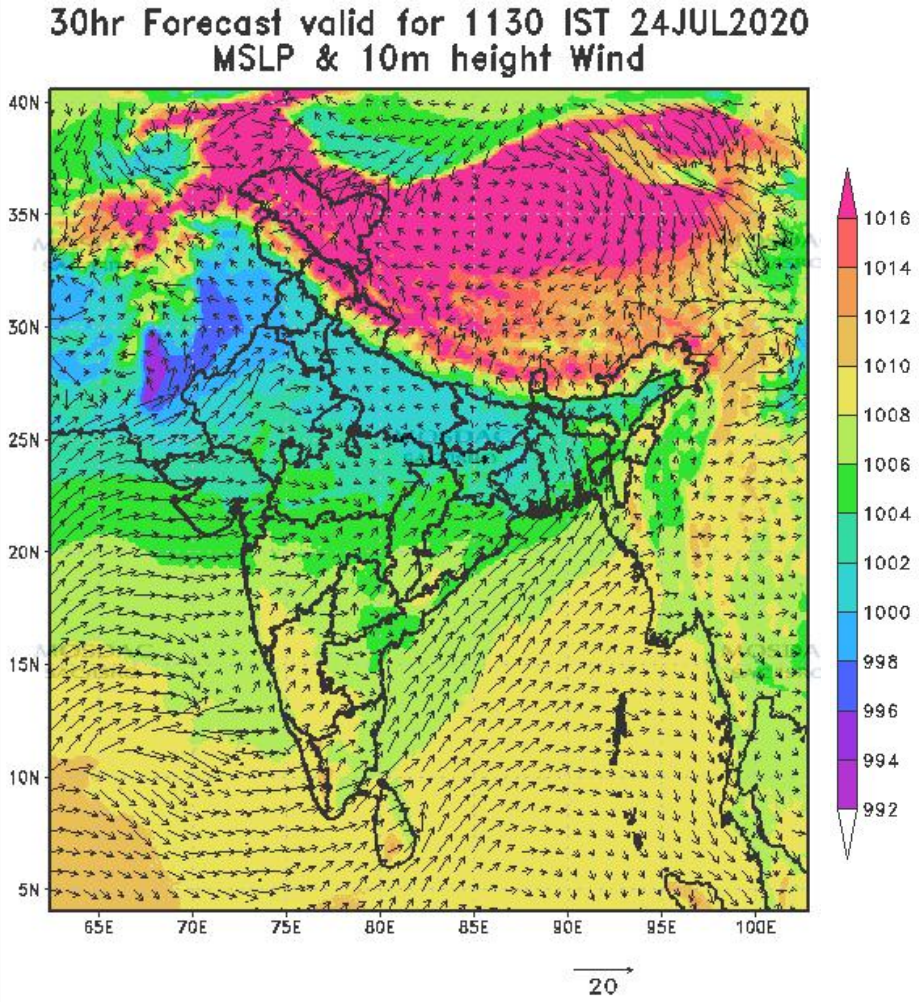


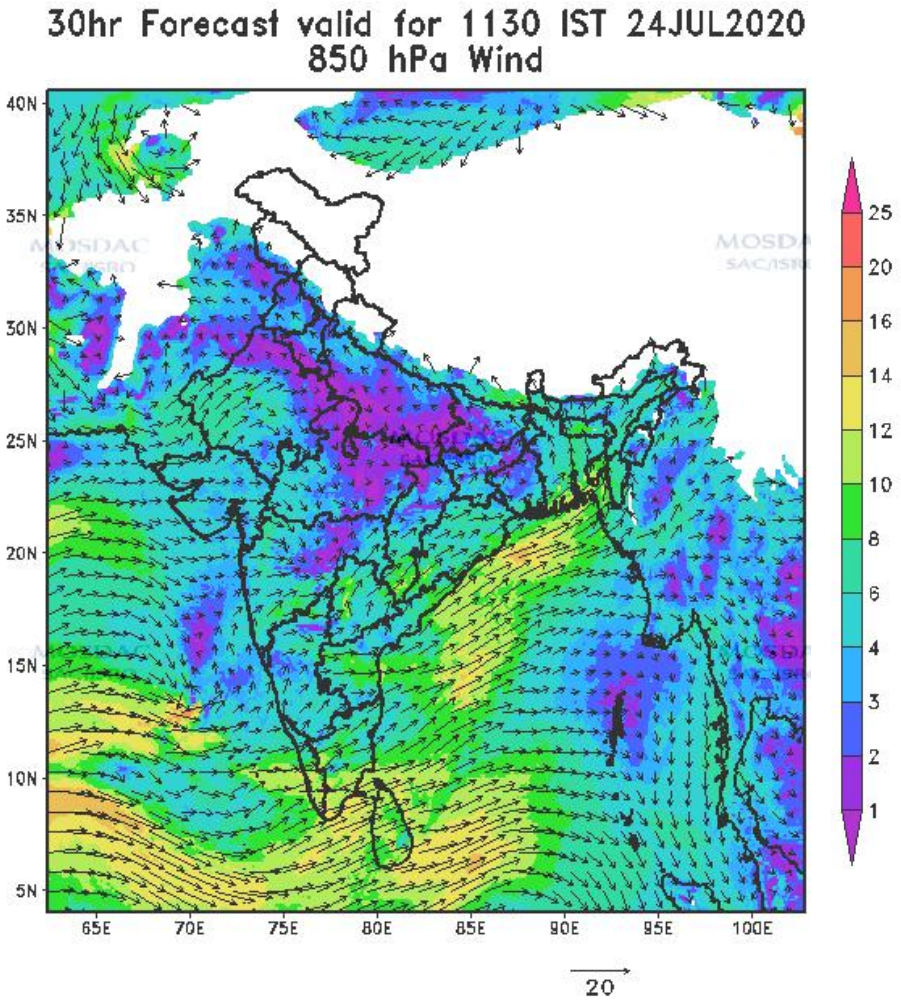
19:30 Hrs of 21th July 2020.

< 0 | 0 - 0.25 | 0.25 - 0.50 | 0.50 - 1.00 | 1.00 - 3.00 | 3.00 - 5.00 | 5.00 - 7.00

Source: SMAP Enhanced L4 Global 3 Hourly 9 km Product

Wind Vectors

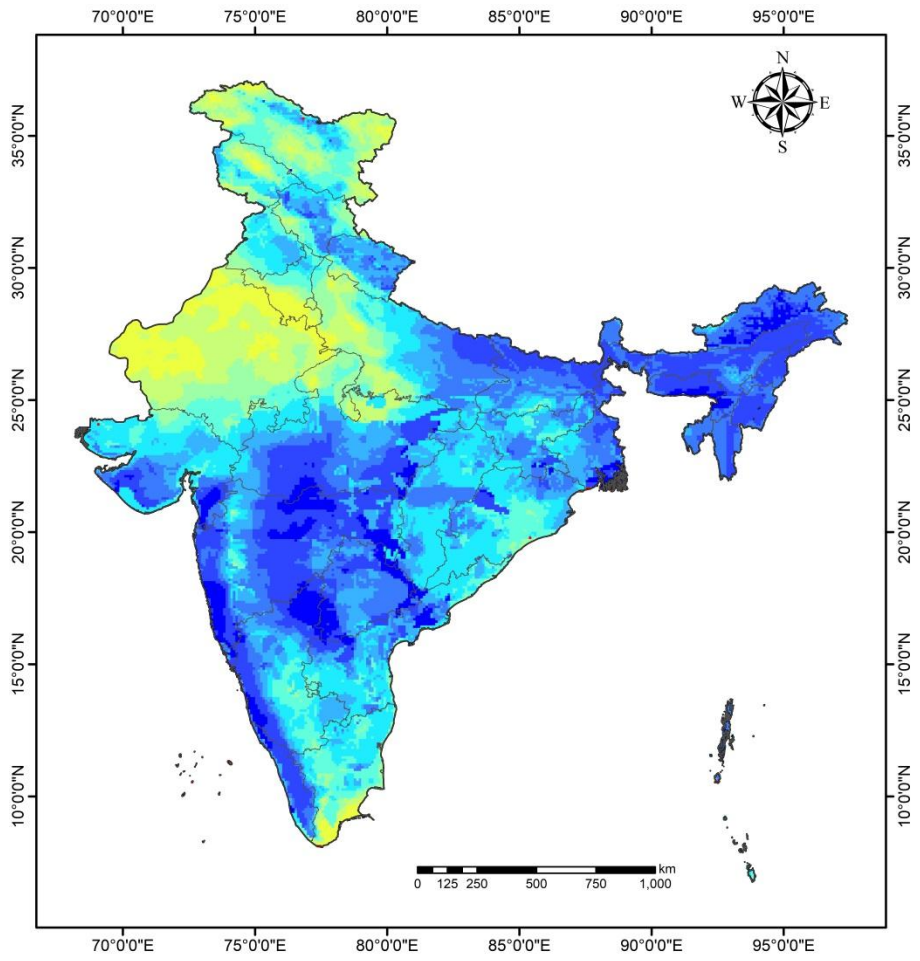




Source: MOSDAC web portal

Wind speed @ 1.46 km from msl.

