Locust Surveillance Using Geospatial Technology

No. 2021/20
Period: 01-31 March.

Image courtesy: https://www.agriorbit.com/

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rrsc_w@nrsc.gov.in or ssrao@nrsc.gov.in

Locust Surveillance Using Geospatial Technology Bulletin is issued 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.

Locust Update by Food and Agriculture Organisation, UN.

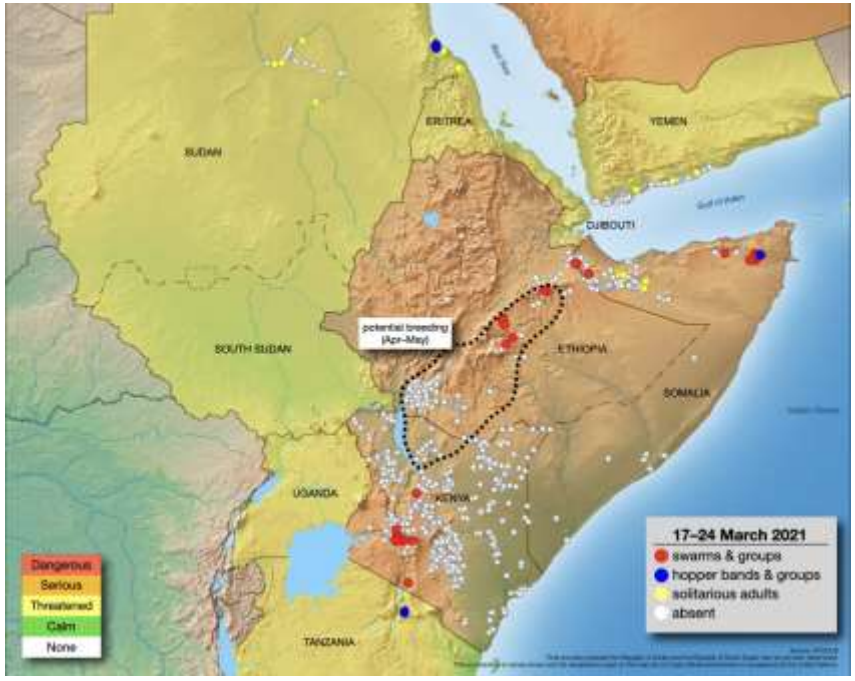
Status

Swarms continue to decline in Horn of Africa

As a result of poor rains in Kenya and Ethiopia, the swarms currently present in both countries are remaining immature and continue to decline due to ongoing control operations. Without rainfall, the swarms will not mature and breed, thus severely limiting the scale and extent of any breeding this spring. The current situation is likely to continue for the remainder of this month as no significant rains are predicted to fall in northern Kenya, Ethiopia or Somalia.

Forecast

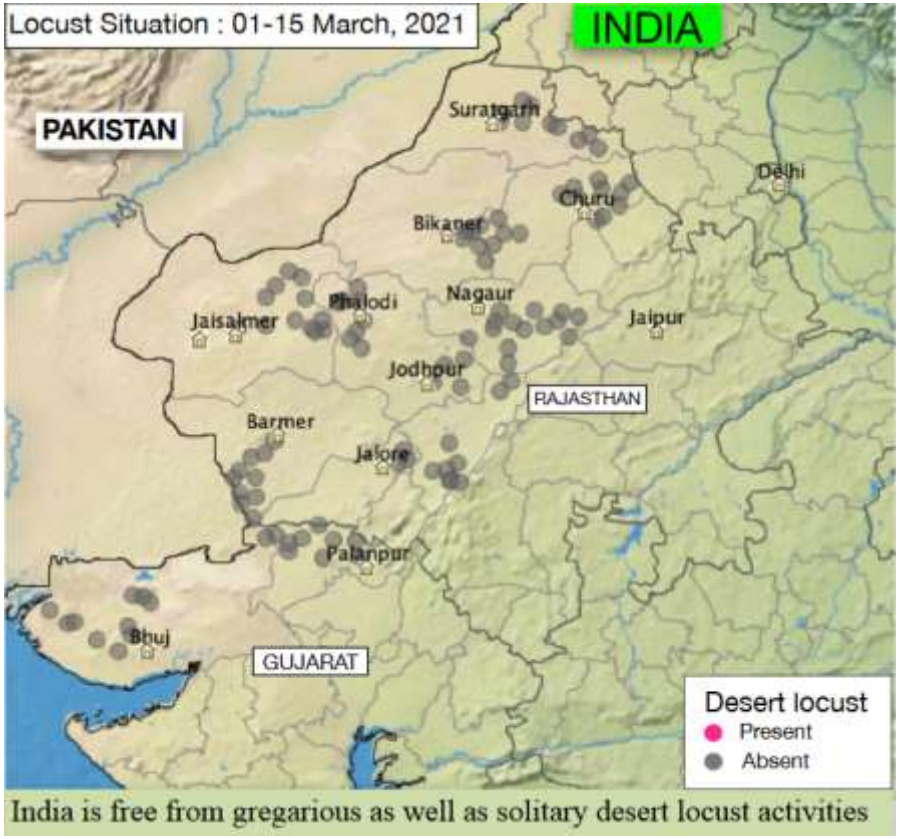
There is cautious optimism that the current upsurge is winding down in the Horn of Africa, especially if poor rains limit breeding this spring in northern Kenya and southern Ethiopia, followed by equally poor rains during the summer in northeast Ethiopia.



