ISSN: 2581- 4613

Not for Sale | Only for Subscriber

ISSUF 1

MARCH 2022

GIS RESOURCES

GEOSPATIAL TECHNOLOGIES FOR CROP DAMAGE AND COMPENSATION



How GIS and Geospatial Tech Can Enhance the Agriculture Sector Farmoanut®: Making Crop Damage and Compensation Estimation Easier

EXCLUSIVE INTERVIEW!

Rajiv Kapoor Chairman and Managing Director, RMSI

Potential Use Cases of Geospatial Analysis for Crop Insurance

RIEGL WAVEFORM LIDAR FOR UAV-BASED SURVEYING



Table of Contents

Columns

05

Editor's Note

23

Interview: A Talk with Rajiv Kapoor, Chairman and Managing Director, RMSI

26

News Digest

30

Geo Events

Articles

Geospatial Tech Can

Agriculture Sector

06

How GIS and

Enhance the

10

Farmoanut®: Making Crop Damage and Compensation Estimation Easier

16

Potential Use Cases of Geospatial Analysis for Crop Insurance

20

Solar Induced Chlorophyll Fluorescence - A Better Predictor of Crop Stress Through Satellite Remote Sensing



Executives

Editor Ashok Prim Director (Retd), Survey of India India

Associate Editor

Dr. Venkata Ravibabu Mandla Ph.D IIT Roorkee, Australian Endeavour Awardee Associate Professor, CGARD, NIRD&PR, Hyderabad, India Email: mvravibabu.nird@gov.in

Advisory Board

Dr. Ch Ramesh Naidu Ph.D JNTU - Hyderabad Professor, Dept. of Civil Engineering, GVPCOE(A), Visakhapatnam, India Email: rameshnaidu@gvpce.ac.in

Dr. Rajitha K Ph.D IIT Kharagpur Assistant Professor, Dept. of Civil Engineering, BITS-Pilani, Hyderabad, India Email: rajitha@hyderabad.bits-pilani.ac.in

Dr. Gourkishore Tripathy Ph.D IIT Bombay Independent Consultant Email: gktripathy@gisresources.com

Dr. T. Ranga Vittal, Ph.D (Geology) Independent GIS Consultant Email: rangavittal@gmail.com

M. D. Cariappa Survey and Field Data Collection Expert (Including UAV and LiDAR Mapping) Alumni Course 500.73, IIS&M, Survey of India, Hyderabad, India Email: kcariappa@gmail.com

Venkat Kondepati, PMP, ITIL, Msc. Geography Independent Consultant Calgary, AB, Canada Email: vkondepati@gisresources.com

Regd. Office

GIS Resources B-24, Jawahar Vihar, Malik Mau Aima, Rae Bareli, Uttar Pradesh, India - 229010 Phone: +91 852 304 7671 Email: support@gisresources.com Website: www.gisresources.com

Advertising and Marketing Queries Email: support@gisresources.com

Disclaimer

GIS Resources is an initiative of Spatial Media and Services Enterprises with the purpose that everyone can enrich their knowledge and develop competitiveness. All views in this issue are those of the authors and don't necessarily subscribe to the views of the GIS Resources.













Editor's Note

By Ashok Prim

very time I read about crop damage, the tedious and longdrawn-out crop damage estimation and compensation process in the papers, it pains me to know that there are more efficient and near real-time Geospatial Technologies that can provide statistics and estimates that can provide relief to farmers.

Already burdened with the apprehension of crop damage due to pests, low yields, and getting adequate prices for their crops, farmers also have to contend with the vagaries of nature with weather events like a strong wind, heavy rain, or hail bringing further losses.

Geospatial Technologies can provide a solution to this recurring problem. The solution is simple and straightforward provided the digital framework is in place. The digital framework is that each parcel corner must have unique coordinates in a spatial reference frame.

Government of India programs such as NUIS, VIS, etc, and technologies like VRS mandate the creation of a strong digital control network to derive the digital coordinate of each parcel corner.

Current-day mobile technology comes embedded with GPS technology. This mobile technology can be used to take pictures of crop damage in which each picture will have the coordinates of the position at which the picture was taken. With GPS embedded in each mobile and with the help of the unique parcel coordinates, it is possible to instantaneously inform the authorities about crop damage within a parcel. The extent and amount of damage can be assessed using other Geospatial techniques in near real-time. Any confirmation can be done later using drone technologies which are much faster than ground-based techniques.

This method will enable the farmer to inform about crop damage and the probable extent of crop damage in near real-time. This information can be used to provide timely compensation through DBT to the farmer for crop damage so that he has enough funds to prepare for his next crop. It is time to harness Geospatial technologies to provide timely relief to our farmers.



How GIS and Geospatial Tech Can Enhance the Agriculture Sector

Radha Basu Founder and CEO iMerit Email: info@imerit.net scale to provide food for smaller groups. Eventually, as civilizations evolved, farmers began cultivating the land to provide food for larger communities. They faced several challenges to achieve higher yields and productivity. However, throughout, there were visionaries and technological revolutions that made fields more bountiful. From new irrigation processes to better crop management, farming became a steadily more scientific enterprise that benefited people across the globe.

housands of years ago, farming started on a small

Challenges in Traditional Farming

Soil quality, rainfall, temperature, humidity, quality of seeds, and many other elements play an important role in farming. Changing weather patterns and environmental impacts are drastically affecting these elements, making it difficult for farmers to predict and make decisions related to preparing the soil for sowing, predicting rainfall and other weather changes, identifying the right land and crops to grow, preparing for birds and animal migration to protect crops, and more.

Traditionally, farmers invested a lot of time, money, and effort to make the right decisions leading to a good yield. It also delayed farming processes and affected eventual outputs negatively.

Role of Artificial Intelligence (AI) and Technology Farmers and agricultural solutions providers are turning to modern technologies to achieve a healthier yield, monitor soil health, and track crop growth. This is not only helping farmers to reduce the workload but is also enhancing the quality of the produce. Today, the agriculture sector is applying AI to a wide range of farming tasks in the food supply chain.

- Real-time updates: Using image recognition technology based on deep learning, farmers can automate detection of plant diseases and pests. These methods classify, detect and segment images to build intelligent models to keep an eye on crop health, which was traditionally done by people. This can also be used to get real-time updates on crop wellbeing or to identify human or animal breaches affecting the crops.
- Pest and weed management: AI systems are capable of using satellite images and historical data to detect and predict possible attacks by insects and the type of insects like locusts, grasshoppers, etc. On detecting a possible pest infestation, these systems can alert the farmers through their smartphones so that the farmers can take the right decision at the right time. Similarly, AI can help in differentiating weeds from crops or identify diseased crops so that they can be cleared.

• Intelligent spraying: Smart sensors, powered by AI, on detecting weed or pest-affected areas, can automate spraying of herbicides and pesticides in the right quantity in the right places. These systems can be built in unmanned aerial vehicles installed with sprayers that can operate with high precision in terms of the area and amount to be sprayed. These can cover larger areas, which, done traditionally, can take a lot of time and manpower.

