USE OF REMOTE SENSING & GIS TECHNIQUES IN AGRICULTURE- A LITERATURE REVIEW

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ABSTRACT

In this paper, we discuss that remote sensing and GIS concepts can be important components in agriculture. By using such technologies, we can improve our agricultural old used practices and, we can bring in new changes towards our agricultural fields. By using GPS **(Global Positioning System)**, we can track data of our agriculture fields which includes the slope of the field, Nutrients of crops, yield assessment of our crop. We can also track geographical references i.e. latitude and longitude. GPS is very efficient, that continuously calculates and records the correct position. By this, it can create a large database for its users. GIS **(Geographic Information System)** is also required for further analysis, by which we can store and handle data that is collected by GPS. By reviewing all those papers, we highlighted here Remote sensing technology, GIS, and GPS that can provide us new ideas, which are much valuable for our agriculture fields.

Keywords: Agriculture, Remote Sensing, GIS, GPS

INTRODUCTION

Remote sensing is to collect data and information about an object or event without any physical contact with that object or event. Remote sending is a phenomenon that has many applications including geology, surveying, forestry, photography and many more. But in the field of agriculture, remote sensing has found significant use. There are many applications of remote sensing in the agricultural sector (Meraj *et al.,* 2021 a, b).

Examples: The nature of the object i.e. green trees has a reflection of sunlight from vegetation which will provide information on the reflection of coefficient of that object and its spectral variation. Below are some concepts where we can use GIS applications:

Forecasting of Crop production: By using remote sensing technology, we can predict the expected crop yield and production in agricultural land and we also can estimate

about the quantity of crops under specific situations.

Crop progress and crop damage Assessment: By using remote sensing technology, we can determine the penetration of land. A ratio of crop that has been damaged and progress of crops, left in farmlands.

Analysis of Cropping Systems and horticulture: By using remote sensing technology, we can study the planting system of various crops. These technologies can also be used for flower growth in the industry of horticulture. By which we can analyze the pattern of flower growth and predict with the help of various analyses.

Identification of Crop: By using remote sensing technology, we can identify crops. If our crops show some strange characteristics, then need to observe our crop. Further, the collected data has been taken to labs where on different aspects of crop and the culture of crop study.

Estimation of crop acreage: By using remote sensing technology, we can estimate agricultural land where we can plant our crop. It is usually a large procedure if we do it manually, due to the huge sizes of agricultural lands that need to be estimated.

Assessment of crop condition and stress detection: By using remote sensing technology, we can assess the crop health condition and assess the stress of crops. Further, these data can be used to calculate the quality of the crop.

Identification of harvesting and planting dates: By using remote sensing technology, now farmers can notice a wide variety of components which includes types of soil and weather patterns to forecast the harvesting and planting dates or seasons of each crop.

Estimation and modeling of crop yield: By using remote sensing technology, experts and farmers can predict the expected yield of the crop for agricultural land by analyzing the crop quality and the area of that land.

Identification of disease and pest's infection: By using remote sensing technology, we can identify the pests in agricultural land and provide data on correct mechanism to control pests. So that we can get rid of this disease and pests on the land.

Estimation of soil moisture: By using remote sensing technology, we can measure soil moisture. With the help of these technologies, we can get soil moisture data that will help us in determining the moisture quantity in soil and estimates about the crop type that can be sown in that soil.

Irrigation management and monitoring: As we know we can get soil

moisture information by using remote sensing technology. On the other sides, this extracted information can also be used in determining the deficiency in soil moisture and we also can plan if soil needs irrigation or not.

Mapping of Soil: By using remote sensing technology, we can map our soil as it plays an important role. With this technology, farmers can get to know what type of soils are good for which crop type and which soil needs irrigation and which one does not need to be. This provided information also helps us in precision agriculture (Pandey et al., 2010; Pandey et al., 2013; Singh and Pandey, 2014; Bhatt et al., 2017; Sharma and Kanga 2020).

Drought Monitoring: By using remote sensing technology, we can monitor the patterns of weather and drought patterns for a given agricultural land. Further this information can be used to predict the rainfall patterns for an area and told us the time difference between the current rainfall and next rainfall that helps us to keep drought record.