Source: Desert Locust Global Situation update as on 25th March 2021 by Food and Agriculture Organisation, UN.

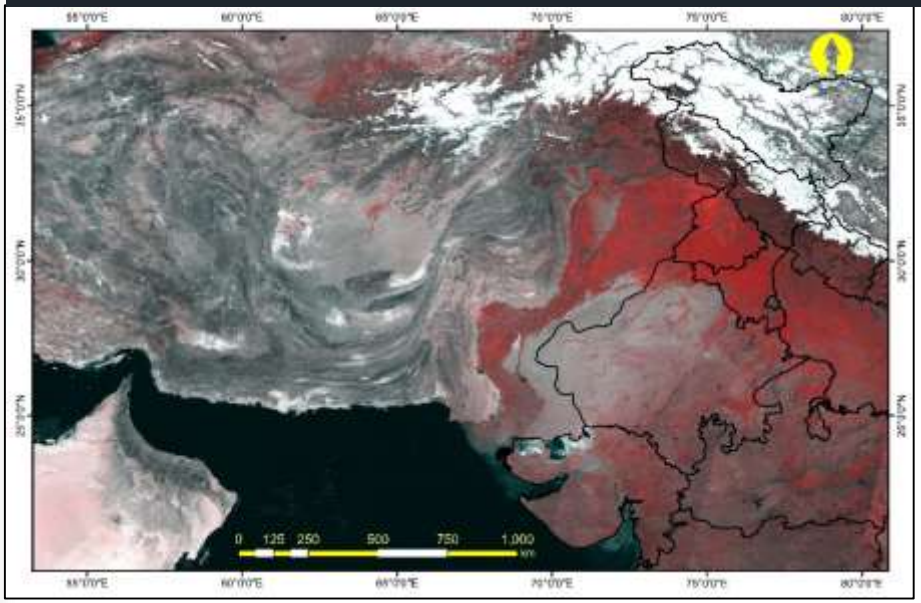
Locust Update by Locust Warning Organisation, India.

During the routine survey, it has been observed that India is free from gregarious as well as solitary desert locust activities during the 1st fortnight of March, 2021. A total 111 nos. of spots were observed towards this.

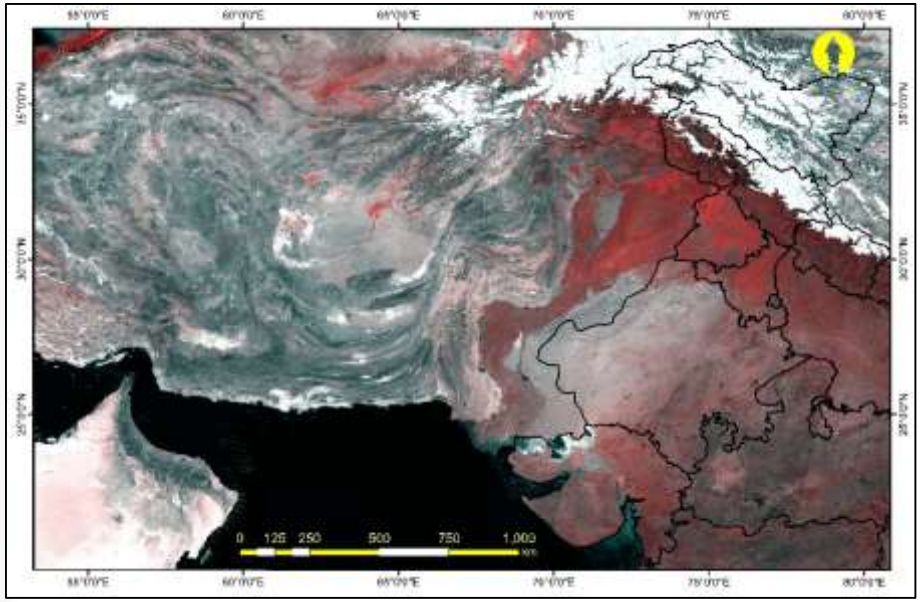


Source: Desterrt Locust Situation Bulletin, 2021/05 Locust Warning Organisation, India

False Colour Composite (FCC)