Monitoring weather and soil conditions: Change in climatic conditions and fluctuations in the quality of air can drastically impact crop health. It can also lead farmers to make wrong decisions, affecting yields. With the help of AI systems, farmers can analyze and predict weather conditions to plan the type of crop and time for the seeds to be sown. Likewise, these intelligent systems can analyze soil health and help farmers to determine the right fertilizer and amount of nutrients required to make the soil beneficial for the crop.

Artificial intelligence can help farmers to automate processes and empower them to cultivate for higher crop yield, quality and faster output while using fewer resources.

Geographic Information System (GIS) in Precision Agriculture

While farmers seek technology to analyze and measure the efficiency of their fields, they can increasingly benefit from a bird's eye view of all the farmlands to gather deeper insights. This geospatial data has the potential to advance farming and optimize resources. GIS-driven models enable farmers to evolve and develop more efficient techniques.

The use of remote sensors is not limited to large farmlands. Even small farms can adopt methods such as zone-based field management, which splits fields into smaller sections based on the type of crops, type of soil composition, and many other factors.

The precision agriculture concept does not consider a farm as a homogenous entity; it factors in critical variations in soil composition, nutrients in that soil, and even moisture levels and quality. All of that requires consistent measurement through the toolsets available to geospatial data analysts,



Figure 1: Marking fields based on the thermal properties of soil assists farmers in determining the most suitable crop location.

and the consequent use of all available means of acquiring that data (remote sensors, satellite imagery, drone, and other aerial imagery, GPS reckoning, etc.).

With GIS availability, factors such as pH rates, the presence of pest infestation, types of nutrients found in the soil (and consequent need for intervention with specific fertilizers), the crops – and their characteristics, including health and density – and even overlaying weather forecasts are consistently monitored and analyzed to make better decisions.

Importance of High-quality Data

GIS and other geospatial techniques for precision agriculture use data around historical land use and characteristics, often supplied by government agencies in the form of survey maps and records, as well as more current data such as infrared and photographic imagery picked from both public and private sources.

Precision agriculture thus relies on image-based data from remote sensing such as determining the greenery of the farmland using a technique to determine the productivity or yield of different zones. This technique is based on the relationship that arises from the comparison of the reflection of red light and near-infrared light.

Data acquisition also needs to account for seasonal and situational changes that add substantially to the requirements for data analysis. Over a period of time, the collected data can provide a precise picture of crop productivity at a granular level as well as growth and yield patterns over the years, all adjusted for seasonal fluctuations. This process is deeply reliant on both the quantity and quality of the data acquired from various sources. It enables analysts to accurately label and organize data to deliver accurate results. Whether the end consumer is a farmer or AI algorithm developers, both groups need accurate annotation of the data as well as the consistency crucial to pattern recognition.

Challenges in Annotating Crops

Annotating crops can be surprisingly challenging as technology-driven systems lack the human intelligence to sort the various varieties that might have similar features. For example, many variations of wheat, to a relatively an untrained eyes can look like weeds – or vice versa. Subsequently, training an algorithm to approximate the knowledge and experience of a farmer requires an extremely large amount of data, which can be overwhelming.

More data and diverse data points are always helpful to accelerate algorithms to learn more and aid in decisionmaking for farmers or scientists. It is clear to many in the sector that a multi-year development project to provide training data to an algorithm for field machinery could require semantic segmentation on hundreds of thousands of images before a farming operation would be able to move from development to live production technology. This is not a simple task.

How Experts Can Help

Understanding GIS and geospatial techniques and implementing them efficiently to enhance agriculture need human-in-the-loop practice to feed, train and monitor algorithms. A data annotation and analysis company such as iMerit will assemble a team of dedicated data analysts to take one or more of a series of annotation-related tasks such as annotating raw images, conducting quality checks (QC) on pre-annotated images, or even some secondary QCs.



Figure 2: Weed and Pest Management.

Combining annotation and verification as a client service can cut costs significantly, up to 50%, compared to other options.

Sentera, a global leader delivering time-sensitive agricultural insights, needed annotation support to scale their business for critical opportunities. Sentera's deep-learning platform FieldAgent helps farmers use drones to gather data and generate real-time insights around weather, soil and field operations to improve harvests, inform growth strategy and control pests. One of Sentera's customers was consulting with farmers who were planting 30,000 plants of corn per acre and wanted to use drones to monitor crop growth progress.

Sentera chose iMerit for their tool-agnostic approach, integration with AWS SageMaker Ground Truth and expert human-in-the-loop annotation. iMerit began the project by successfully annotating test batches around Sentera's edge cases. These results helped Sentera realize how they could leverage iMerit to improve the deep-learning outputs of FieldAgent. iMerit's feedback helped Sentera create unambiguous and actionable instructions for annotators across the image data to ensure every tassel is labeled. After iMerit annotated 1.2 million tassels with 95% accuracy, training datasets were created and fed into FieldAgent's algorithm to improve tassel detection.

The agriculture sector has become one of the biggest consumers of GIS and geospatial data across the globe. Data annotation specialists have thus stepped up to play a pivotal role in enriching GIS images and unearthing ground realities to help the sector reduce costs and enhance yields. Additionally, by employing technology, farmers and agriculture businesses can achieve more with less resources. GIS and geospatial intelligence is consequently capable of solving global food supply chain problems by supporting agriculture practices, especially in regions facing famine, droughts or other challenges.

About Author

Radha Basu, Founder and CEO, iMerit

Radha Basu is the Founder and CEO of iMerit, a global AI data solutions company delivering high-quality data that powers machine learning and artificial intelligence applications for Fortune 500 companies. She is a leading tech entrepreneur and a pioneer in the Indian software business. Under her leadership, iMerit has employed hundreds of skilled and marginalized women and youth in digital and data services worldwide. Additionally, iMerit employees contribute to growing industries ranging from virtual/augmented reality to the sharing economy to e-commerce and financial services.

Radha has received many honors including the Global Thinkers Forum Award, UN Women-ITU Gender-Equality Mainstreaming Technology Award, Silicon Valley Business Journal Women of Influence Award, Top 25 Women of the Web, and CEO of the Year.

Previously, Radha was the SupportSoft Chairwoman and CEO. She led the company through public offerings and built it into a worldwide market leader in support automation software. Prior to SupportSoft, she spent 20 years at Hewlett Packard, where she assisted HP's electronic software division business and founded the company's operations in India, and set up the first software center of any multinational in Bangalore.

Radha founded Santa Clara University's Frugal Innovation Hub and co-founded the Anudip Foundation - iMerit's sister foundation. She also serves on the boards of NetHope, Jhumki Basu Foundation, and the Miller Center for Social Entrepreneurship.

Radha Basu has a Master's in Computer Science and Biomedical Engineering from the University of Southern California and has done an Executive Management Program in Business Administration and Management, General from Stanford University Graduate School of Business.