Surface Soil Moisture Map (%)



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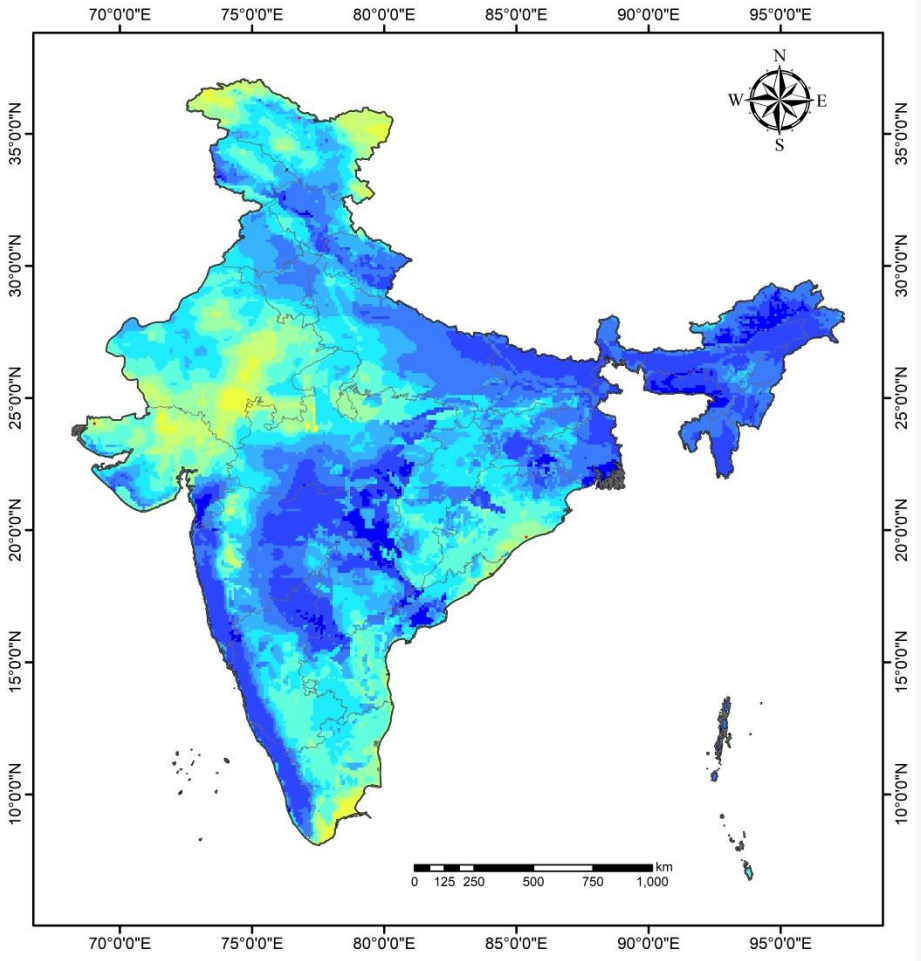
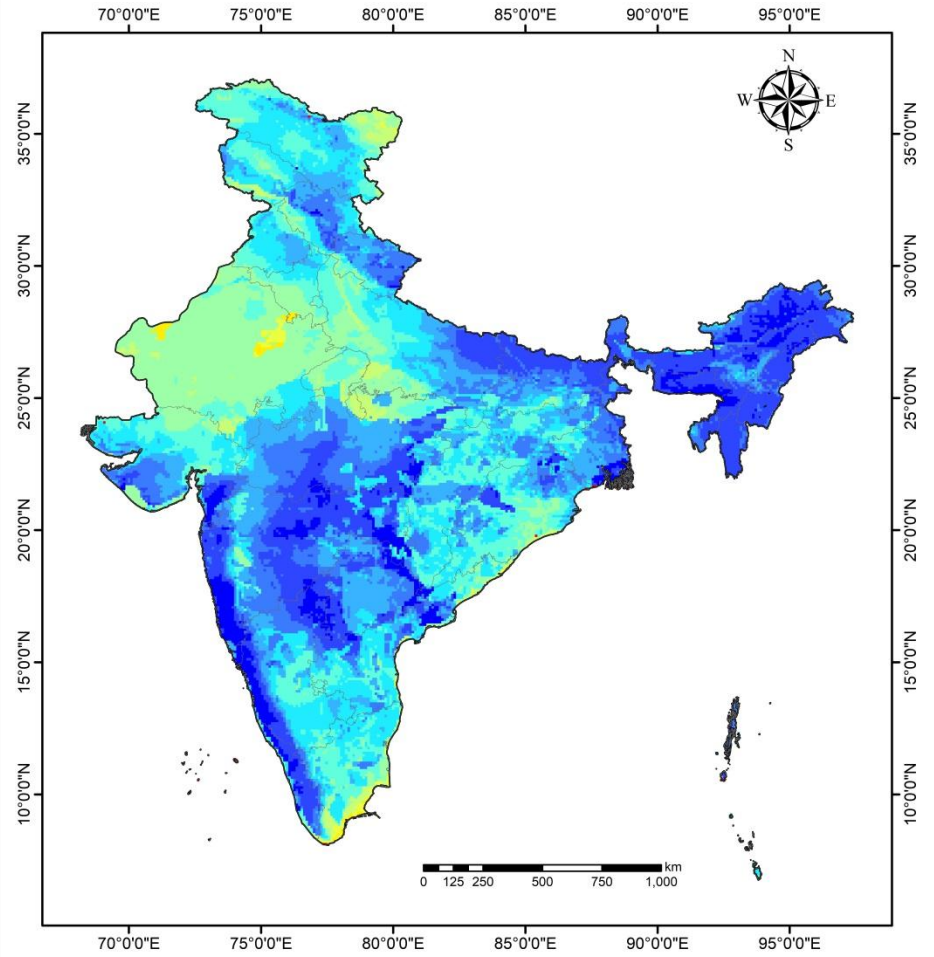


19:30 Hrs. of 21th July 2020.

Source: SMAP Enhanced L4 Global 3 Hourly 9 km Product

Root-Zone Soil Moisture Map (%)