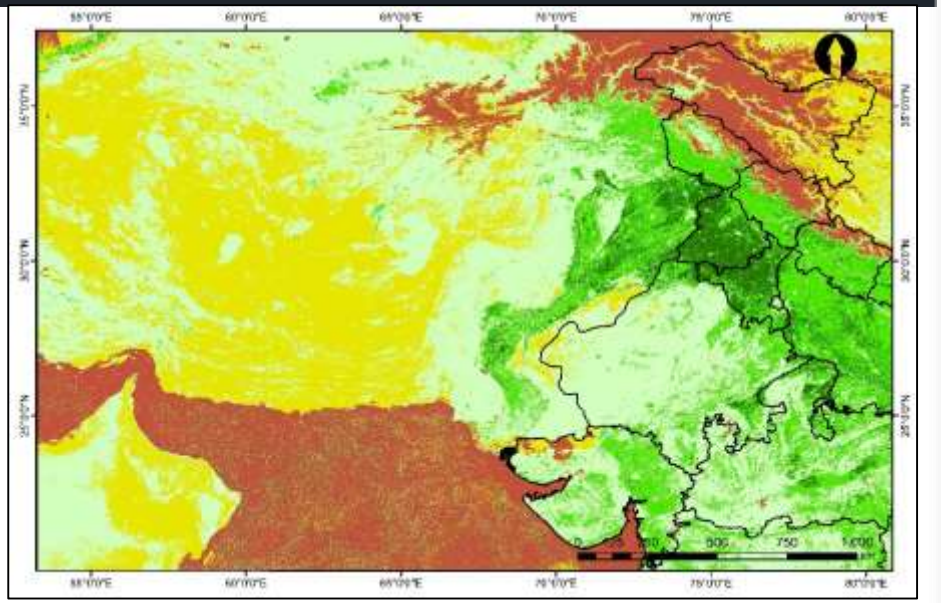
6th Mar – 14th Mar, 2021



22th Mar – 30th Mar, 2021

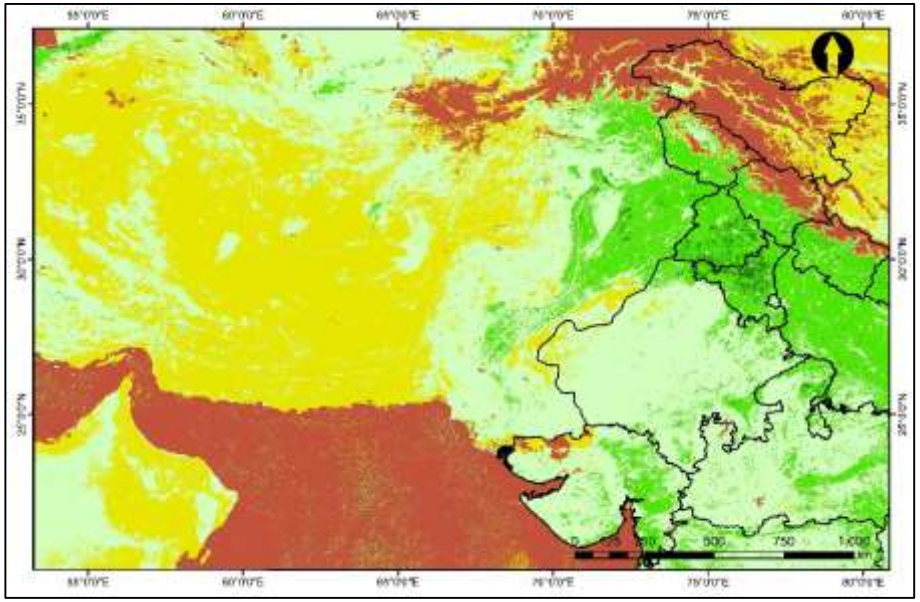
Source: MODIS 8 day Composite

Normalized Difference Vegetation Index (NDVI)



1st Mar – 10th Mar, 2021

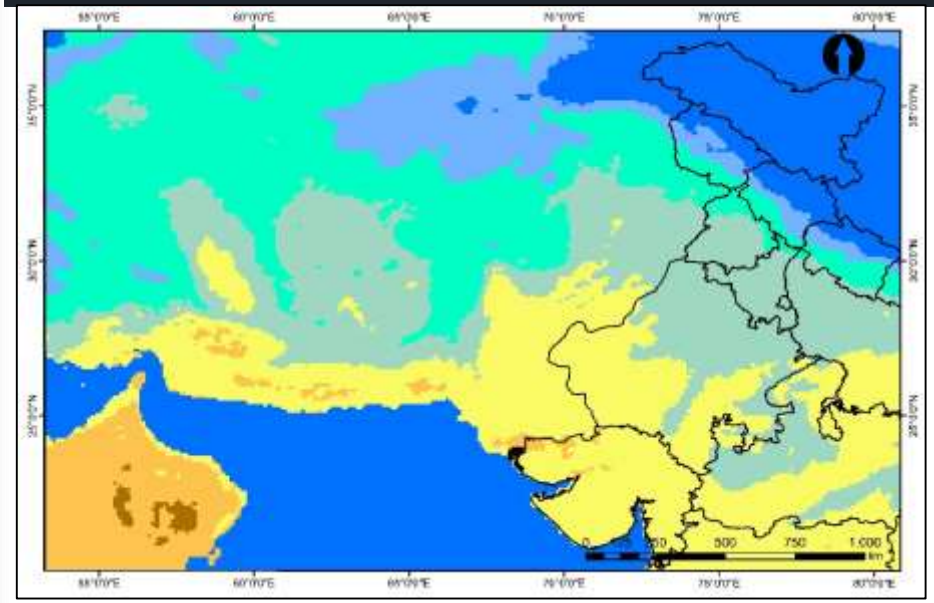
< 0.0 | 0.0 - 0.1 | 0.1 - 0.4 | 0.4 - 0.7 | 0.7 - 1.0