Farmonaut[®] We Make Farming Better With Remote Sensing Data

Farmoanut®: Making Crop Damage and Compensation Estimation Easier

By Dipanker Gyan Partner at Farmonaut Farmonaut Email: dipanker@farmonaut.com

10 GIS RESOURCES / MARCH 2022

rop damage in agriculture happens due to multiple reasons like floods, drought, fire, hailstorm,
disease, water stress, frost, low and high

temperatures, etc. This loss is assessed in terms of losses in yields and/or loss of profits due to adverse market events. Geospatial technologies can help mitigate some of the effects of crop damage due to disease which is linked to pest infestation and water stress which can be solved by manual intervention. Timely identification of disease and water stress can help in decreasing the damage done to the crops. However, other forms of crop damage are due to factors that cannot be mitigated manually. Whenever an extreme weather event happens the first goal of geospatial technology is to estimate the extent of damage done to the crops.

Farmonaut's Satellite-Based Crop Health Monitoring System is built to put satellite technology in the hands of each and every farmer in the most economical way. Farmonaut's main objective is to break the cost barrier and help democratize remote sensing in the farming community by providing an on-the-go always ready platform for field monitoring through satellites. The system is accessible through our web, android as well as iOS apps.

Farmonaut enables farmers to monitor their fields remotely through satellites by providing them with a detailed analysis of crop health, vegetation water stress, and soil organic carbon content. Through our platforms (android, iOS, or web-app) farmers and business partners can select fields and identify the regions of the fields at which the crop growth is not normal. They can also use our API to provide satellite data to their user base. They also receive vegetation water stress, evapotranspiration, and soil organic carbon data on top of the weather forecast data from the nearest weather station. We provide uninterrupted satellite data even during cloudy weather through radar sensors. We are using geospatial technology to help farmers cut down on the investment onfarm inputs, and enable them to increase the yield.

There are various schemes like Pradhan Mantri Fasal Bima Yojna (PMFBY), Weather Based Crop Insurance Scheme (WBCIS), Pilot Unified Package Insurance Scheme (UPIS), and Coconut Palm Insurance Scheme (CPIS) that covers the losses to crops due to extreme weather events resulting in yield loss or loss due to lower profits on adverse market events. Crop yield loss is calculated in terms of revenue loss volume i.e tonnes/hectares. Crop profit loss is estimated due to a fall in the market prices of crops.

This scheme provides income stability and reduces the debts of farmers. Income stability provides financial stability for farmers, reduces farming distress, technology advancement, yield protection, provides awareness, mitigates climate change and global warming, and financial inclusion. Indian farmers' backs are broken due to unstable income and piling debts which lead to monocropping, reduces crop diversification, hesitancy for farm mechanization, use of new farming techniques, new seeds, nano fertilizer, and precision farming adoption. This will stop migration to bigger cities, avoid malnutrition, piling of debts, reduce dependency on government, mitigate climate change and global warming risks, and improve income. Here, a premium is payable to crop insurance companies like Agriculture Insurance Company (AIC) or private crop insurance companies. Here premium is paid by farmer and government collectively for each field insured.

Crop yield loss is estimated through various vegetation indices and SAR where various statistical models are constructed to arrive at the yields. Various indices like NDVI, EVI, SAVI, NDRE, VARI, SIPI, Leaf chlorophyll index, and any other advanced indices along with SAR. There are various models which are already available and various tools available in the market which has already integrated various statistical models or can be done through AI algorithm using R, Python, and SAS coding. There are already standard statistical techniques already available for each crop but it has to be adjusted for crop location, crop type, variety, and duration. This process can be done with the assistance of remote sensing, GIS, Statistical, and agronomy teams working together. Also, help from various market intelligence companies, government agencies data and research companies with historical data and prices data will help in reducing the time taken to access the yields, accuracy, and cost. Various experts in the market with experience in the industry along with the above team will help in accurate estimations. Also, with each passing year, the AI program will get smarter and will reduce the error or variation in yields.

Crop revenue loss is primarily due to bumper crops which leads to lower prices of crops in markets. This risk can be mitigated through the advanced estimate of the planted area after 50 days of planting of the crop and yield 4-6 weeks

Our Products and Services



Satellite Based Crop-Health Monitoring Crop Performance, Irrigation, Soil Health Insights every 3-5 days.



Large Scale Mapping & Traceability Tools To help map thousands of farms and collect farm data with ease.



Satellite + Weather Data API Access analysis ready satellite data available from 2017 onwards.





Farmers' Social Network To educate farming community about remote sensing tech



Large Scale Crop Area & Yield Estimate To estimate crop area & yield of various crops at district & state level.



Portable & Stationary IOT Devices To capture hyper local soil and weather parameters in real-time before harvest with the help of remote sensing, GIS, and Artificial Intelligence. This will lead to advanced estimates of crops and will lead the state agencies to access the losses expected after harvest. Geospatial technologies along with market intelligence regarding prices, crop balance sheet, and trade data will help in minimizing the loss of farmers by efficient market intervention by government agencies (FCI, NAFED, CCI, state procurement boards, fertilizer and pesticide companies, etc. and other boards like Tea Board, Spice Board, Rubber Board, Coffee Board, Coconut Development Board, ISMA, etc.

Moreover, these technologies provide intelligence to various companies and institutions to secure their raw material in advance. Many warehousing companies can estimate the requirement of facilities in event of a bumper crop. Governments can decide the stock limit for traders and agencies in advance. Millers and crushers can plan in advance the requirements of plant capacity and marketing strategies and pricing in advance. Fertilizer companies plan their production lines in advance. Seed companies can work on seeds much in advance. Thus, any revenue losses incurred by farmers due to a fall in prices of the crop or bumper harvest can be mitigated using geospatial technologies.

Yield loss occurs due to pest infestation, high or low temperature, precipitation, frost, wind, soil nutrients deficit, monocropping, over-irrigation, salinity, and leaching. All these are not visible to the naked eye immediately. Satellite data using Vegetation Indices (NDVI, EVI, SAVI, NDRE, VARI, SIPI, Leaf chlorophyll index, etc.), SAR, Water indices (NDWI, NDMI, and Evapotranspiration), etc. Remote sensing provides these data in advance much before the naked eye. However, there are some limitations in remote sensing in yield loss detection but the use of ground teams or providing advanced intelligence to individual farmers can reduce the

yield loss through timely intervention. However, if the loss occurs then the loss will be estimated in advanced as explained above. Water plays very important role in crop vields. Water stress can be accessed by NDWI, NDMI and Evapotranspiration. So, advanced information to farmers about water stress or evapotranspiration will help in timely irrigation, will help in reducing yield loss in advance. Similarly, pest infestation leads to bad health of crops which can be accessed in early and yield loss can be reduced by using pesticide or crop growth regulator, nano fertilizer etc.

Remote sensing provides advanced data on precipitation, temperature, wind, and frost in advance which helps in timely intervention by farmers, FPO's, seed companies, fertilizer and pesticide companies, central and state governments, machinery companies, banks, crop insurance companies, contract farming companies, etc. The best case is the prediction of monsoons by the Indian Meteorological Department (IMD). Advance cyclonic formation information, Indian Ocean Dipole, EL Nino and LA Nina, winter temperature, rainfall warning helps in reducing and planning for crop loss and crop storage loss.