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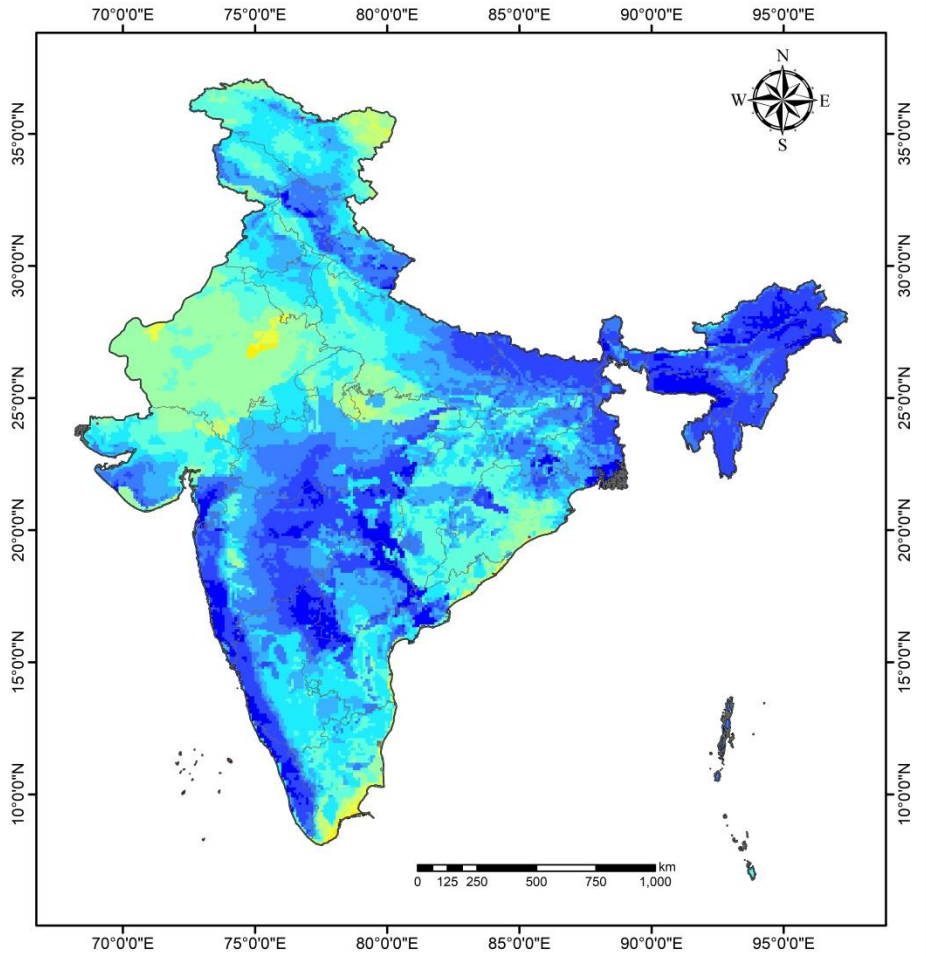
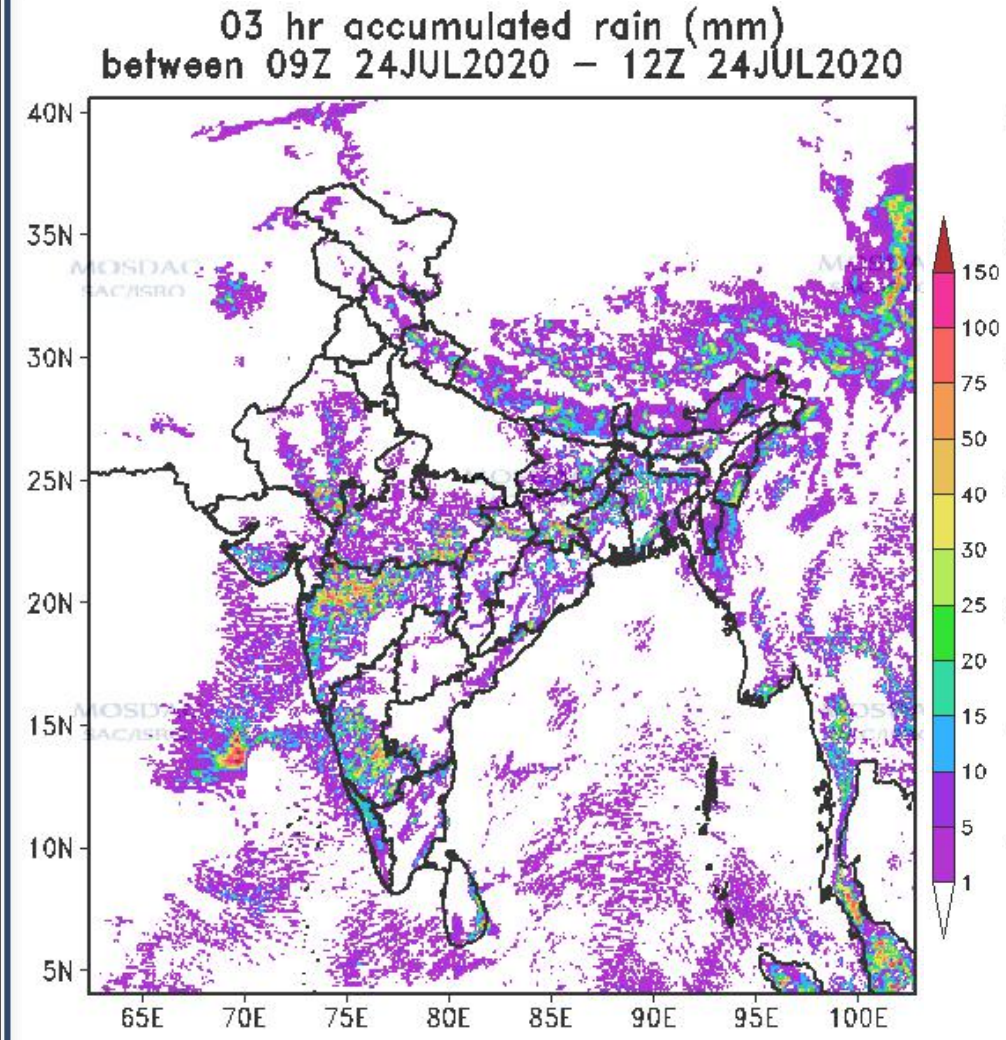
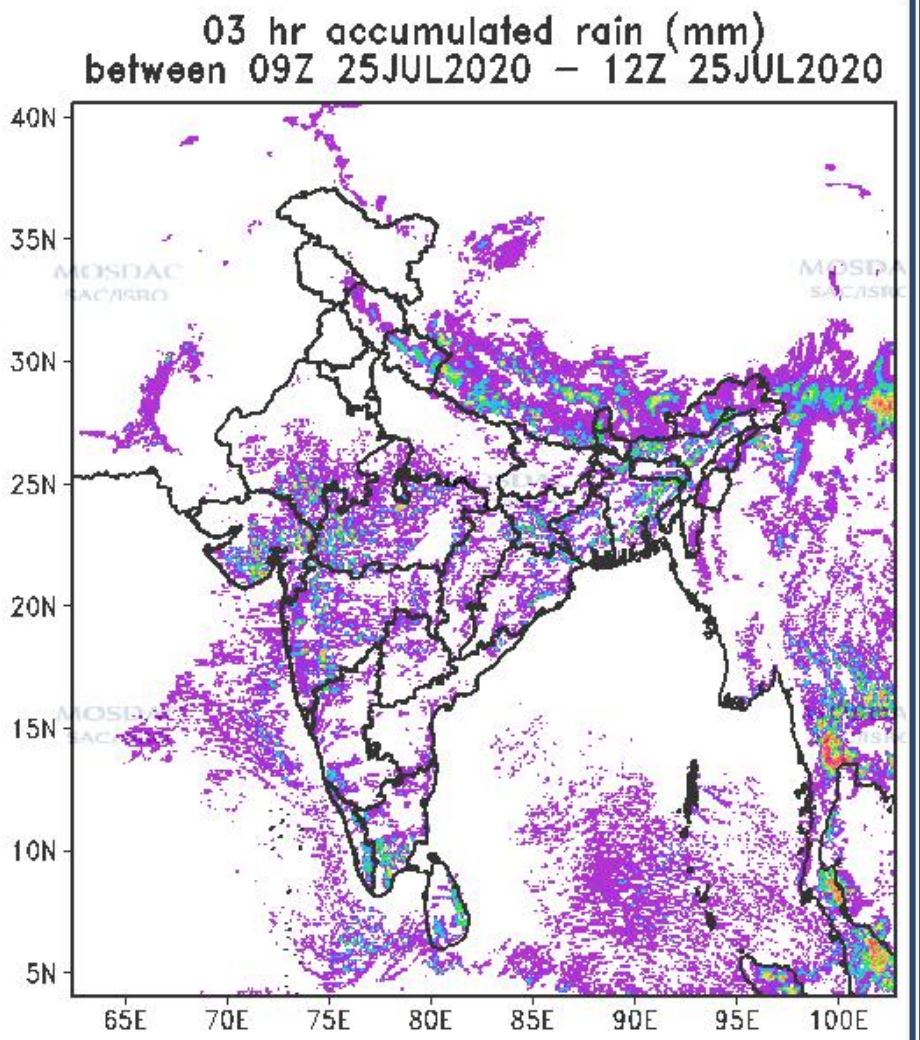


19:30 Hrs. of 21th July 2020.

Source: SMAP Enhanced L4 Global 3 Hourly 9 km Product

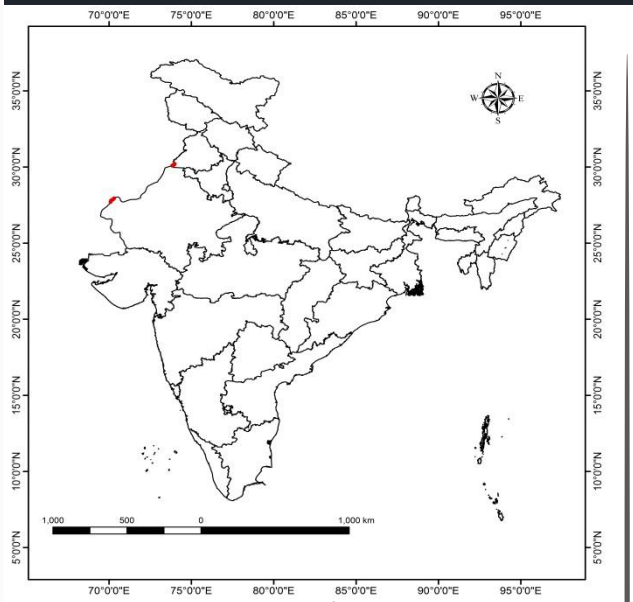
Accumulated Rainfall



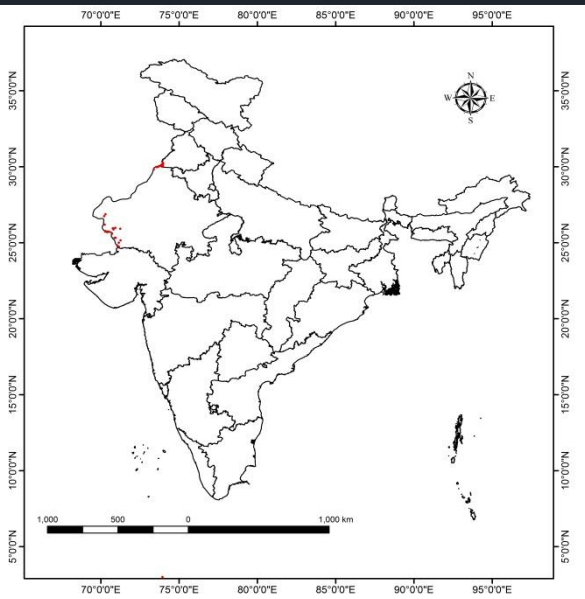


Source: MOSDAC web portal

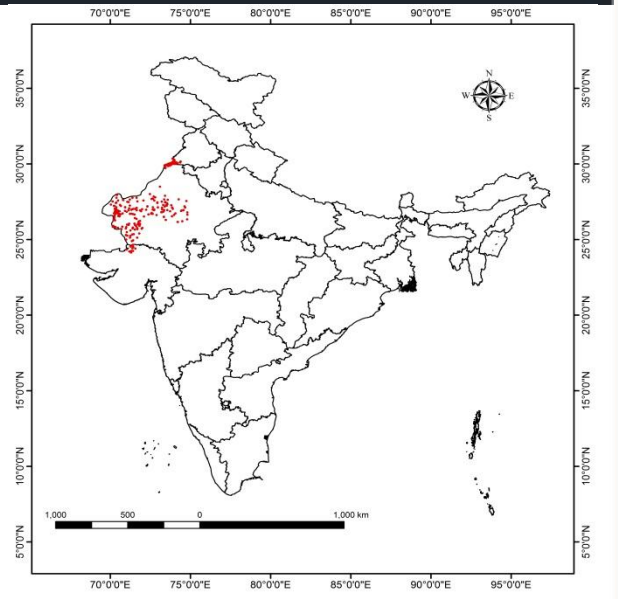
Monitoring of Locust Infestation (April – June, 2020)



