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A REVIEW -APPLICATIONS OF REMOTE SENSING IN THE AGRICULTURE

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Abstract: The present paper summarizes the main remote sensing applications, with a focus on regional to global applications in Agriculture. With recent improvements in sensor technologies, data management, and data analytics, the agriculture community now has various Remote sensing options. In the assessment and management of agricultural activities, remote sensing, along with other modern approaches such as geographic information systems, plays a key role. These technologies can be utilized in agriculture for a variety of purposes, including vegetation cover monitoring, crop yield, and production forecasts, pest and disease infestation, land use and land cover, plant water demands evaluation, and water resource management. This task can now be completed in half the time, or even less time, with fewer resources and great precision.

Keywords: Remote sensing, Agriculture, Crop yield

Introduction: Agriculture is extremely important in India's economy. Agriculture supports more than half of rural households. Agriculture is a significant part of the Indian economy, accounting for around 17% of total GDP and employing more than 60% of the population. As Remote sensing is well suited for gathering information across broad areas with high revisit frequency, remote sensing can greatly help to give a timely and accurate picture of the agriculture sector. Remote sensing is the art and science of gathering information about real-world things or areas at a distance without having to come into direct physical contact with them. The purpose of this study is to review the most common remote sensing applications, with a focus on regional and worldwide applications. Remote sensing data can substantially assist in the monitoring of the earth's surface features by providing immediate, synoptic, cost-effective, and repeating information. (Justice et al., 2002). The use of remote sensing technologies to detect and characterize agricultural production based on biophysical properties of crops and/or soils has the potential to revolutionize the detection and characterization of agriculture output. (Liaghat and Balasundram, 2010). Remote sensing satellite data can be utilized for yield estimation (Doraiswamy et al., 2005; Bernerdes et al., 2012), crop phenological information (Sakamoto et al.,2005), stress detection (Gu et al.,2007), and disturbance detection (Gu et al.,2007). Remote sensing and GIS work well together to create Spatio-temporal fundamental informative layers that can be used in a variety of applications, such as flood plain mapping, hydrological modeling, surface energy flow, urban development, land-use change, crop growth monitoring, and stress detection. (Kingra et al.,2016)

Importance of Remote sensing and GIS: Remote sensing is the most used method for the collection of physical data to be integrated into a GIS. Without making direct contact with items on the ground, remote sensors collect data. They detect energy reflected from the earth and are usually mounted on satellites or aircraft to do so. GIS is the ideal tool for identifying prospective land for any crop since it brings all the data together on a single platform for study. Different vegetation indices, such as NDVI, FPAR, and TVI, are commonly used to track crop health, which is also proportional to production. Vegetation cover monitoring, crop yield and production projections, pest and disease infestation, land use and land cover, plant water demand evaluation, and water resource management are just a few of the applications for these technologies in agriculture.