Soil deficiency, organic content, leaching due to monocropping, overgrazing, and excessive use of fertilizers and pesticides leads to bad quality of the soil. Soil Organic Carbon (SOC) estimates the organic content is accessed through remote sensing which can be collated with soil testing in deficit areas will improve yields and help in the reduction of crop loss. Proper grazing techniques can be applied, crop rotation and optimal use of fertilizers and pesticides help in yield loss reduction.

Crop area can be estimated by using Synthetic Aperture Radar (SAR) data or other indices like NDVI, EVI, SAVI, and other vegetative indices where the model is trained with field data through field teams who through ground-truthing provide the GPS coordinates of the fields with a particular crop of a statistically significant number. This trained model is then applied to crops through classification algorithms through AI. The classification techniques can be based on statistical models using AI. So advanced estimation of the crop area will provide intelligence to various state and private agencies in advance and accurate data on crop area much in advance and much cheaper than government estimate. At present, the standard practice of crop area is through AGRICOOP weekly sowing area in which final estimates come until 2-4 weeks in advance.



Figure 1: Govt. of India's report on Agricultural situation in India recognized Farmonaut's work in the farming sector.

However, this is possible 6-10 weeks in advance depending upon crop location, crop type, crop duration, and crop variety. Thus, geospatial technologies can help to estimate the loss of revenue in advance and compensation can be provided early as compared to crop cutting which is very costly, cumbersome, has shortcomings, calculation mistakes that lead to either delay in loss estimate or improper compensation as farmers need money just after harvest to plan for the next crop.

This is done through loss estimation by inspection and crop cutting. However, this is an inefficient and costly exercise. In this exercise, the land is inspected by an insurance company to confirm whether the damage has occurred and once it is done the yield of the harvested field is recorded and compared to the crop yield done through crop cutting to ascertain the loss and fix compensation. These steps involve various manual factors which are subject to errors, are inefficient, costly, and time-consuming.

Geospatial technology has all the necessary ingredients to solve the above problems through advanced technology which is efficient, cheap, less time-consuming, and lower errors. The steps involved in crop damage estimation can be started by identifying the crops which have been damaged and fields that are reported to have incurred damage with geo-coordinates. The next step is to estimate the yield of the crops in the adjacent areas where the crop was not damaged to arrive at the yields and estimate the crop loss of the individual fields using various parameters of geospatial technology. Based on the above process compensation can be decided for individual farmers at a very cheap cost and minimal manual intervention and less susceptible to errors. However, this process needs the use of advanced technology which uses trained manpower in GIS and remote sensing, advanced software and platforms, and ground-truthing wherever needed to improve the predicted yield. In some cases, advanced statistical modeling is done to ascertain yields taking into consideration various other parameters. One important factor is that geospatial technology can be used to calculate yields much before the harvest and any compensation for farmers can be ascertained much before harvest. This can save farmers time and misery.

At Farmonaut we are doing yield and area calculation of various crops much before the crops are harvested. Our platform can be used to ascertain the harm to plants from disease and water stress much before it is visible to naked eyes and intervention can be done to mitigate the damage. We use various geospatial technology and statistical modeling to ascertain the crop yield area and yield. Our platform can identify crop stress, water stress much before it is visible through the naked eye. We can calculate the total area of crop damage and color code the areas in various baskets like very severe, severe, moderate, and low damage. Once it is done then the individual field's loss can be ascertained.

At present Agriculture Insurance Corporation (AIC) and various insurance companies are operating in India in the field of crop insurance through Pradhan Mantri Fasal Bima Yojna and most of them are using both manuals as well geospatial techniques to ascertain losses and compensation to individual farmers. However, geospatial technology is an



Figure 2: Satellite Data Analytics on Farmonaut Web App.

INDUSTRY

emerging technology and with time the cost will come down and accuracy will increase once technology advances and more and more database is built by the insurance companies reducing manual intervention and producing accurate results. This is still a work in progress and the best results will be available in the coming years. Only technology has the power to increase scale, accuracy, reduce inefficiency, reduce cost and provide insight in advance and solve modernday problems.

At Farmonaut we are committed to providing advanced technologies and platforms at lower cost, trained manpower to estimate crop damage, higher scale, advanced signaling and estimation of crop loss, crop loss risk mitigation to ascertain crop loss, etc. We will be implementing the best technologies and manpower in the future to solve the problems faced in event of crop loss and compensation estimation. We wish to work with various government agencies, insurance companies, various stakeholders, intermediaries, companies, and businesses to estimate crop losses and compensation estimation. Help companies in solving their problem of risk arising out of crop loss.



Figure 3: Farm Harvest from one of Farmonaut Natural Farmers.





Connected Cities and Services Summit

Digital reality for critical infrastructure and services

Join us at HxGN LIVE Global 2022, Hexagon's digital reality solutions conference that will bring visionaries from around the world to discuss, debate and experience the autonomous future across seven educational, industry-specific summits.

Discover how to better position your organization for the connected future at our Connected Cities and Services Summit.

hxgnlive.com/global

© Copyright 2022 Hexagon. Hexagon AB and/or its subsidiaries and affiliates. All rights reserved.



Potential Use Cases of Geospatial Analysis for Crop Insurance

By SatSure Bangalore, Karnataka, India Email: info@satsure.co Website: www.satsure.co

nderstanding Primary and Secondary Perils A report by Swiss Re states \$202 billion in global

economic losses from natural and man-made catastrophes in 2020, of which secondary perils drove around 70%. The general description of primary and secondary perils in the insurance industry is that primary perils are large-scale catastrophes like earthquakes and cyclones, while secondary perils can be natural catastrophes of low to medium magnitude, having higher frequency like hails, floods, droughts, wildfire, etc.

While the modeling capabilities for primary perils are well adopted and implemented in the industry, the capabilities for secondary perils have still not matured. With the frequency of secondary perils on the rise globally, geospatial analysis can play an important role to fill the data gap and providing alternate data insights access for the stakeholders to evaluate the risk due to a natural catastrophe and generate the much-needed granular damage estimations.

Geospatial Analysis for Crop Damage Estimation

The insurance sector has been one of the early adopters of geospatial analysis for insurance product designs and claims analysis. This is also reflected in the revised Pradhan Mantri Fasal Bima Yojana (PMFBY) guidelines, the insurance scheme deployed by the Government of India. Contained in the provision, the insurance company, and the concerned states can use satellite and UAV remote sensing for CCE planning, yield estimations, loss assessments, assessment of prevented sowing cases, and clustering of areas for risk. Additionally, the Government has mandated the use of technology like satellite-based remote sensing for crop monitoring and Crop Cutting Experiments (CCEs) coordination with the concerned states.

It is well researched and documented how satellites help monitor the crop condition throughout the cropping cycle. There are different remote sensing indexes that can be used to monitor and analyze the vegetation index like Normalized Difference Vegetation Index (NDVI), Normalized Difference Wetness Index (NDWI), Vegetation Condition Index (VCI), Temperature Condition Index (TCI), Vegetation Health Index (VHI), Enhanced Vegetation Index (EVI), etc.