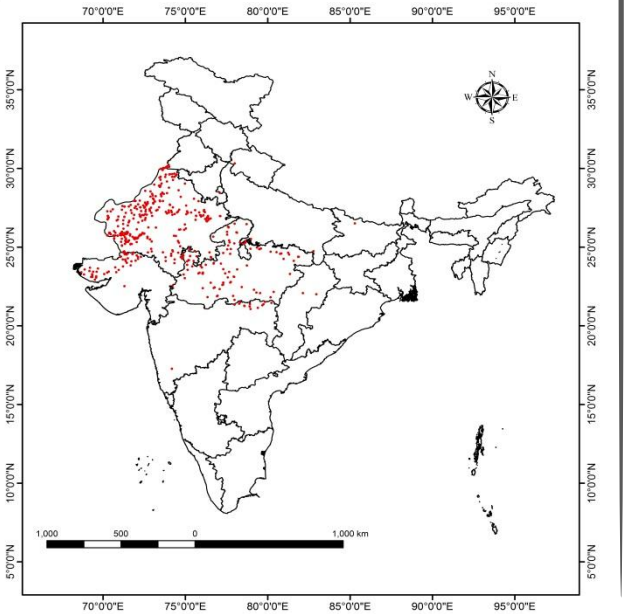
1st – 15th April, 2020: 74 sq.km.



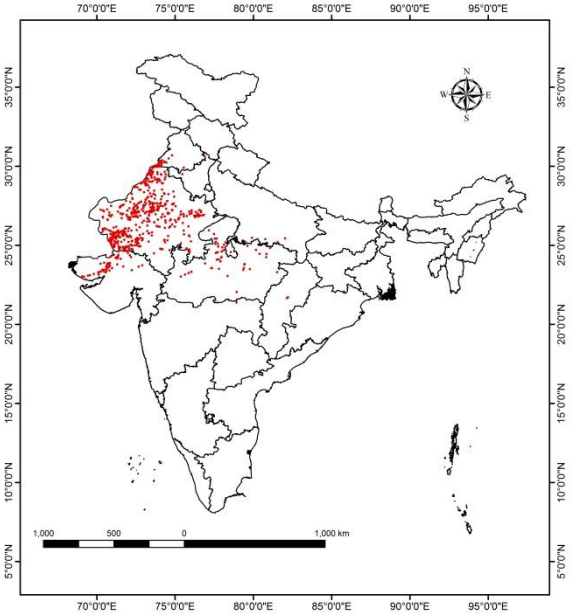
16th – 30th April, 2020: 13604 sq.km.



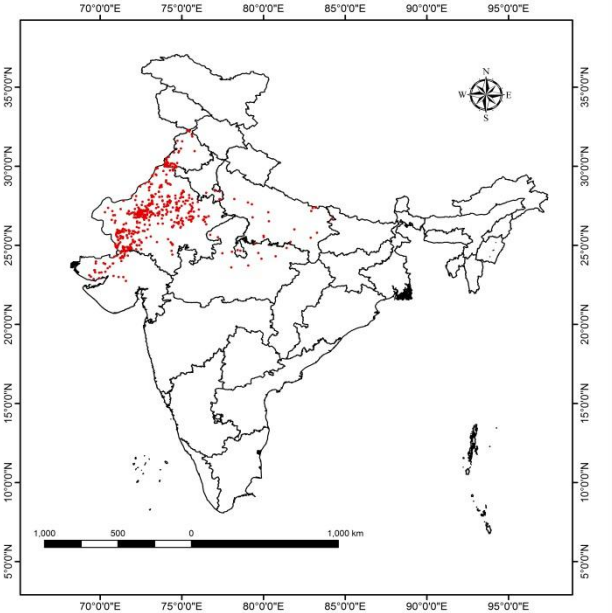
1st – 15th May, 2020: 1,32,315 sq.km.



15th – 31st May, 2020: 6,45,723 sq.km.



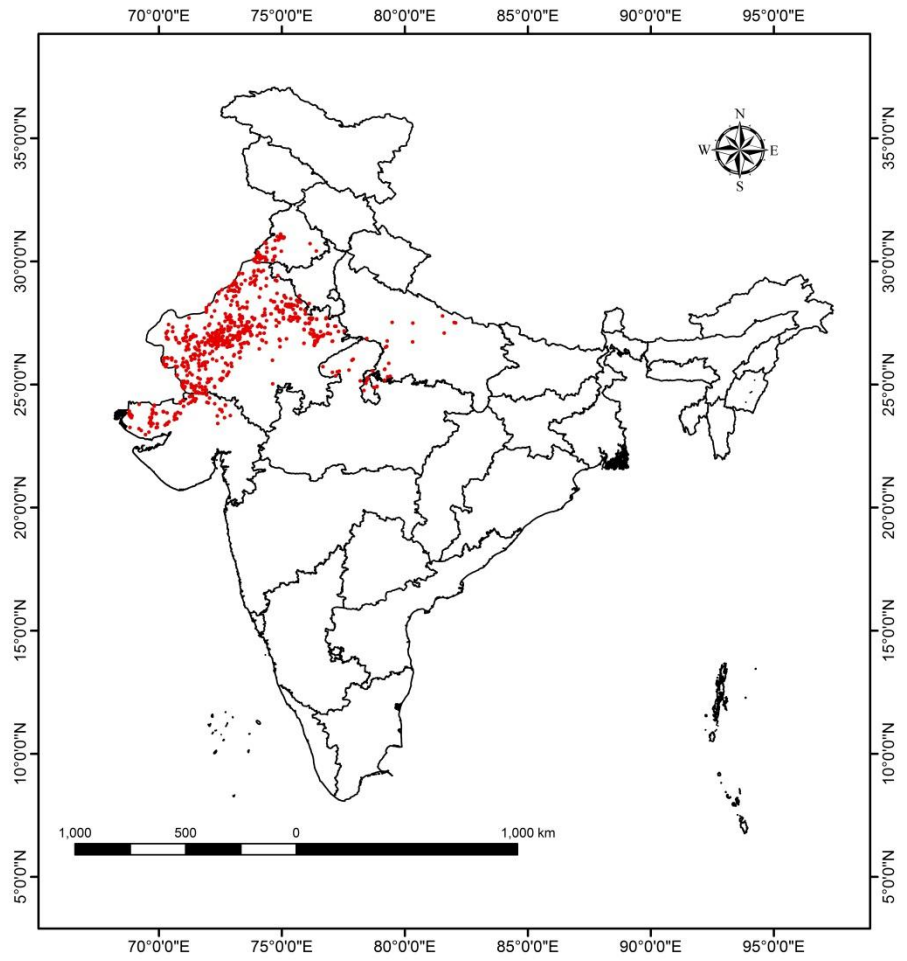
1st – 15th June, 2020: 5,10,991 sq.km.



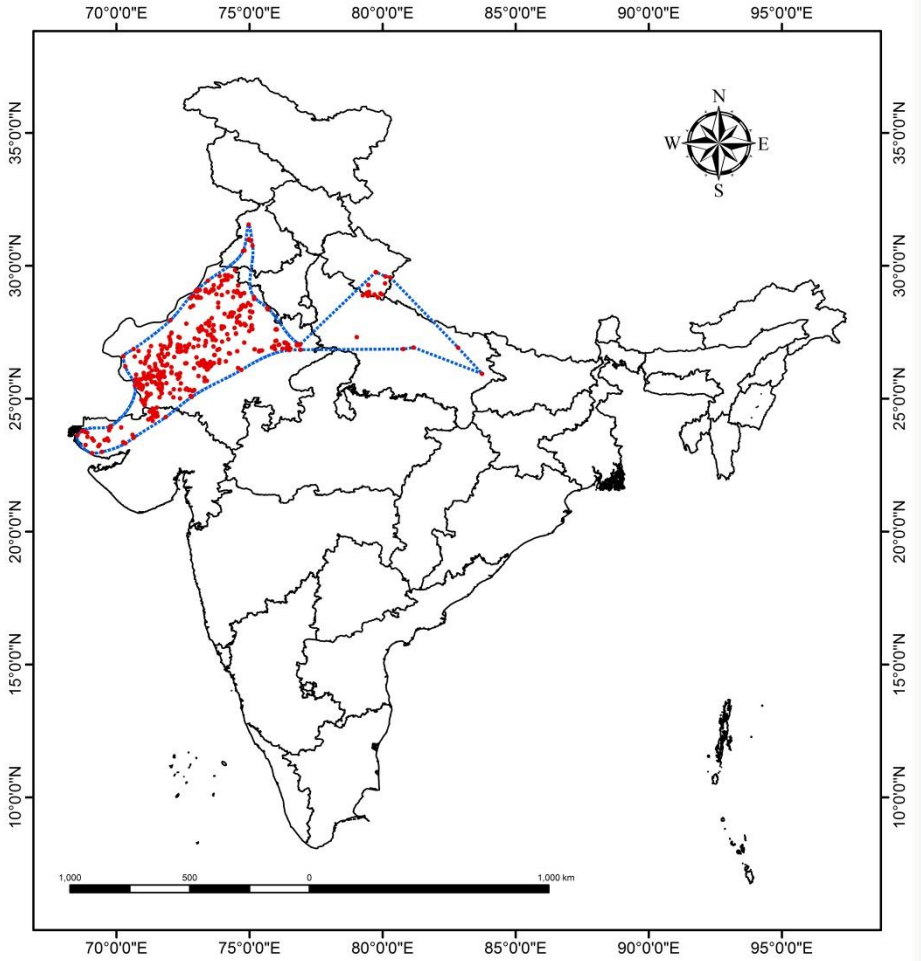
16th – 30th June, 2020: 5,36,348 sq.km.