11th Mar – 20th Mar, 2021

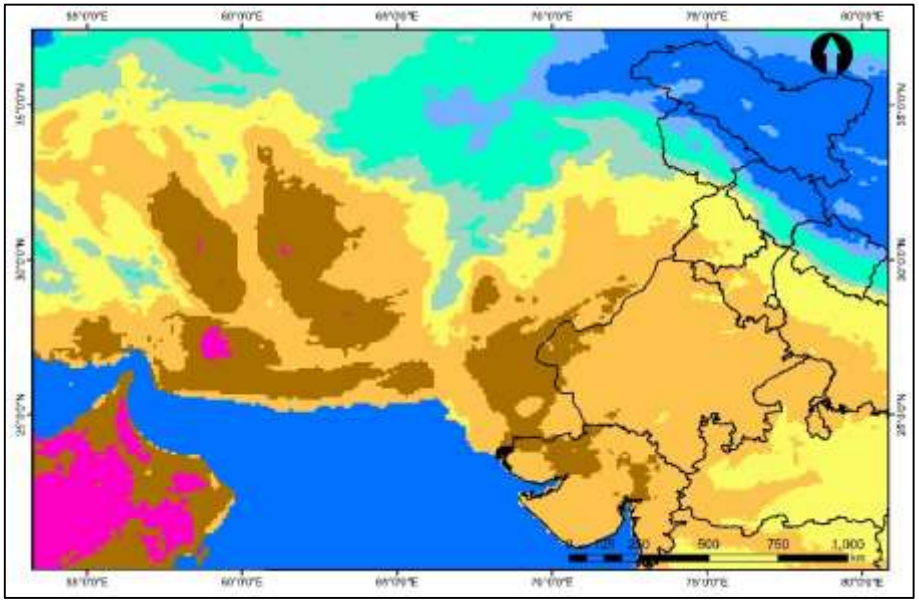
Source: eMODIS Ver. 6

Land Surface Temperature (^{0}C)



19:00 Hrs. IST of 1st Mar - 2021

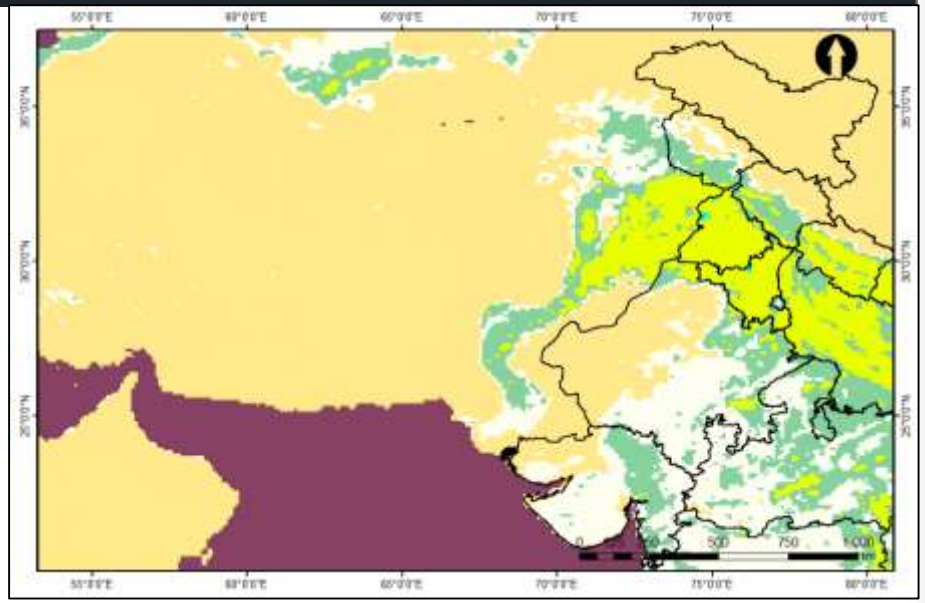
< 0 | 0 - 10 | 10 - 20 | 20 - 25 | 25 - 30 | 30 - 35 | 35 - 40 | 40 - 45



Source: SMAP Enhanced L4 Global 3 Hourly 9 km Product

19:00 Hrs. IST of 27th Mar 2021.

