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Remote Sensing: A Revolutionary Approach in IPM

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Introduction-

The push for increasing productivity and the increased pressures imposed by plant pests have an impact on modern agriculture. GIS Information and RS are now being employed in Precision Agriculture applications for variable rate application of pesticides, herbicides and fertilisers, but the comparatively less-used techniques of Remote Sensing and Spatial Analyses can provide value to integrated pest control approaches. The technologies are useful in the context of integrated pest management because they allow for a thorough understanding of the spatial complexity of a field's abiotic and biotic properties (through remote mapping or spatial modelling). This article discusses some of the advancements in remote sensing and GIS as they relate to integrated agricultural plant pest management, as well as some of the obstacles that farmers face in implementing them.

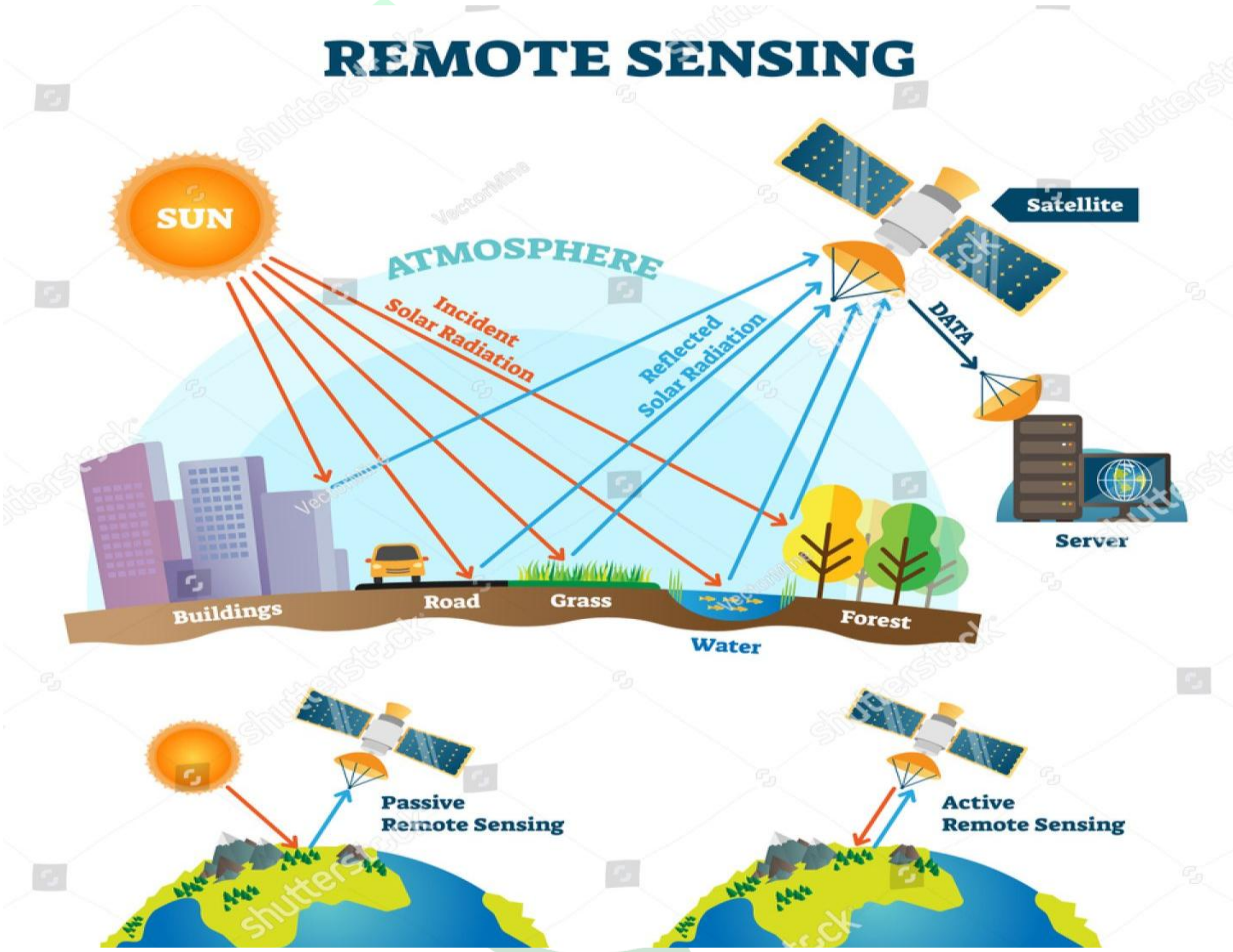
Remote Sensing

The acquisition of knowledge or information about items from a distance without coming into close contact with them is known as remote sensing. In 1921, remote sensing was first used to assess pest damage in forestry. From the perspective of remote sensing, the EM spectrum infrared and visible bands are important. The infrared (IR) region's wavelength ranges from 3 µm to 3mm. Far IR, mid IR and near IR are the three types of IR (0.72-1.3 µm). The visible region's wavelength ranges from 0.4 to 0.7 µm. The emissive or thermal section of the EM spectrum is known as far IR because these rays heat