Source of Locust Incidents: LWO-Jodhpur

Monitoring of Locust Infestation (July 2020)



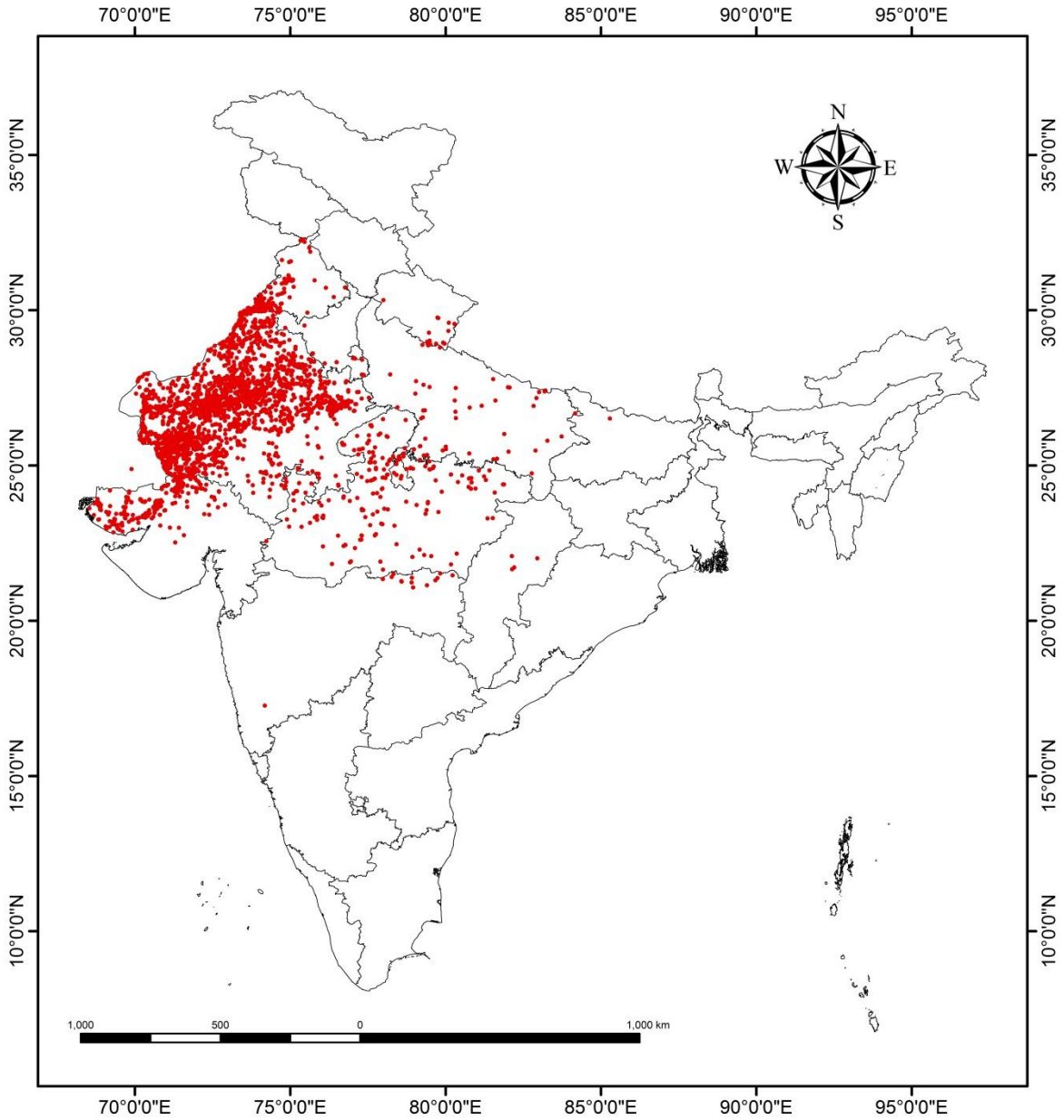
1st – 15th July, 2020: 4,77,391 sq.km.



16th – 23rd July, 2020: 3,51,610 sq.km.

Source of Locust Incidents: LWO-Jodhpur

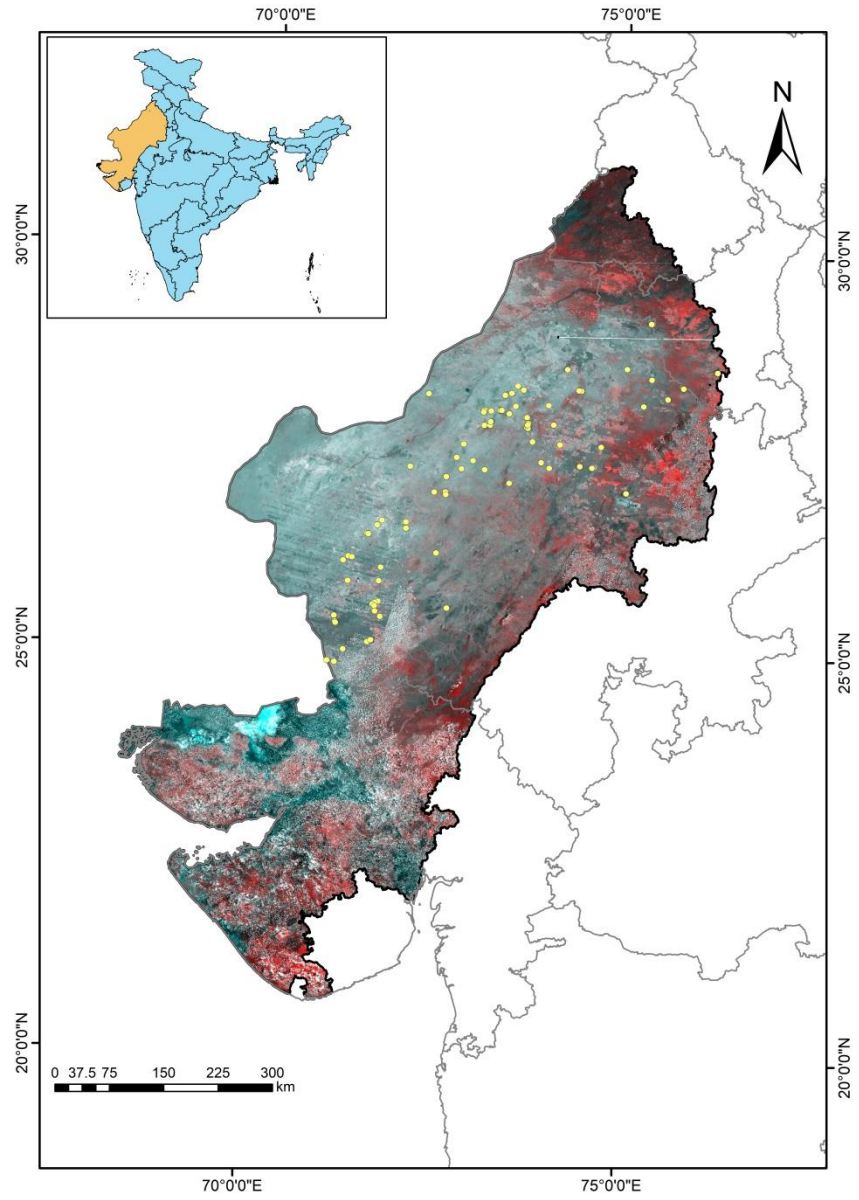
Monitoring of Locust Infestation (April – July, 2020)