Leaf Area Index (LAI)



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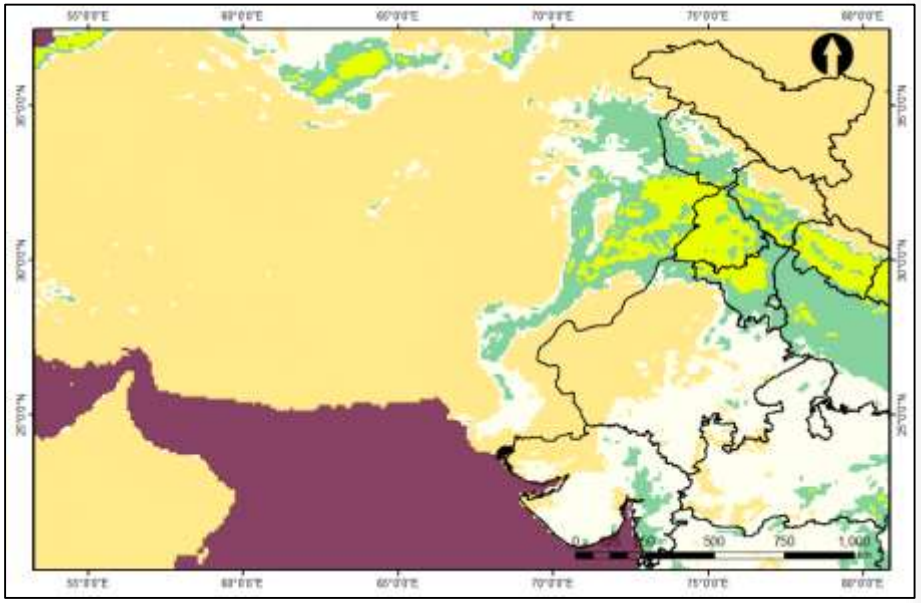
< 0 | 0 - 0.25 | 0.25 - 0.50 | 0.50 - 1.00 | 1.00 - 3.00 | 3.00 - 5.00