NDVI, amongst the other indexes, is possibly most widely used to classify a crop and mimic the phenological features of a crop during its cropping cycle when a dense time-series dataset is available. The before and after event images provide clarity on the extent of damage that occurred in the area of interest. Historical time series satellite imagery helps understand the crop phenology for every season, which can give a year-onyear correlation of the cropping pattern, which can then be used to monitor how the crop is growing in the current season. During any natural catastrophe, any crop damage which occurs gets due to a drop in the NDVI profile of the crop.

There are different approaches to estimating crop damage due to different natural catastrophes. For instance, in the case of flooding, it is important to understand whether particular crop damage has occurred due to the flood. A combination of optical and SAR data can be used in this case to analyze the damage. To capture flood inundation, the extent of flooding can be estimated using the backscatter analysis from SAR data. The potential depth of flooding can be calculated by incorporating a Digital Elevation Model (DEM) to account for the slopes and plains in the area of interest.

Figure 1 shows the crop acreage calculated using NDVI. In cases where the latest data of the event is not available due to a cloud cover issue, an earlier image can be used.

Figure 2 shows flood inundated areas analyzed using DEM and SAR. The next image, which is captured at a 7-day interval, shows the extent of flooding area can increase within a very short time.

Figure 3 shows the crop damage map.

As it can be seen from the images, the intensity and the exact areas where the crop damage has occurred can be identified using a combination of optical and SAR data.



Figure 1: Crop Acreage Estimation Using Satellite Imagery-Based Analytics.



Figure 2: Flood Inundation Analysis on Date 'T'.



Figure 3: Crop Damage Map Generated Using Satellite Imagery-Based Analytics.

There are cases like paddy crop, which has a good waterbearing capacity. These crops may react differently in flooding events, so it becomes additionally important to analyze the phenology curve of the crop with an NDVI chart to pinpoint whether there is any case of crop damage.

Another unique analysis is where crop damage was estimated for a volcanic eruption. This example again highlights the importance of SAR data. On the 12th of January, 2020, the Taal volcano erupted in the Philippines. The following Figures 4 & 5 clearly show the eruption and the visibility issues in the case of optical data. The first approach was to create a Land Use Land Classification (LULC) map.

As can be seen from the images, after the eruption on the 12th of January, the area was engulfed in a thick layer of

clouds, and optical methods of risk assessment were not possible. As a result, Sentinel 1's Synthetic Aperture Radar (C-band) or SAR-C was utilized, allowing clear data access.

After the pre and post-event backscatter thresholding response, the extent of damage could be calculated by additionally categorizing the damage to agricultural land and water body with the help of the LULC map.

SAR Interferometry can be used for earthquake, water body damage, landslides, and wildfire identification.

The two examples highlight how optical satellites are required to continuously monitor the crop health condition and the growth stages and estimate potential damages by correlating with abnormal changes in the corresponding NDVI curve



Figure 4: Optical Imagery Captured Using Sentinel- 2.



Figure 5: Pre and Post Event Analysis Using Sentinel 1 SAR Image.

while SAR data allows analyzing the area of interest when optical data access can be a problem. Geospatial technology, thus, can be extensively used to estimate crop damage due to natural catastrophes like typhoons, hailstorms, floods, etc.

We at SatSure have built innovative products which provide enhanced monitoring capabilities for cases like crop damage assessments. India regions like South East Asia are prone to heavy cloud cover during heavy rainfall. It is a common problem where analysts fail to access data due to the limitations of optical data and the limited frequency of SAR data. SatSure Cygnus is artificial intelligence (AI) driven 'High-Frequency Optical Virtual Satellite Constellation' with a 3-day revisit rate that provides 10-meter resolution images for crop and vegetation monitoring. SatSure Cygnus is able to provide accurate vegetation monitoring even during heavy cloud cover using the patent-pending SAR to Optical Image Reconstruction technique developed by SatSure.

Compensation Estimation

Under the PMFBY operational guidelines, a detailed protocol is in place for instances like crop sowing failure, post-harvest failures, and mid-season adversities. For instance, a few of the points that the operational guidelines highlight are:

- 1. Crop damage should have occurred on account of inundation; mere waterlogging without corresponding crop loss will not be considered.
- 2. If the affected area is more than 25% of the insured area of notified crop in notified insurance unit, then the losses are not individual but are widespread; therefore, all eligible claimant insured farmers would be paid ad-hoc claims for localised losses.
- 3. For mid-season adversity claims, Insurance cover will be provided to the farmers to provide immediate relief in case of adverse seasonal conditions during the crop season, viz. floods or prolonged dry spells, where the amount payable will be 25% of the likely

claims, subject to adjustment against the final claims.

Similarly, for instances of prevented sowing, standing crop failures, and post-harvest yield losses, geospatial analysis like vegetation condition, crop area, yield estimates, etc., along with weather datasets, play an important role in estimating the extent of crop damage to enable the relevant claim settlements.

With satellite-based geospatial analysis, farmlevel assessments can be done to capture crop damages. Thus, the insurance unit flexibility is provided with geospatial analysis. The compensation estimation finally boils down to how the insurance product is defined. For instance, in the case of parametric insurance, the cover is made against the probability of a particular event happening instead of indemnifying an actual loss. This is usually done by triggers whenever a particular event threshold is crossed. The trigger can be weather events, crop yield, market indices, etc. In any case, geospatial analysis plays an important role in either estimating the actual losses and crop damages or providing a proxy trigger, like in the case of parametric insurance.

To know more about how SatSure can help you with geospatial analysis for your problem statements, reach out to us at *info@satsure.co*.

References

- https://www.swissre.com/institute/research/sigma-research/sigma-2021-01.html
- https://pmfby.gov.in/pdf/Revised_Operational_Guidelines.pdf



Figure 6: Crop Damage Area Analysis.



Figure 7: SatSure Cygnus NDVI vs Commercially Available NDVI During Heavy Cloud Cover .



Solar Induced Chlorophyll Fluorescence - A Better Predictor of Crop Stress Through Satellite Remote Sensing

Ву

Dr. Prakash Mohan MM^{1} & Dr. Rajitha K^{2}

Alumni BITS Hyderabad Asst. Professor BITS Hyderabad, Civil Engineering Department

emote sensing for crop health monitoring and management

Remote sensing has proven to be an efficient crop monitoring technology relating to various crops' biophysical and biochemical conditions and diseases. The various methods which utilize spectral responses, spectral indices, and machine learning integrated with field data demonstrated their strength and scope for crop stress identification. Since the spectral index and spectral response curves are more related to the biochemical properties of crops, present-day research attempts to incorporate information on biophysical changes. The question on what parameter from remote sensing platform can connect to molecular level photosynthetic activities direct towards the solar-induced chlorophyll fluorescence (SIF) parameter. This article mainly focuses on the traditional method of understanding crop stress and diseases and how the SIF information can further improve these methods for better crop management.