Mapping of land cover and land degradation: By using remote sensing technology, we can design the land cover for a particular area. With this data experts can predict which land area has been degraded and which area are still in good condition. It also helps them for measures curb land degradation during its implementation (Kanga et al., 2017a, b; Rather et al., 2018; Hassanin et al., 2020; Kanga et al., 2021).

Problematic soil identification: By using remote sensing technology, we can identify the soil problems, while sustaining in the planting season for optimum crop yield.

Detection of Crop nutrient deficiency: By using remote sensing technology, we can help experts and farmers to determine the proportions of deficiency of crop nutrients and provide treatments that helps to increase the level of nutrients in crops, so that we can increase crop yield.

Reflectance modeling: By using remote sensing technology, we can extract information about the reflectance of the crop, and it is the only technology that provides this information. This reflectance of crop is depending upon the amount of moisture present in soil and nutrients in the crop, that have a significant effect on crop yield (Farooq and Muslim, 2014; Nathawat et al., 2010; Kumar et al., 2018; Joy et al 2019).

Determination of water content of field crops: By using remote sensing technology, we can determine the moisture content of soil and estimation of content of water in crop

fields (Singh et al., 2017b; Kanga *et al.* 2020a, b).

Forecast of Crop yield: By using remote sensing technology, we can estimate accurately about the expected yield of the crop during planting season with the help of various crop information such as crop and soil moisture level, crop quality, and crop land cover. Further combining all this data, we can estimate accurately crop yield.

Flood monitoring and mapping: By using remote sensing technology, agricultural experts and farmers can map out the areas that are hit by floods and areas having poor drainage functions. With the help of this data, we can prevent any future flood disaster (Ranga et al., 2020 a, b; Meraj et al., 2020 a, b; Kanga et al., 2020a, b).

Collection of current and past weather data: By using remote sensing technology, we can collect and store, current and past data of weather that can be used for prediction and future decision making.

Crop intensification: By using remote sensing technology, we can collect important crop data such as crop rotation, crop pattern and crop diversity for a particular soil of land.

Mapping of water resources: By using remote sensing technology, we can it for mapping water resources for agricultural land. With the help of such technology farmers can get to know about the availability of water resources and the adequacy for farmlands.

Precision farming: Remote sensing technology also plays an important role in precision agriculture has been taken place the cultivation of healthy crops which guarantees by farmers to harvest crop after an ideal period.

Monitoring of Climate change: By using remote sensing technology, we can monitor climate change and keep a track record of climatic conditions. It also plays an important role in the finalizing of what crops can be grown where (Bera et al., 2021; Tomar et al., 2021; Joy et al., 2021; Chandel et al., 2021; Kanga et al., 2021).

Monitoring Compliance: By using remote sensing technology, farmers and agricultural experts can keep records of farming practices and ensure all compliance by all farmers. It will help all farmers to ensure the accurate process of planting and time of harvesting crops.

Soil management practices: By using remote sensing technology, we can manage soil practices and determination of soil by collecting data from agricultural lands.

Estimation of Air moisture: By using remote sensing technology, we can use to estimate of air moisture by which we can determine the humidity of specific area. With the help of humidity level, we can determine the crop type that can be grown in such areas.

Analysis of crop health: By using remote sensing technology, we can analyze the health of crop by which we can determine the crop yield.

Mapping of Land: By using remote sensing technology, we can map our agricultural land for different purposes like landscaping and crop growth. With this mapping technology can used for specific land soil purposes in precision agriculture.

GIS in Agriculture

Nowadays farming is more experienced than ever it was. Those farmers that know, do lots of analysis and planning. While doing strategic planning such information is required like soil characteristics, soil type, climate resources and water sources. In the case of precision farming, historic and soil fertility plays an important role. With the help of GIS in agriculture, lands could be more beneficial due to informed farmers can reduce waste and can achieve higher crop yields.

Burrough and McDonnell (1998) has defined GIS as a powerful set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world for a particular set of purposes.

The application of GIS is transforming management and planning in the agriculture field. Those technologies it has been a large scope to the connection of remote sensing-based investigation is 'Geographical information system (GIS)'. GIS provides different ways to cover many 'layers' of data: the actual physiognomy, human pressure indices and the ecological condition.