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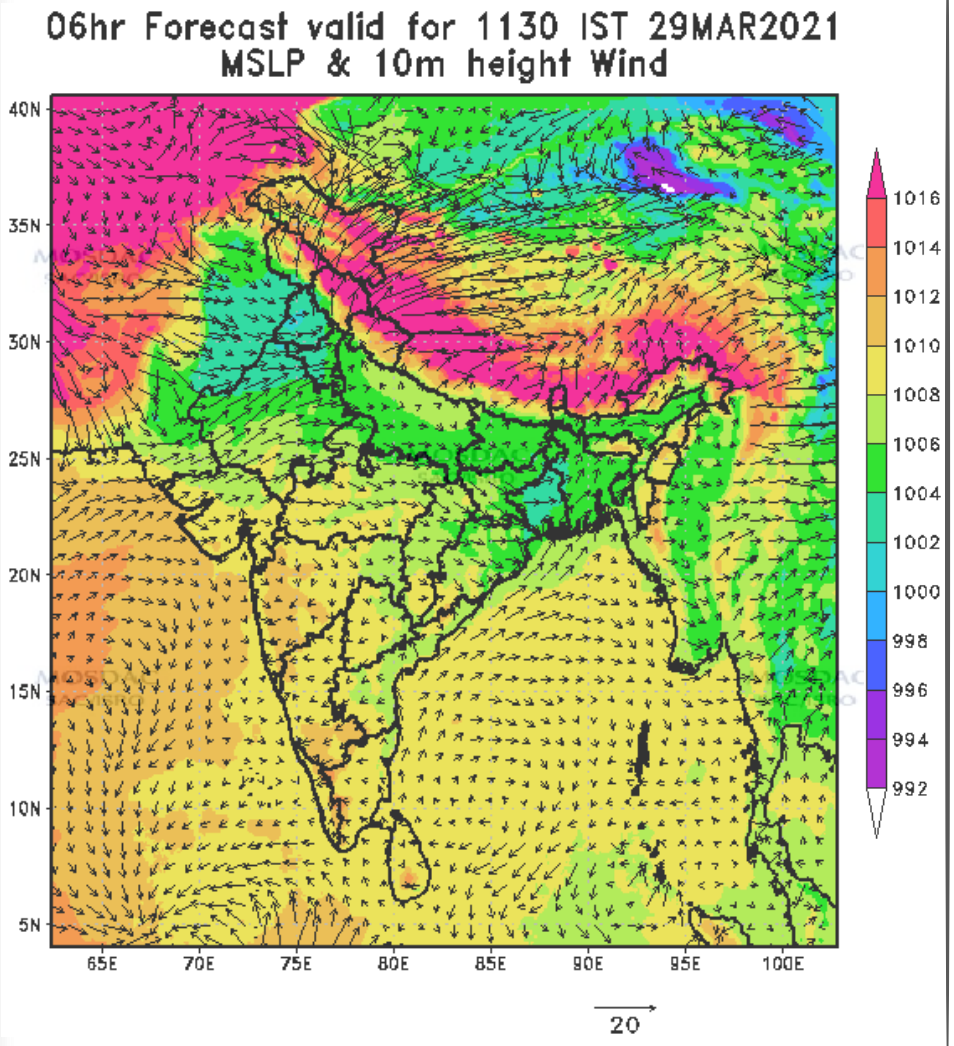
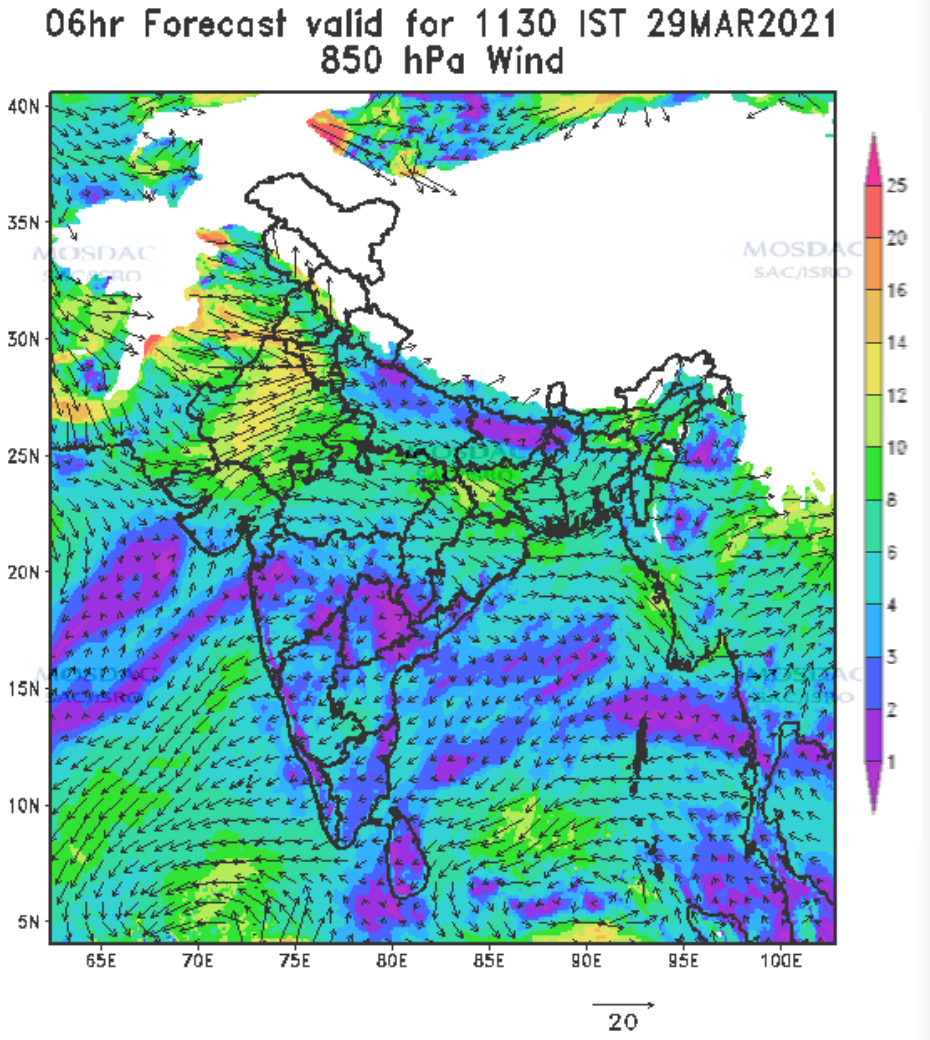
Wind Vectors