Overview of traditional methods

Satellite remote sensing techniques are often used for crop disease identification due to their synoptic coverage, repetitively, and non-destructive way of analysis. The basis of these methods lies in the appropriate identification of relationships between the fluctuation of the spectral reflectance curve and plant stress. Spectral reflectancebased methods are referred to as traditional methods in this the article only because these methods have already undergone numerous revisions and improvements to their greater extent. From a 'crop disease management' point of view, leaf scale or plant scale information is often desirable for better disease identification. The medium resolution satellites like Landsat, Sentinel 2, etc., provide extremely smooth spectral response curves, which are not at leaf/plant scale. These data sets are often used for analyzing plant stress due to extremities like drought or waterlogging situations. Hence the utility of these medium resolution satellite data in crop disease identification is limited. Since the sensitivity of crop dynamics lie in the NIR and red electromagnetic spectrum, more spectral subdivisions in these regions were provided in recent multispectral remote sensing sensors. The addition of many red edge bands in Sentinel 2 is the step towards this goal.

The utility of hyperspectral data and its effectiveness compared to multispectral data is demonstrated in various applications. High sensitivity to spectral changes of the crop could help to detect diseases. The large volume of data and unavailability of enough satellites make this method unadaptable for day-to-day crop monitoring. UAVs with hyperspectral radiometers are often used at the farm level, which adds to their efficiency due to the minimum atmospheric disturbances. Rather than looking into individual spectrum changes, the spectrum combinations or indices could better relate to infected crops' biochemical processes. But in most crops, the disease specificity is difficult to achieve when spectral changes vary with local conditions. It is not easy to generalize the information through a standard curve for crops. In such cases, careful feature selection from spectral bands backed by field data and optimal choice of ML algorithm could provide better outputs when hyperspectral data is unavailable.

Machine learning algorithms have greater power when dealing with a large amount of 'quality' data. ML has been applied in many crop monitoring applications and has become a powerful tool for Agri entrepreneurs doing business in the precision farming sector. ML algorithms learn the intrinsic (linear and nonlinear) relationships between the independent factors and crop health and classify or predict them without relying on specific crop parameters. Artificial neural networks (ANN), Support vector machines (SVM), tree-based ML models, etc. (Random forests, decision trees, Extreme gradient boost, etc.) are successfully applied in many research and commercial applications. These models are feature extraction-based models where the input features to the ML algorithms are manually extracted or manually feature engineered. When it comes to deep learning, automatic feature engineering is implemented, and the outputs are more reliable than ML techniques. Agricultural remote sensing coupled with ML applications utilizes a large

volume of input data from the field and image. Aligning the field data collection with the satellite overpass is subjected to clear weather conditions. The spatial scale of satellite data becomes another challenge while establishing mathematical relationships with field and satellite data.

When we use satellite data for crop management, many fundamental questions are often unanswered, like which satellite data to be used? Optical data or SAR data? How many bands are to be included? Are the same features applicable to different crops? How much information is needed for running a particular model? The answers to these questions in a multivariate complex agricultural system are not easily available. Ignoring the answers to these questions and simple generalizations may often lead to undesirable results.

Solar-induced chlorophyll fluorescence

All methods mentioned above are spectral reflectancebased methods that are dogged by sensor characteristics and resolutions. The noise of the data is remarkably high and depends on field conditions. Moreover, spectral information is not much related to the biophysical state of the crop. The solar-induced chlorophyll fluorescence (SIF)based crop monitoring method mostly addresses crop physiological changes. This method delivers information to the user from a perspective relating to the crop's biophysical activities than biochemical changes.

SIF is an electromagnetic signal re-emitted by Chlorophyll-a of a plant which was absorbed by chlorophyll-a and chlorophyll-b from active photosynthetic radiation but unused for photosynthesis. Fluorescence is a special technique used by plants to dissipate their energy from photosynthetically absorbed radiation. This interesting phenomenon was discovered by Sir David Brewster, a Scottish scientist, almost a century ago and new in remote sensing applications due to the unavailability of sensors that pick these weak signals. It is emitted at 650-850 nm spectral ranges and only a negligible percentage (0.5%) of the radiance from the plant canopy. It requires sensors with a high spectral resolution which often leads to capturing larger noises. The emissions generally happen from chlorophyll-a at two spectral regions (685-695 nm and 730-740 nm), and it slightly covers the visible region of the electromagnetic spectrum. These two regions are named F685 and F740, respectively (Please refer to Figure 1) and are difficult to be captured by human vision. Since the emissions are proportional to the photosynthetic activity of the vegetation, it is considered as a linear proxy to photosynthesis. In remote sensing-based studies, photosynthetic activity is indirectly estimated by NDVI values. The NDVI like indices are more influenced by visible

changes and are saturated at higher values. It cannot provide information about how efficiently light is used for photosynthesis. Since the SIF is more related to physiological processes inside the plant, it is a good indicator of drought and diseases-induced stress. The SIF is considered as a 'photosynthesis index' and not a 'greenness' index like NDVI.



Figure 1: Govt. of India's report on Agricultural situation in India recognized Farmonaut's work in the farming sector.

Healthy vegetation generally emits more fluorescence

compared to unhealthy vegetation. Therefore the diminished fluorescence directly indicates the decline of crops' physiological activities. The fluorescence may not always fluctuate along with the crop's greenness. For example, irrespective of high NDVI for forests, the SIF will be less than agricultural areas. It means that healthy agricultural fields glow better than unhealthy fields and forests.

Japan's Greenhouse Gases Observing Satellite (GOSAT) was the first mission to assess the utility of SIF for vegetation monitoring from space. It captured fluorescent signals globally with a very coarse spatial resolution. OCO-2 is another mission that retrieved SIF measurements in spatial resolution of 2 km. It was not a global scanning mission, and was used for small experimental patches near Chicago.

Sentinel 5P mission has recently demonstrated the SIF data captured by the TROPOspheric Monitoring Instrument (TROPOMI) onboard. The data from TROPOMI is not fully dedicated to the SIF measurement of vegetation. The Fluorescence Explorer (FLEX) mission is ESA's fully dedicated SIF mission expected to be launched in 2025. It is designed to fly tandem with Sentinel 3 mission. The FLEX is a high-resolution mission that will acquire data in 500-780 nm. Various SIF missions and their specifications are shown in Figure 2.

The presently available SIF data sets are of coarse spatial resolution and are not useful for any field scale estimations. Since vegetation indices are not much sensitive to the biophysical activity of a crop, SIF may provide additional information for better crop management. SIF-related research is still in its infancy, and its correlation with photosynthetic activity is not fully understood. Currently, the data acquired are noisy, and

GOME 1995-2003 Spatial resolution 40 km X 40 km

SCHIMACHI 2002-2012 Spatial resolution 30 km X 60 km



GOME-2 2007-Present Spatial resolution 80 km X 40 km



GOSAT 2009-Present Spatial resolution 10.5 km

OCO-3 onboard ISS

2019-Present

Spatial resolution

12.8 km path



2014-Present Spatial resolution 1.29 x 2.25 km

OCO-2



TROPOMI 2018-Present Spatial resolution 7 x 3.5 km



FLEX Future Mission

Figure 2: Solar- induced chlorophyll fluorescence missions.

techniques are to be improved to eliminate heavy data noises.