the thing first, and then the object emits the rays. Mid-IR, near-IR, and visible portions of the spectrum, on the other hand, are collectively referred to as the reflecting portion of the spectrum since they are simply reflected by them. Three components form a remote sensing system: the signal, sensor and sensing. The signal is the reflected radiation from an object's surface. A sensor such as the human eye, a camera or any other instrument, detects the signal.

Types of Remote Sensing:-

1.Active Remote Sensing System- An active remote sensing system includes a sensor as well as a light source that shines on the object being detected. In other words, it also contains the signal source, such as a camera with flash. It can detect the object using natural radiation in the sunlight but it must create radiation to irradiate the target in the dark.

2.Passive Remote Sensing- A sensor is the only component of passive remote sensing system. It doesn't emit radiations that would irradiate the thing being sensed. These can only see items when they are exposed to sunlight or electricity, but they do not emit radiation.



Remote Sensing Techniques used in Entomology: In the past few decades, remote sensing technology has advanced on two fronts:

1. **Aerial Photography:** Crop loss information has been collected in large part through the use of photography. Pest damage has also been photographed using panchromatic, colour infrared and black and white infrared films. The activity of insects is identified in aerial photography by the changes in the look of plant leaf. If insects leave deposits on leaves or cause changes in leaf colour, shape or density as a direct or indirect result