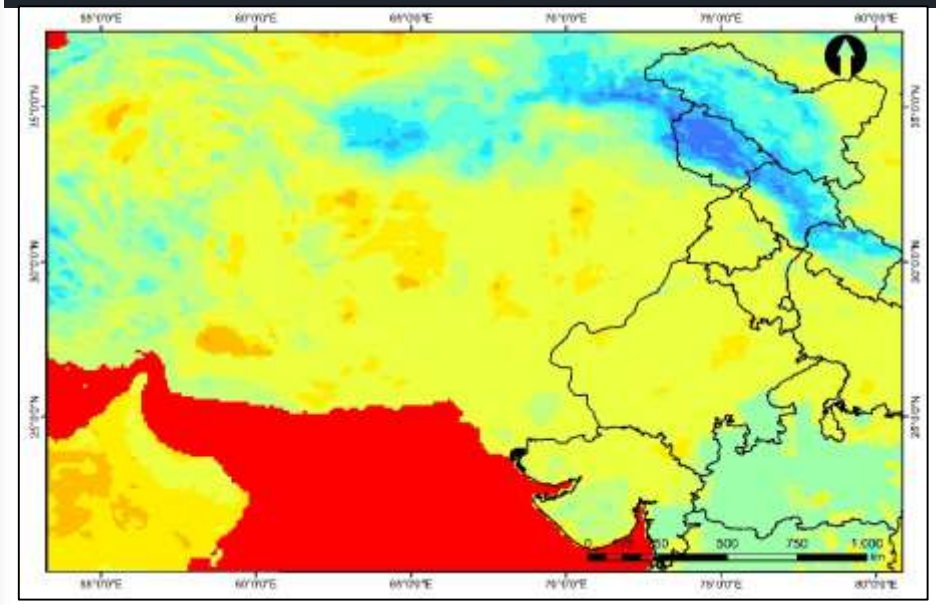




Source: MOSDAC web portal

Wind speed @ 1.46 km from msl.

Surface Soil Moisture Map (%)



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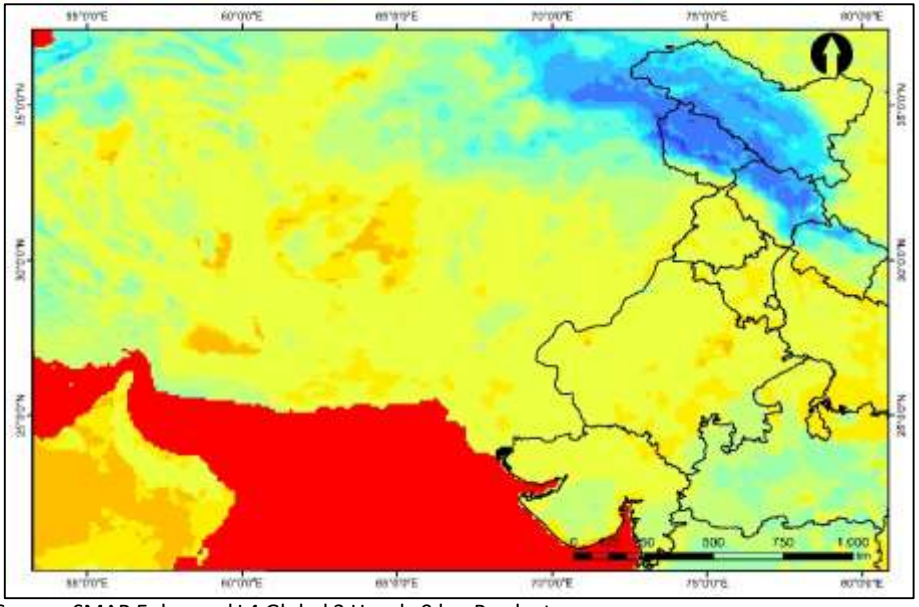

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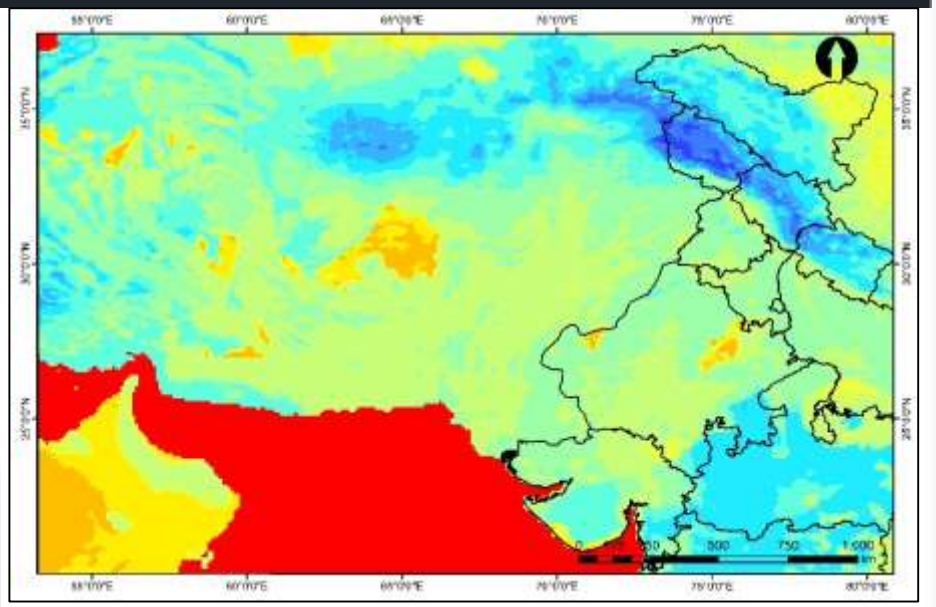
Root-Zone Soil Moisture Map (%)