In this article, the authors clearly state that the SIF is not the replaceable solution for spectral curve-based crop management. It is always a piece of additional and critical information to be used along with spectral or structural data. The synergy is the better option rather than the sole utilization of SIF for crop monitoring and management perspective.

RMSI - A Global Leader in Geospatial and Engineering Solutions

A Talk with Rajiv Kapoor, Chairman and Managing Director, RMSI

R MSI is one of the world's leading global GIS companies across the globe. RMSI's core competency lies in providing solutions across the entire geospatial value chain - from data enhancement including every manner of geospatial data conversions to software development to modeling, analytics, and consulting. The ability to offer complete GIS solutions, comprising data, software, and engineering under one roof, is a key differentiator for the company.

We had a great opportunity to have a questionnaire with Rajiv Kapoor, Chairman and Managing Director, RMSI. He has shared interesting insights on the journey of RMSI in the last 3 decades. He also talked about company expansion plans, untapped opportunities in the Indian geospatial market, and advice to budding entrepreneurs and college students.

The questionnaire follows as...

GIS Resources - Let's start from the beginning, back in 1992 what made you interested in geospatial technology, and the idea of starting RMSI. And how has been the journey so far?

Rajiv Kapoor- We are a three-decade-old company focused on geospatial and engineering solutions. Way back in 1992, when GIS was considered a niche technology, we identified that geospatial technology could be a real business enabler and play a crucial role in business transformation in the future.

What interested us was the location context and how it can play an important role in each sector from infra development, transportation, to utility, telecom, etc. For example, a utility company has millions of assets, and in case of a fault, location data provides context to identify the correct failure location of an asset with respect to the power breakup and managing a quick redressal.

Since its inception, RMSI started with one of our first customers (GE Capital) for whom we did digitization of paper maps to working with some of the largest and most recognizable Fortune 500 companies today, creating maps and powering intelligence platforms. We work with most blue-chip companies (Top 15-20) in each of our core sectors, including government and private sector clients.

RMSI has grown from an initial team of five people to a company of more



Rajiv Kapoor

Rajiv represents the executive management on the Board of Directors of RMSI. He has been with the company since 1997 and has played a significant role in the company's growth and business expansion. Rajiv has the overall responsibility for developing the company's vision and strategic direction.

Rajiv previously worked as a Financial Controller with KB&T Limited, managing its finance and accounting functions, including treasury and banking operations, foreign exchange management, project finance and resource mobilization, budgeting, public issue formalities, and all legal and commercial aspects of the business.

Rajiv is a Chartered Accountant and has a degree in B.Com (Hons.) from the University of Delhi. than 5000 people. During this journey, one thing that has stood out is our commitment to our human capital as we have consistently been ranked as one of the best companies to work for in prestigious surveys.

GIS Resources - Could you tell us about expansion & investment plans contributing to the growth dynamics in India?

Rajiv Kapoor - Despite COVID, we have been fortunate to manage a good growth path for the company. We successfully transitioned to the WFH model and continue to support our clients uninterrupted across global geographies.

In the coming year, we are forecasting a much higher growth. We already have subsidiaries in key geographies and looking to consolidate our presence in international markets.

- We have plans to grow our onsite teams Have to increase our presence in different markets locally to manage the sensitivity of data.
- We are also looking at investing in new business development models, having sales resources who are persuasive and innovative to understand client's problems, and partnering with them to offer solutions.
- From the Indian context, we are excited about the new geospatial policy and the liberalization of the drone policy. We are developing innovative IP solutions with a special focus on location intelligence and opportunities within the infrastructure and logistics sectors. These revolve around last-mile mapping challenges and effective visualization and analytics for large infra projects. Our solutions are driven by industry needs and current gaps.
- We are fortunate to be working with all the sunshine sectors. For e.g. Automotive sector is looking at bringing in autonomous cars, utilities bringing in green and sustainable utilities, and the mapping sector is looking at location intelligence for all industries. Our focus is on how to develop solutions and products around our client's challenges.
- We are also looking for similar or complementary companies, acquiring stakes in these companies to accelerate our agenda.

GIS Resources - How does RMSI envisage the use of Geospatial technologies in substantial development?

Rajiv Kapoor - We want to transform through the use of emerging technologies and do more of what we can in lesser time/effort induced and with more precision. For eg. Building capabilities around developing smart applications on top of data we own, data we can leverage, or open-source data.

Drones hold an important place in the construction industry. Many firms are adopting it for surveillance and mapping activities. During the project design phase, a high-quality drone survey can help in 10-20% design savings due to multiple benefits such as choosing the optimum route, value engineering, identification of obstacles before construction, better land-acquisition planning, and undertaking better visual planning for projects.

Al/ML will also have a visible synchronization with geospatial in the future. We have already been using Al/ML for at least the last 5 years in many areas dealing with the usage of digital maps. Anything that is spatial information has a pattern and uses Al/ML. One can train algorithms to sense these patterns. For example, Supervised learning can be effectively applied in geospatial. We have done a fair amount of work using this tool, especially in cadastral applications, and now we are increasingly looking at the telecom engineering space and figuring out how it can be applied to some of the problems in this industry.

Also, the announcement of a new geospatial policy and relaxation of drone policy in India will bring in far more data being generated in the market, opening opportunities for Indian companies like us to develop innovative applications to leverage data.

GIS Resources - In your opinion, what are untapped opportunities in the geospatial market (in India)?

Rajiv Kapoor - There is a lot of untapped potential with significant usability of GIS in healthcare wider use in infrastructure, e-commerce and logistics sectors that can drive real transformation. As per the latest Union Budget announcements, there is a significant government push in increasing infrastructural investments with programs such as Gati Shakti, Svamita, etc. These programs will have a technology backbone spanning geospatial mapping to GIS analytics as a core technology. GIS can play a critical role in substantially reducing the cost of these projects by reducing duplication of work across departments and smarter monitoring.

Further, base data was available earlier, but we can develop high-resolution contextual data to amplify last mile connectivity in the country with the new policy.

GIS Resources - There is a lot of talk going around about The Draft National Geospatial Policy 2021 and liberalization of Geospatial policy, what does this entail to RMSI?

Rajiv Kapoor - The Government of India took excellent initiatives in the Geospatial sector last year by liberalizing the Geospatial policy and creating an enabling infrastructure for Drone Industry through Drone Rules 2021.

To fully realize the benefits of these major policy initiatives, there is a need to increase budgetary outlays for these sectors to undo the damage caused by the earlier restrictive policies. There is a shortage of quality survey infrastructure in the country in terms of manpower, knowhow, and equipment. Most of the Indian cities have not been surveyed properly, and this results in large leakages & damages, and illegal construction problems besides aggravating issues like urban flooding.