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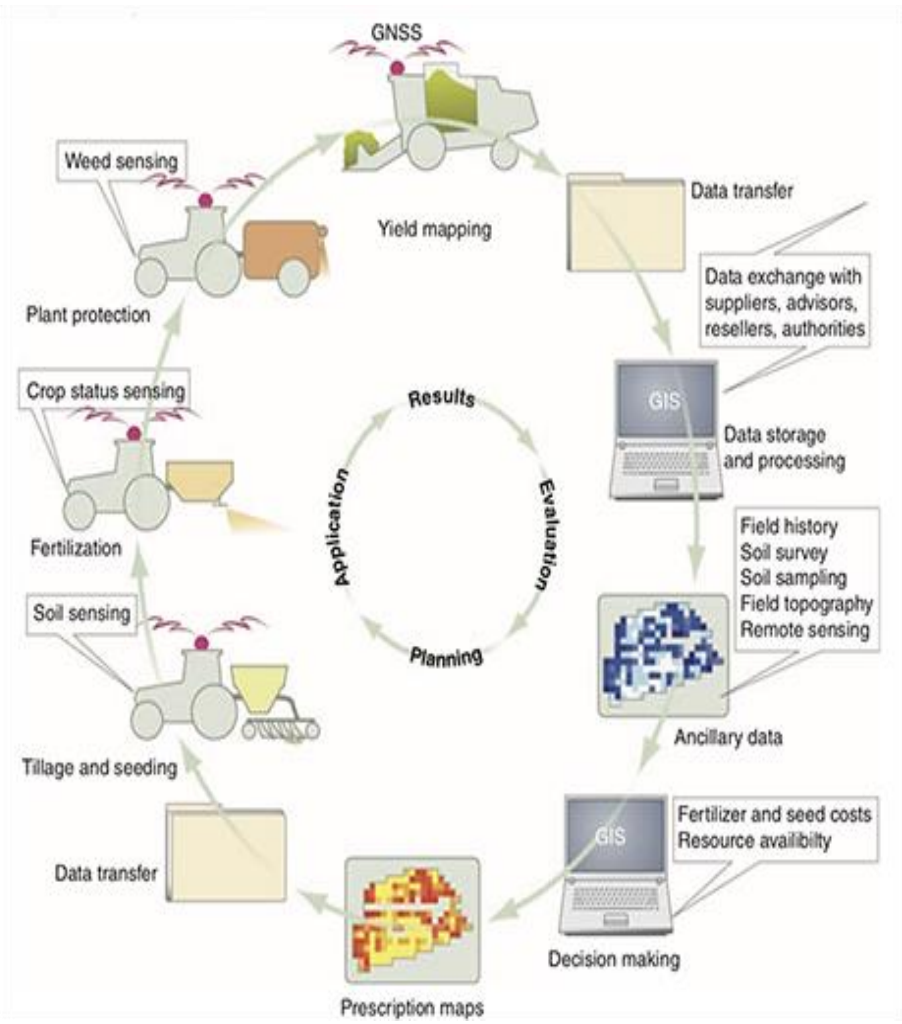

Land evaluation: One of the most popular and essential applications of remote sensing is soil mapping. Farmers can use soil mapping to determine which soil is best for specific crops, as well as which soils require irrigation, and which do not. Precision agriculture benefits from this Information. The ILWIS system (Meijerimk et al., 1988) was developed at the International Institute for Aerospace Survey and Earth sciences in the Netherlands as a GIS-based theoretical framework for land assessment. It has been used in various research. (Zuviria and Valenzuela 1994, Zhou 1995, Ramalho-Filho et al., 1997). New generations of remotely sensed data sets and geographic information system (GIS) models have made it possible to predict soil attributes and quality at various spatial scales. (De Paul Obade et al., 2013)

Crop yield and production forecasting: Crop yield is affected by several factors, including crop type, field water, and nutrition status, weed control, insects and disease infestation, and meteorological conditions. To organize harvest, storage, transportation, and marketing activities, government agencies, commodities traders, and producers need information on expected yields. The sooner this knowledge is available, the lower the economic risk, which leads to better efficiency and returns on investment. Crop yields have been forecasted using remote sensing, generally based on statistical empirical connections between yield and vegetation indices. (Thenkabail et al., 2002, Casa and Jones 2005). It may be possible to generate growth profiles and extract yield-related information at the area level utilizing IRS P3 WiFS (Wide-field sensor) and IRS-1C WiFS and LISS3, which have a decent periodicity. (Menon, 2012)

Pest and Disease infestation: Remote sensing technology can be used to identify pest-infected and unhealthy plants in an efficient and cost-effective manner. They used remote sensing techniques to identify individual insect pests and differentiate between insect and disease damage to oats. Liaghat,S., et al., 2010). They proposed that remote sensing may be used to detect canopy features and spectral reflectance variations between insect infestation and disease infection damage in oat crop canopies. Riedell et al., (2004). Change in spectral responses to chlorosis, yellowing of leaves, and foliage decrease over time have been linked using a remote sensing approach in assessing and monitoring insect defoliation, assuming that these differences can be connected, categorized, and interpreted. (Franklin,2001). Huang Y, et al., 2008 have stated Varying flying altitudes can provide different spatial resolutions when using airborne remote sensing and Ground-based platforms are commonly employed in pest management, crop disease detection, and weed infestation detection, and give useful data for management planning and decision making.