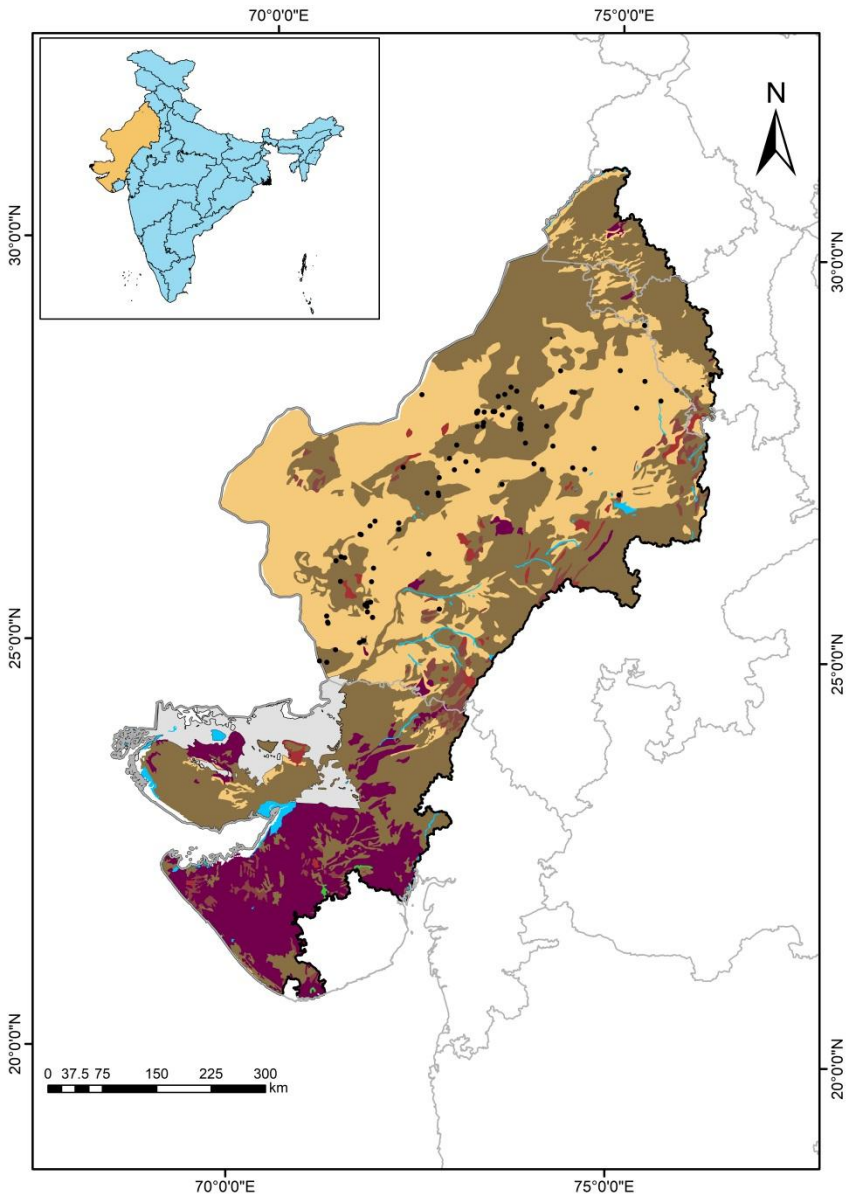
Source of Locust Incidents: LWO-Jodhpur

1st April – 23th July, 2020: 10,26,494 sq.km.

Locust Breeding Sites in Thar Desert Region



False Color Composite

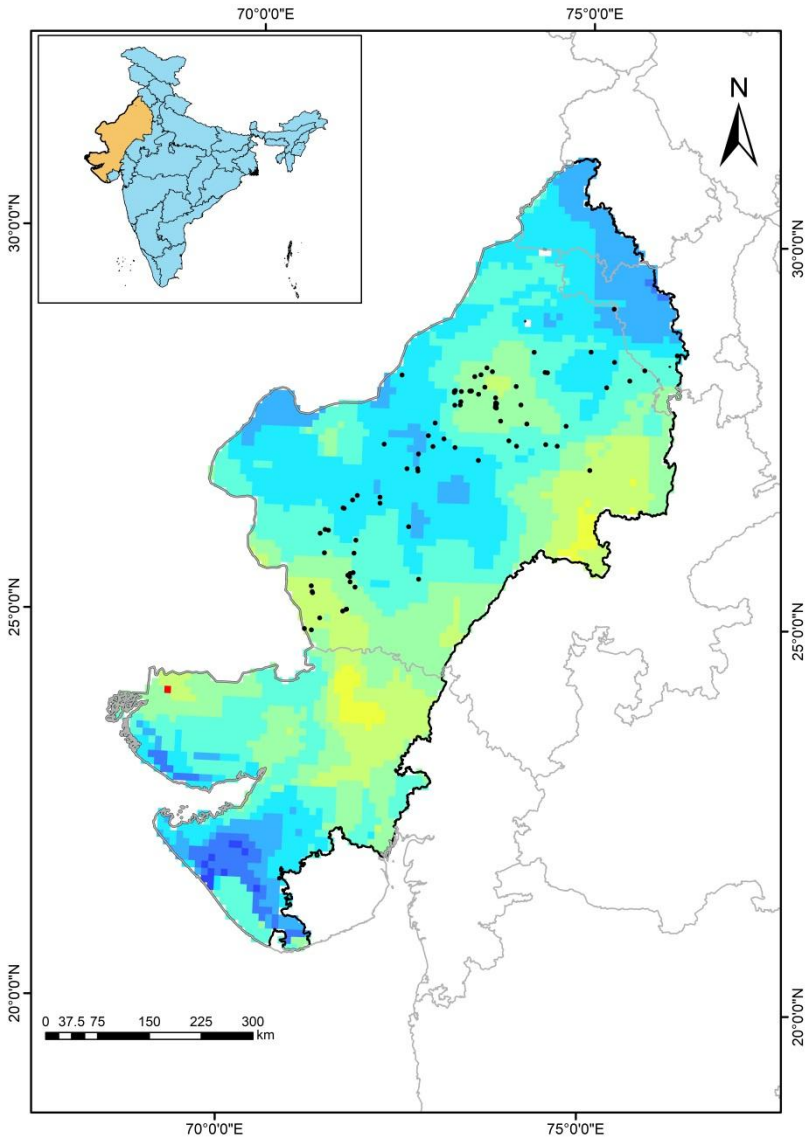


Soil Texture Map

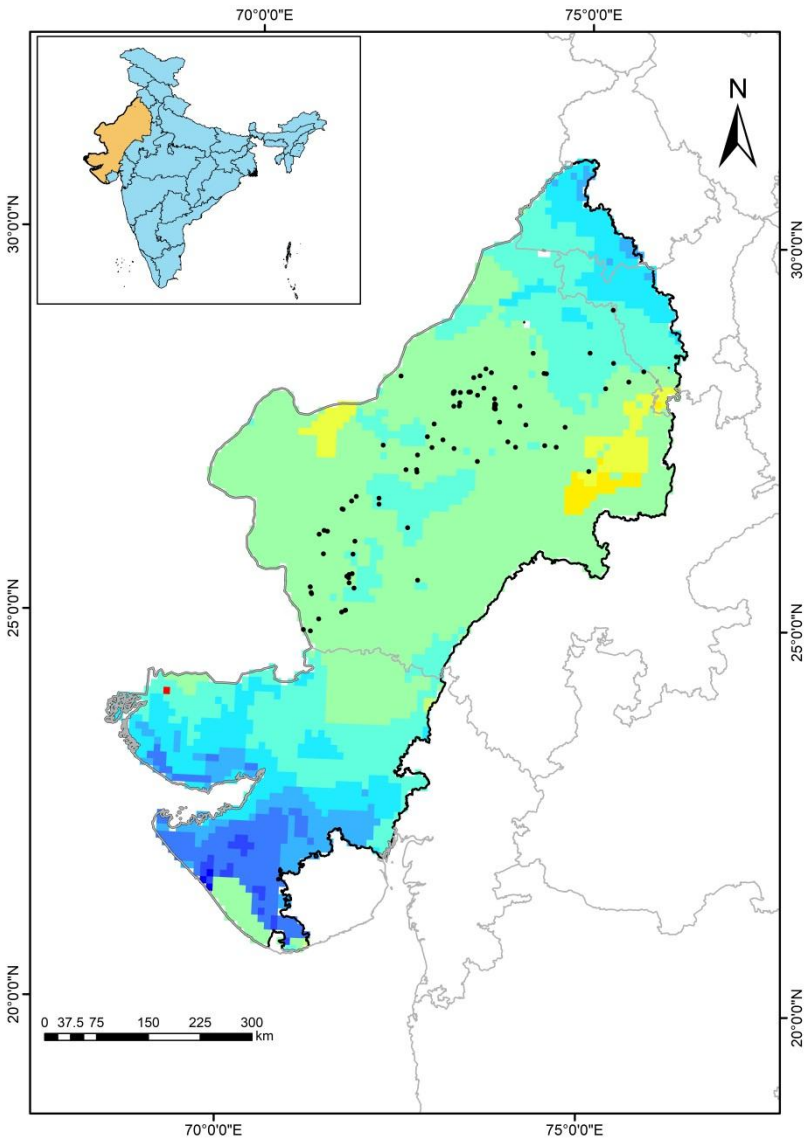
Clay Skeletal | Clayey | Loamy | Rann Of Kach | Rock Outcrop | Sandy | Water bodies