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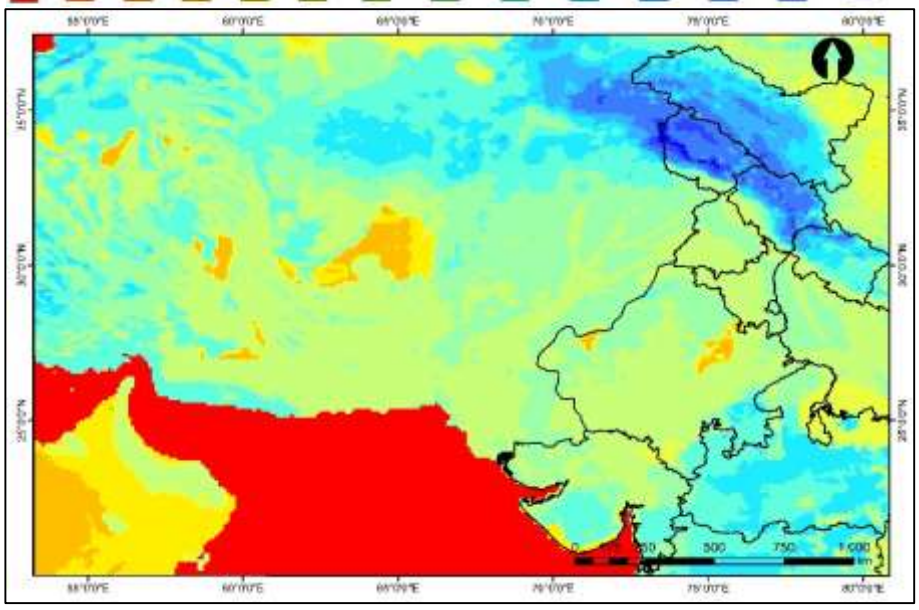

19:00 Hrs. IST of 27th Mar 2021.

Source: SMAP Enhanced L4 Global 3 Hourly 9 km Product

Recent Applications of Artificial Intelligence for Locust Studies – A Review

Artificial Intelligence (AI) techniques have matures to a level that now a days they are widely used to solve a variety of problems and to optimize the production and operation processes in the fields of agriculture, food and entomological studies. Applications of remote sensing in the studies of locusts have relied on precipitation and vegetation index derived from satellite data. Machine learning models fed with meteorological data such as wind speed and direction, temperature and humidity has been able to predict with high accuracy the future locations of locust swarms. Scholars are now feeding the model with data on soil moisture and vegetation cover, trying to predict where the insects have laid their eggs and how likely they are to hatch and survive, in order to concentrate spraying efforts in those areas (Dans, 2021).

Gómez et al. (2018) have studies the influence of soil moisture on wingless juveniles and used two machine learning algorithms (generalized linear models and random forest) to evaluate the link between hopper presence and soil moisture conditions under different time scenarios. There study concluded that random forest technique yields best model performance with very good validation results according to the true skill statistic and receiver operating characteristic curve statistics. From their study, it was found that an area becomes suitable for breeding when the soil moisture values are over 0.07 m3 / m3 during 6 days or more. The results from their studies demonstrate the possibility to identify breeding areas.

Kumar and Rahman (2021) have used deep learning techniques for early detection of locust swarms. Their model makes use of convolutional neural networks that detects the presence of Locusts in the given setting and outputs a count of the insect present in the area. The outputs obtained in their study shows that the deep learning implementation is accurate up to 83%

Image courtesy: https://www.selinawamucii.com

Kuzi—the Swahili name for the wattled starling, a bird renowned for eating locusts - is an AI-powered tool that generates a real-time heatmap of locusts across Africa, shows all potential migration routes, and gives a real-time locust breeding index (Kuzi, 2021). Using satellite data, soil sensor data, ground meteorological observation, and machine learning, Kuzi can predict the breeding, occurrence, and migration routes of desert locusts across the horn of African and Eastern African countries, and uses deep learning to identify the formation of locust swarms. Kuzi then sends farmers and pastoralists free SMS alerts 2-3 months in advance of when locusts are highly likely to attack farms and livestock in their areas.

Artificial Intelligence is having an ample scope to provide realistic solutions for tackling the locust menace and food security issues.

References

Gómez, D., Salvador, P., Sanz, J., Casanova, C., Taratiel, D., & Casanova, J. L. (2018). Machine learning approach to locate desert locust breeding areas based on ESA CCI soil moisture. Journal of Applied Remote Sensing, 12(3), 036011.

Kumar, K. S., & Rahman, A. A. (2021). Early Detection of Locust Swarms Using Deep Learning. In Advances in Machine Learning and Computational Intelligence (pp. 303-310). Springer, Singapore.

Kuzi. (2021) . Using AI to avoid the next Locust Plague. Available at https://www.selinawamucii.com/kuzi/

Dans, E. (2021). How machine learning can stop locust plagues. Available at https://medium.com/enrique-dans/how-machine-learning-can-stop-locust-plagues-ce5346ce9b12