Land use and Land cover: Remote sensing and geographic information system (GIS) have been widely used in the preparation of Land use and Land cover information for a given area. In terms of cost, accuracy, and manual errors, it outperforms manual surveys over large areas. Human activity contributes to environmental issues such as deforestation and biodiversity loss, and global warming has a significant impact on Land use and Land cover. (Kidane, Y., et al., 2012). As a result, available data on Land use/Land cover can provide crucial input for environment management decision-making and future planning. Unplanned and unmanaged changes in Land use/ Land cover arise from rising populating and rising socioeconomic status. (M. Kumar, et al., 2006). Because of its synoptic and repeat coverage, remotely sensed data from satellite-based sensors has proven effective for large-area LULC characterization. Using multispectral, high-resolution Landsat TM data as a key input, significant progress has been achieved in categorizing LULC patterns. Vogelmann, J. Et al., 2001. The method of identifying variation associated with land use and land cover features in geo-registered multi-temporal remote sensing data is known as digital detection. Sun WC, Ishidaira H and Bastola S (2011). Land use/Land cover maps produced from satellite imagery were subjected to a pixel-by-pixel change detection comparison approach (Reis S, 2008)

Monitoring of Vegetation cover: Crop classification, cropland estimation, and yield evaluation are all aided by the science of remote sensing. Aerial pictures and digital image processing techniques were used in several research investigations. However, remote sensing assists in minimizing the amount of field data required and enhances the accuracy of estimates. (Kingra et al., 2016). In terms of crop health and productivity, some remote sensing approaches place a greater emphasis on physical factors of the crop system, such as nutrient stress and water availability. And other researchers are more interested in employing remote sensing indices to provide a synoptic view of regional agricultural conditions. The Normalized difference vegetation Indicator, introduced by Rouse et al., is the most widely used for assessing vegetation status (1974). The NDVI is the most often used vegetation index (Calvao and Palmeirim, 2004, Wallace et al., 2004)

Assessment of water demands of plants: Remote sensing data can help assess the changes within the field and apply water properly when utilizing variable rate irrigation equipment like the centre pivot system. Water stress produced by extreme wet and dry conditions can be alleviated by adopting variable rate application conditions to achieve uniformly high yields across the field while reducing water and nutrient losses. (McDowell et al.,2017; Evans et al.,2013). Many studies have demonstrated that accurate estimates of plant water content may also be acquired at the satellite level. Gao 1996 determined plant liquid water using the NDWI, which was calculated from a combination of two MODIS satellite sensor water absorption bands centred at 860nm and 1240nm. Satellite Images are very good for estimating vegetation water content over large agricultural regions and can help with appropriate water management by providing data on total evaporative water demand for crops.

Water Resources Management: Water shortage has become a worldwide and regional issue in the recent decade, and it must be managed prudently using cutting-edge technologies. One of the most effective technologies for measuring and monitoring water resources is remote sensing. Usali, N., & Ismail, M.H. (2010). The difficulties, importance, and long-term management of groundwater and freshwater are further described using geographic information system (GIS) and remote sensing (RS) technology. (M. Kumar, Kharagpur, & Burchart, 2006). With careful consideration of source materials and database creation, the combination of geographic information systems and remote sensing techniques has permitted analyses of aquatic vegetation growth, salt marsh quality, and floodplain disturbances throughout time. (Welch R, Remillard M,1991)

Conclusion: Remote sensing allows you to obtain information about any object or phenomenon without having to come into close contact with it. On a single click, decision-makers can see all the farmlands, together with their associated data and present state. Traditional methods of production estimation and crop damage assessment take a month or two to complete and required a large amount of manpower. With these technologies, the same task can be accomplished in half the time or even less time, with fewer resources and more precision. Data acquired at the satellite, aerial, and ground levels helps in the monitoring of weed infestation, pest damage, and plant infections, allowing for rapid response. The ability to make use of remote sensing data to assess plant fertilization needs to be based on crop and soil nutrient content helps to boost yields and improve the quality of produced seeds and fruits, which is vital for agricultural profitability. Governments can use remote sensing data to make key policy decisions or to address national agricultural challenges. With all these advantages, it's evident that remote sensing techniques can help with resources efficiency, remote sensing loss reduction, and long-term Sustainability.

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