Source: Locust Incidents - LWO-Jodhpur; FCC – MODIS 8 day Composite

Locust Breeding Sites in Thar Desert Region



Surface Soil moisture map 19:30 Hrs of 21st July 2020

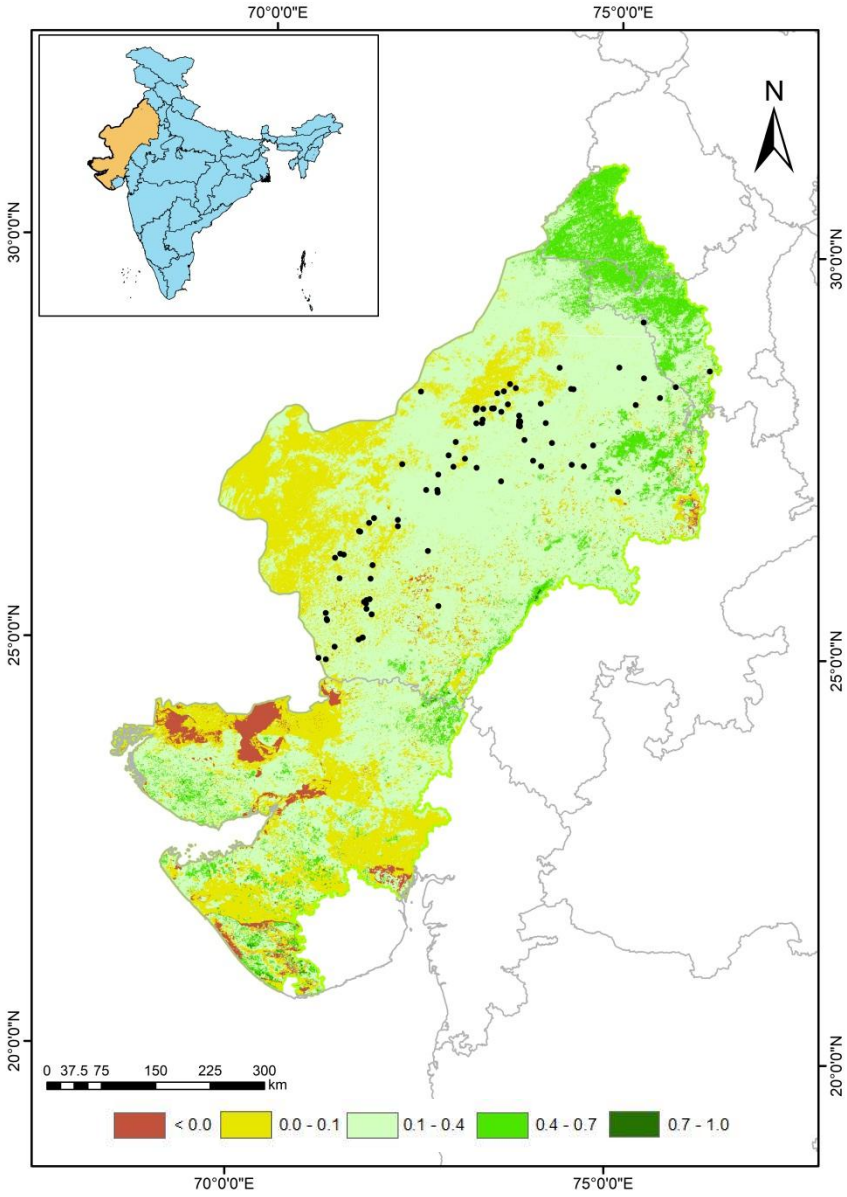


Root-zone soil moisture map 19:30 Hrs of 21st July 2020

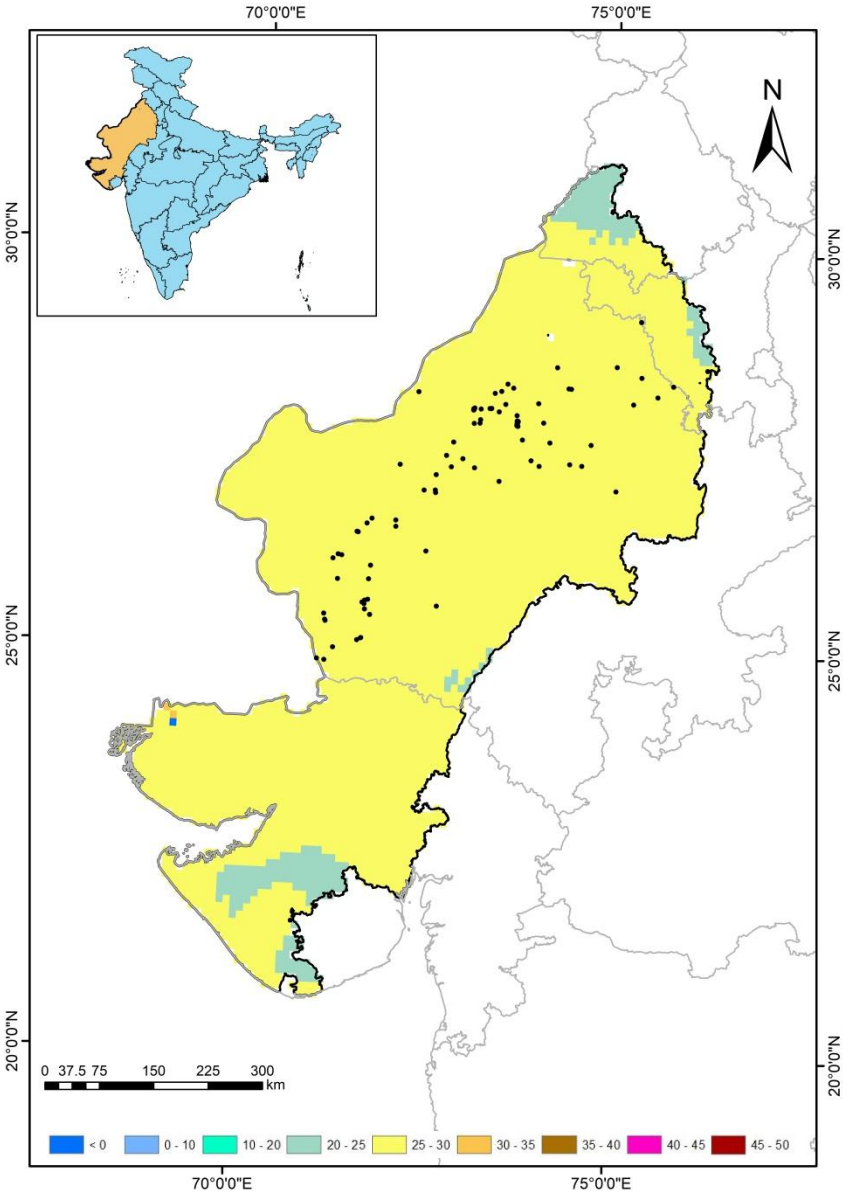
0-1 | 1 - 2 | 2 - 3 | 3 - 4 | 4 - 5 | 5 - 10 | 10 - 15 | 15 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45 | 45 - 50

Source: Locust Incidents - LWO-Jodhpur; Surface/Root-zone Soil Moisture - SMAP Enhanced L4 Global 3 Hourly 9 km Product

Locust Breeding Sites in Thar Desert Region



Normalized Difference Vegetation Index



Land Surface Temperature map

19:30 Hrs. of 21th July 2020

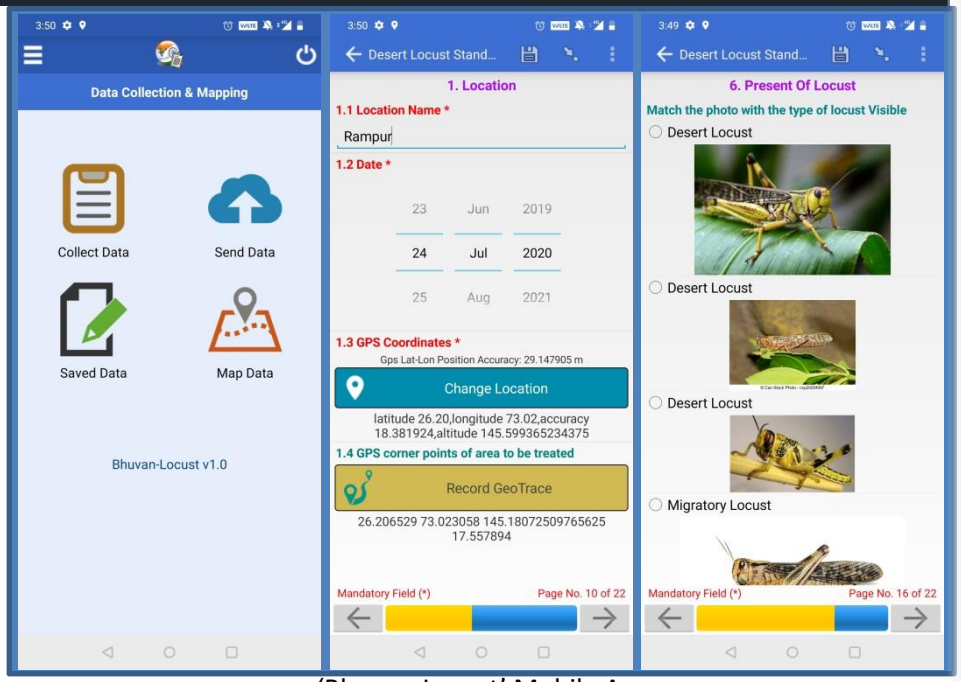
Source: Locust Incidents - LWO-Jodhpur; NDVI – EMODIV Ver. 6; Land Surface Temperature - SMAP Enhanced L4 Global 3 Hourly 9 km Product

Mobile App and WebGIS based Solutions for Locust Surveillance

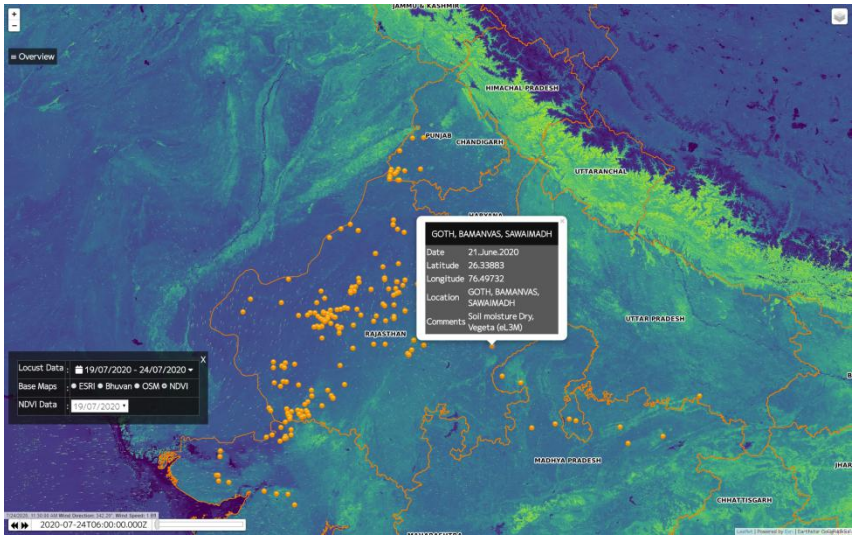
Regional Remote Sensing Centre – West (RRSC-W) has entrusted to develop various tools using Geospatial Technologies for Locust surveillance. Towards this, certain promising and proven technologies like mobile apps and WebGIS based information systems are being developed.