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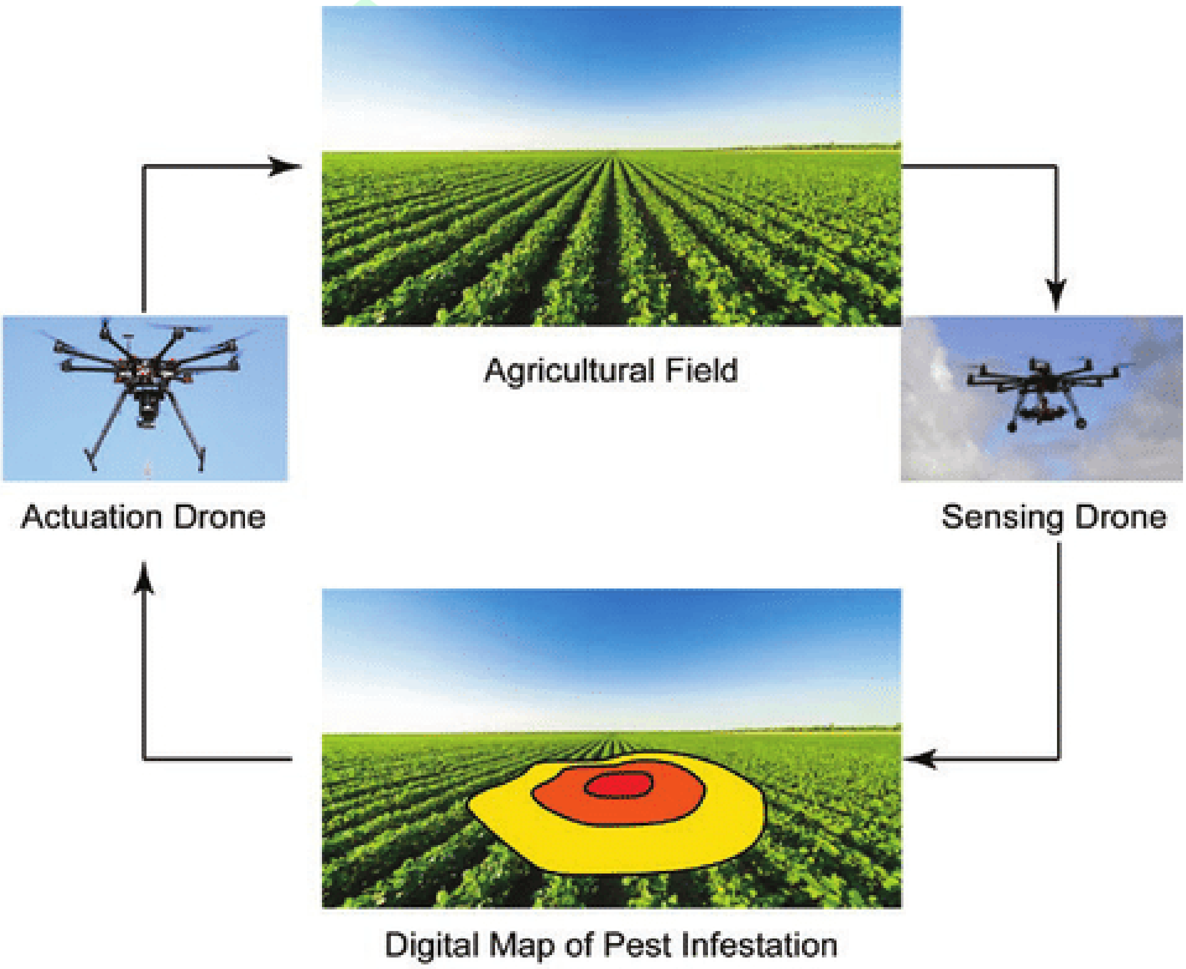
of feeding, the foliage may be altered. In pictures, various type of damage can be spotted. Spruce budworm and other defoliators produce leaf thinning and discoloration from green to yellow and yellow to red. Aerial pictures can clearly demonstrate this. In the same manner, sucking insects damage trees, twigs and branches which can be seen in images. Some insects, such as aphids create honeydew on which the sooty mold fungus feeds. Aerial photography may easily spot the blackening of the foliage caused by this fungus.



Aerial photography was used to investigate distribution of host plants of tropical fruit flies. Aerial photography is routinely used to monitor the post harvest plant removal of cotton to prevent the outbreak of boll weevil, *Anthonomus grandis* in Texas.

2. Satellite based multispectral scanning: These gather data in the visible and infrared ranges of the electromagnetic spectrum. Non-photographic techniques are another term for them. Images can be formed over a far larger range of EM wavelengths (0.4-14 µm) than the photographic method. These do not produce a detailed overview of a scene in timely manner. These scanners on the other hand, use sensors with a very small field of view to scan an area in a systematic manner building up an image as the scan proceeds. IRS-1A and IRS-IB, the Indian Remote Sensing Satellite System, give images in the following bands: i) 0.45-0.52 µm ii) 0.52-0.59 µm iii) 0.62-0.68 µm iv) 0.78-0.86 µm. Satellite remote sensing is a great way to look into the environmental components that affect pest development, like rainfall and air temperature. Winds coupled with rainstorms bring armyworm flying moths, *Spodoptera exempta*, together. As a result, caterpillar epidemics become widespread. Data from Meteosat has been used to track these storms and swiftly pinpoint future outbreaks. Landsat data was used to identify locations with short-lived vegetation that could host the desert locust *Schistocerca gregaria*.