As we all know that agriculture has an important role in developed and undeveloped countries' economies. We can use GIS technologies to calculate and analyze crop inventory. It is reliable and accurate for estimating crop that help to reduce variability in grain industries. In the farming industry, the investigation and visualization of agricultural workflows and the environment with GIS tools has proved that they are beneficial. Behind its profitability and success, the basic is to balance it outputs and inputs of agricultural land. The commonly used spatial data is in the form of layers that may represent the elements of environment and topography. With the help of GIS, we can get data in many different forms those can be

images, maps, drawings, animations, and cartographic pictures.

GIS plays an important role from mobile GIS in the land to the scientific survey of production data at the farmland manager's office. It is also helping farmers worldwide to reduce the production cost, increase production and to manage their farms more systematically. As we know we cannot control natural inputs in our fields, but with these technologies we can understand them better and manages our farms well such as soil amendment analysis, soil erosion identification, soil erosion identification and crop yield assessment.

Yang et al. (2004) study about crop yield estimation in north china by using remotely sensed data with an ecosystem model. He used in his study to estimate crop yield of north China is remotely sensed data i.e. the MODIS LAI product with an ecosystem model i.e. the spatial EPIC model. The crop models are based on traditional productivity simulations are mostly site-specific. In that study, they first developed the spatial crop model by integrating the geographic information system (GIS) with the environmental policy integrated climate (EPIC) model to imitate the regional crop productivity. Wu Bingfng and Liu Chenglin, 2000 also worked on a crop growth monitor system with the help of AVHRR and VGT data model.

P. Shanmugapriya et al (2020), stated that in the field of agronomical research, remote sensing plays an important role in climate change, physico-chemical and variation in soil. The production of the agricultural crop will be monitored by a system that strongly follows weather patterns that are in relation with the biological life cycle of crops. All these above-mentioned factors are irregular in space and time dimensions. Because of unfavorable growing conditions, agricultural productivity can be changed within a small period. Monitoring of agricultural productivity should be followed timely. With the help of remote sensing tools, we can monitor and provide adequate images of agricultural land with high accuracy and revisit frequency. Based on spatiotemporal for sustainable management agriculture, all these factors are determining the agricultural lands to be analyzed.

GPS in agriculture

With the help of GPS (Global Positioning System), we can record variability in the field in form of geographically encoded data. we can continuously record and determine the correct position. Into this technology, we can get more details of our agricultural land as we got previously, so a bigger database is available for users. The correct yield data can only be recorded only on those points where recording is done with GPS position. Here the yield monitors and PS receivers are coupled to provide spatial coordinates for the data of yield monitor. It can be made for each field into yield maps. The collected information from different satellite and it can be referenced with the help of GPS cab be included to create field management strategies for cultivation, harvest, and chemical application. (Liaghat and Balasundram 2010). The implementation and development of site-specific farming is only possible by combining the Global Positioning System (GPS) and geographic information systems (GIS) tools. With those technologies, we can collect real-time data with correct position, which will further lead us to effective analysis and manipulation of large amounts of geospatial data. For precision farming GPS based application works well and very useful in farm planning as well, like tractor guidance, field mapping, crop scouting, soil sampling, yield mapping and variable rate applications. On other hand GPS also helps farmers to work in such typical weather conditions like fog, dust, rain, darkness, and low visibility.

CONCLUSION

After Going through all above technologies used for our agricultural lands, we came to know that by using them we can improve our land and crop assessment. We also can determine erosion controls, long-term cropping plans, assessment of tillage systems and salinity controls by using these map data. As the amount of data grows with time, more interpretation is required so also sometimes leads us to misinterpretation. Nowadays our farmers also adopting new technologies and work with agricultural professionals like GPS and computing sciences. Hence, we can say that GIS, GPS, and remote sensing can be a foundation of agriculture.

After all the above studied points we know that with the help of remotely sensed data, we can identify different plant-related issues like

as weed infestations, plant populations, wind damage, water deficiency or surplus, nutrient deficiencies, insect damage, herbicide damage, and hail damage. While in variable rate application of pesticides and fertilizers we can use collected information from remote sensing can be used as base maps. Farmers can easily treat their affected areas with the provided information from remotely sensed images. Those problems are faster captured by remote images before being identified visually. Ranchers use remote sensing to find areas of weed infestations, overgrazed areas, and prime grazing areas.

Hereby, all those points proved that remote sensing, GIS, and GPS play and beneficial as well and important role for our agricultural land and crops.

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