A mobile app namely 'Bhuvan-Locust' is being developed for citizens and institutional official where one can upload locust sightings and related field level informaton. The app is based on the FAO design recommendation.

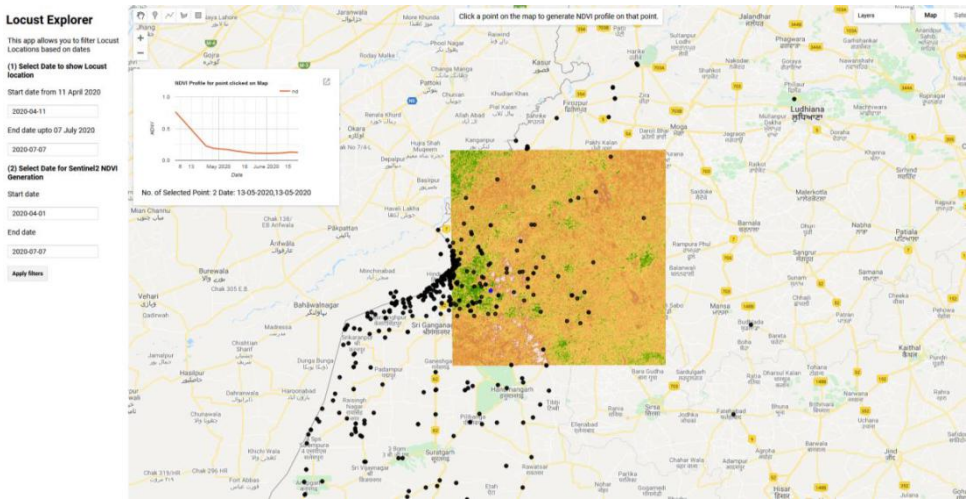
WebGIS based portal namely 'Bhuvan-Tiddi' is under development and through which users can visualize various geospatial layers and other modelled outputs. One of the solution to detect impacts of Locust is based on Google Earth Engine (GEE) through which the users can visualize the changes in vegetation status online at a given location/area.



'Bhuvan-Locust' Mobile App



'Bhuvan-Tiddi'- WebGIS Portal for Locust Surveillance

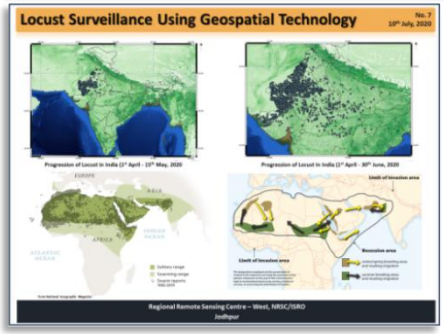


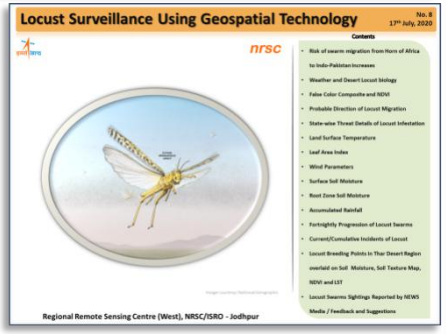
GEE based Vegetation Status Monitoring

Locust Swarm Sightings Reported by NEWS Media

Source	Headlines	Date	Reported Areas
Amar Ujala	उत्तराखंड की सीमा से सटे यूपी के गांवों में टिड्डी दल का हमला, ड्रोन, स्प्रे और फायर ब्रिगेड से की जा रही किसानों की मदद	18/7/2020	करीमगंज, मन्वपट्टी (उत्तरप्रदेश) रुद्रपुर, किच्छा व सितारगंज के पास सीमांत सैजना, सैजनी गांव, रतनपुरा, दरऊ, मटिया
Jagran	हरियाणा में फिर हो सकता है टिड्डी दल का हमला, नूंह, रेवाड़ी, महेंद्रगढ़, भिवानी व चरखी दादरी में अलर्ट	18/7/2020	नूंह, रेवाड़ी, महेंद्रगढ़, भिवानी और चरखी दादरी
Amar Ujala	रुद्रपुर से टिड्डियों ने बिलासपुर की तरफ किया रुख, टनकपुर पहुंचा टिड्डी दल नेपाल की ओर निकला	18/7/2020	बिलासपुर , रुद्रपुर, किच्छा, सितारगंज, खटीमा व पंतनगर
Rajasthan Patrika	मंडोर में टिड्डी ने मचाया उत्पात	18/7/2020	गोकुल जी कि प्याऊ (मंडोर), डांगियावास, बीसलपुर, देचू, पीपाड, लोहावट, जोधपुर, बाड़मेर, जैसलमेर, बीकानेर
Dainik Bhaskar	नागौरी बेरा में टिड्डीयो का हमला, खदेड़ने के लिए लोगो ने बम-पटाखे छोड़े	18/7/2020	डांगियावास, खातियासनी, बावरला, बीसलपुर, पालासनी, बनाड़, देवलिया, जाजीवाल, सालवा कलां, असंदा, सोढेर कि ढाणी, नांदडा कलां, दान्तिवाडा, चौढा, खोखरिया, कोकुंडा
Amar Ujala	नेपाल सीमा से सटे उत्तराखंड के गांव में फिर टिड्डी दल का हमला, मक्का और धान की फसलों को किया चट्ट	19/7/2020	पिथौरागढ़ का तल्लीसार गांव
Navbharat Times	टिड्डी दल पहुंचा नेपाल, किसानों को राहत	19/7/2020	काकोरी (लखनऊ), बाराबंकी, नेपाल
Jagran	नेपाल और उत्तर प्रदेश की सीमा से वार कर रहा टिड्डी दल	19/7/2020	उत्तराखंड का कुमाऊं , ऊधमसिंह नगर जिले के किच्छा, सितारगंज |
Amar Ujala	Locust Attack: अब चंपावत और बागेश्वर पहुंचा टिड्डी दल, किसानों ने धुआं कर और शोर मचाकर भगाया	20/7/2020	भोलनानाघर और काफलीगैर (बागेश्वर) चंपावत जिला (उतराखंड)
Amar Ujala	Locust Attack : पिथौरागढ़ में टिड्डी दल का आतंक, चट कर दी मक्का और धान की फसल	22/7/2020	पिथौरागढ़ में विकासखंड विण का तल्लीसार, मूनाकोट ब्लाक का तड़ेमियां (उतराखंड)
Rajasthan Patrika	पाक से तारबंदी के नीचे से आने लगे हॉपर, पैदा हुई टिड्डी कि चौथी पीढ़ी	22/7/2020	बाड़मेर का सेडवा, जैसलमेर, जोधपुर, बीकानेर, चुरू, सीकर, नागौर, पाली, हनुमानगढ़, श्रीगंगानगर

Feedback and Suggestions





Came across the Locust Bulletin, No. 8, 17 July 2020, of your esteemed institute NRSC - West / ISRO, Jodhpur, India. It is an excellent work accomplished by the team, in collecting, collating and compiling the desert locust relevant data on remote sensing platform.

Dr G K Mahapatro, ICAR, Pune.

Thank you for sharing the Locust report. It has been very nicely brought out.

Dr. Shubendu Ray, MNCFC.

It is good to see you have taken up this study very seriously and bringing out periodically the bulletin.

Dr. P.V.N Rao, NRSC.

Excellent efforts and good way to present the forecast in correlation of moisture and temperature

Dr. Vipin Chaudhary, CAZRI.

Great job by Team RRSC-West. Brought back many memories of work done with Locust Department.

Dr. Rajashree Bothale, NRSC.

Congratulations to team RRSSC-WEST for bringing such an informative Locust Bulletin. It's very useful particularly for the planners of the State Government for making arrangements and creating awareness among farmers well in advance.

Dr. Virender Singh Arya, HRSAC.

Very good to see very timely edition of locust forecast bulletin. Multi source satellite data has been analysed very effectively.

Dr. C. S. Jha, NRSC.

Corrigendum

The copulation process shown in bulletin no. 8/2020 in page no. 2 pertains to Aak Grasshopper Poekilocerus pictus.

Please send your feedback to rrsc_w@nrsc.gov.in or ssrao@nrsc.gov.in