Application of Remote Sensing in pest management-

Remote sensing can be considered as a fast, non-destructive and relatively cost-effective method to study biophysical and biochemical parameters of vegetation across vast spatial areas (Ngie *et al*., 2014). Remote sensing (including aerial photography) can supply baseline information for land-use and other forms of spatial planning in areas where maps are not available and it is used as an input for the modeling of alternative land use options (i.e. agriculture or biological conservation) (Leeuw *et al*., 2010). The application of remote sensing in pest monitoring, detection, early warning and management aspects in the field of agriculture are summarized as follows:

1. **Survey of ecological conditions and forecasting locusts-** The desert locust is found in Rajasthan, Gujarat and Haryana all of which are located in the world recession zone. Because of the favourable soil moisture, widespread rainfall, shade and lush vegetation in the recession area, locust breeding is successful resulting in destructive swarms. Controlling locusts is a challenging task if action is not taken immediately. Satellite remote sensing provides vegetation index maps and rainfall estimates allowing researchers to keep a close eye on the population of desert locusts. The population of desert locusts and rainfall have been discovered to be closely related to the temporal (time related) and spatial (space related) distribution of desert vegetation. For the past four decades, the utilisation of satellite remote sensing technologies has created many hopes for locust surveillance. The combined use of remote sensing data and RAMSES

locust data over a 43-year period (1965-2008) proven to be significant. These locust data aided in the prioritisation of different areas based on their relevance to locust ecology. They allowed researchers to concentrate their efforts just on regions of high importance for this species prevention.

2. **Assessment of crop infested with insect pests**- Several remote sensing approaches have been developed to employ visible and infrared pictures to detect stress in rice production induced by BPH infestation. The use of remote sensing to detect insect infestations will spread, allowing precision farming to be practised. ENVI 4.8 and SPSS software were utilised to conduct analyses utilising the Normalized Difference Vegetation Index (NDVI), Standard Difference Indices (SDI) and Ratio Vegetation Index (RVI). The threshold for zoning outbreaks might be clarified by using these indices as an indicator.
3. **Whitefly monitoring and management**-Cotton whitefly (*Bemisia tabaci)* has caused havoc on the cotton crop in numerous parts of India. Both adults and nymphs suck sap from plants causing leaf yellowing and shedding, as well as a decrease in boll production. The fungus sooty mould grows on the insect's honeydew as a result photosynthesis and lint quality suffer. Remote sensing was used to detect a whitefly-infested cotton crop. The cotton crop was assessed using Landsat fake colour composites. Whitefly-affected areas with moderate (50 % crop loss) and severe (80 % crop loss) crop loss were easily detected.

Conclusion-

In remote and inaccessible places, remote sensing has been utilized to provide vital information on crop status and the detection of insect population development. Its goal is to fill in gaps in existing systems by ensuring a consistent flow of information regarding areas afflicted by insect pests, diseases and other yield-reducing factors across the country. Based on research findings on some crop pests and diseases, GIS and Remote Sensing can be used in agriculture insect pest management decisions, timely planning and getting different information in many specific areas. Insect pest forecasting in the agro-ecosystem allows farmers to be informed about potential outages, allowing them to be prepared and take appropriate action to use biocontrol agents, mechanical means and pesticides, lowering production costs and serving as a tool in precision farming. As a result, recent breakthroughs in the field of remote sensing open up a lot of possibilities for using this technology in agriculture for pest monitoring, detection and prompt, precise management.

References-

Acharya, M., & Thapa, R. (2015). Remote sensing and its application in agricultural pest management. *Journal of Agriculture and Environment*, **16**, 43–61.

De Leeuw, J., Georgiadou, Y., Kerle, N., De Gier, A., Inoue, Y., Ferwerda, J., & Narantuya, D. (2010). The function of remote sensing in support of environmental policy. *Remote sensing*, **2**(7), 1731-1750.

Levin, N. (1999). Fundamentals of remote sensing; 1st hydrographic data management course. IMO-*International Maritime Academy, Trieste, Italy*.

Ngie, A., Ahmed, F., & Abutaleb, K. (2014). Remote sensing potential for investigation of maize production: review of literature. *South African Journal of Geomatics*, **3**(2), 163-184.