RMSI is an established mapping expert and can help the drone ecosystem develop towards mapping. With the help of drones, one can conduct illegal construction and encroachment monitoring and effectively manage urban floods, forests, pollution, assets, and many more areas.

Furthermore, the liberalization of geospatial policy will level the playing field for private entities. A ready supply of geospatial data will be available to create high-quality maps. Moreover, having access to accurate geospatial data will benefit multiple sectors that were suffering before.

GIS Resources - What are major trends that you think could influence to drive the Geospatial market most in the coming years?

Rajiv Kapoor - With the recent IPCC 2021 report findings, India is on a red alert with respect to the impact of climate change by 2030, including a high threat to some of the key coastal cities in the country. The trends in climate change are increasing at such a fast pace that this is a real threat now. RMSI specializes in assessing the impact of climate change on hydro-met hazards. We are working extensively on this segment from a flood, climate change, and disaster perspective to enable mitigation strategies at the country and State level. Preventive steps can be certainly taken today to manage the climate change scenario. We are also working towards publishing a Climate Risk Index for India.

In the area of disaster risk reduction, there is a growing trend globally to make extensive use of technologies such as Decision Support Systems and Drones. As part of government engagements in India and emerging economies, RMSI is developing Decision Support Systems (DSS) to help governments combat disasters.

Another big trend is about the infusion of new technologies like AI/ML with GIS for faster and quicker development of specific data at a high resolution. These infusions will pave the way to find smarter ways to generate data driving usability for very specific use cases.

The recent union budget announcements around drone usage, land records digitization, and programs like the Svamita & Gati Shakti will certainly see larger geospatial technologies engagement, hence driving the market. GIS will be driving the country's growth ambitions, aiding the new-age ecosystem by providing location intelligence at the fingertip.

GIS Resources - You have 3 decades of experience in the geospatial industry, give some advice to GIS Resources readers and budding entrepreneurs who would like to turn their ideas into a profitable business. Rajiv Kapoor - When we were formed, one obvious assumption was around the growth of this technology. We always knew that geospatial will have a significant play but we never realized that it will move from being a niche to a mainstay technology in this short span. From a technology enabler, it has become a technology that

solves customers' business problems. The acceptance and adaptability of the technology have increased multifold.

For budding entrepreneurs who would like to turn their ideas into a profitable business, I would say that instead of being solution providers, they should partner with their clients to solve complex problems. They should enable their clients by solving their core business challenges rather than offering piecemeal solutions. This will help them get on the path of their digital transformation journey.

GIS Resources - Last question for students, what talent sets do you look forward to hiring fresh college graduates?

Rajiv Kapoor - While hiring freshers, our focus is on identifying candidates with the right work attitude and culture fit. Additionally, we look at base qualifications in telecom and engineering and put them through rigorous induction programs to upskill them to be market-ready.

NEWS DIGEST

BUSINESS

<

December 16, 2021 - March 15, 2022

Locana Debuts Winter Release of Lemur, Providing Enhanced Mobile Access to Geospatial Information Systems

Locana, an international leader in spatial technology previously known as Critigen, announced its winter 2021/2022 release of Lemur. enterprise-grade mobile software that provides mobile workers zero-training access to an organization's existing geospatial information system. By delivering an intuitive, robust geospatial toolset, Lemur reduces time wasted finding information, improves safety, and increases field efficiency. Additionally, Lemur is purpose-built to work offline, allowing field workers to continue work regardless of cell coverage.

Hexagon and Dayou Partner to Bring High Accuracy GNSS Corrections to the China Market

Hexagon's Autonomy & Positioning division is has to announce its partnership with Chinese positioning company Dayou. This collaboration will bring TerraStar X technology to the Chinese market, providing fast precise point positioning (PPP) corrections for autonomous vehicles and mass-market use such as smartphones. The partnership enables Hexagon and Dayou to provide consistent positioning solutions globally, including North America, Europe and China, so OEMs can deploy the same design worldwide. The GNSS corrections generated from TerraStar X technology enable lanelevel accuracy with convergence in under a minute for consumer and automotive-grade GNSS receivers, supporting ADAS, autonomous applications, safety-critical applications and more.

YellowScan Global Support Community adds first Aussie Organization to Growing List

YellowScan, a global leader and designer of next generation manned and unmanned LiDAR solutions, announces the latest addition to its long list of YellowScan Global Partners Network, Sphere Drones.

Thomas Sweet Joins Trimble's Board of Directors

Trimble has announced the appointment of Thomas Sweet to its Board of Directors, effective January 15, 2022. Sweet is chief financial officer (CFO) of Dell Technologies, one of the world's leading technology companies. His career at Dell spans 24 years where he held various finance and sales leadership positions before being appointed CFO in 2014.

Trimble Extends its Support for Empowered to Educate with Multi-Year Foundation Grant to Grow its Fellowship Program

Coinciding with International Women's Day, Trimble and the Trimble Foundation Fund has announced continued support for Empowered to Educate. With a mission to empower women with resources and support to become leaders and innovators of education, Empowered to Educate forges pathways for female educators with its two-year fellowship program. The program connects young female educators-who are innovators, pioneers and creative leaders-with leadership development, mentorship, exposure to professional networks and micro-grants to support their work.

Esri Launches New Solution to Help Communities Assess Social Equity

In communities across the US, public and private sector organizations are working to advance racial equity and social justice. Governments, in particular, are seeking to ensure that their constituents have equitable opportunities for education, employment, access to healthy foods and affordable health care, as well as safe housing options. In response to this challenge, Esri, the global leader in location intelligence, has partnered with Race Forward's Government Alliance on Race and Equity (GARE) alongside other leaders in government nationally to create a Social Equity Analysis solution.

Esri Releases Updated Land-Cover Map with New Sets of Global Data

Governments and businesses across the world are pledging to adopt more sustainable and equitable practices. Many are also working to limit activities that contribute to climate change. To support these efforts, Esri, the global leader in location intelligence, in partnership with Impact Observatory and Microsoft, is releasing a globally consistent 2017-2021 global land-use and land-cover map of the world based on the most up-to-date 10-meter Sentinel-2 satellite data. In addition to the new 2021 data. 10-meter land-use and land-cover data for 2017, 2018, 2019, and 2020 is included, illustrating five years of change across the planet.

Teledyne Geospatial Wins 2021 MAPPS 'Project of the Year Grand Award' and the 'Technology Innovation Award'

Teledyne Geospatial is pleased to announce that the next generation Optech CZMIL SuperNova topo/bathy lidar system has been awarded both the Geospatial Excellence Award for Technology Innovation and the Geospatial Excellence - Project of the Year Grand Award. The Optech CZMIL SuperNova boasts the best depth performance and the highest green laser point density in its class.

Dewberry First to Purchase Advanced CZMIL SuperNova LiDAR Bathymeter in North America

Teledyne Geospatial has announced the sale of its next generation bathymetric lidar CZMIL SuperNova to leading professional services firm Dewberry. Dewberry is the first private North American company to purchase the CZMIL SuperNova, adding this unique capability in support of state and federal coastal zone mapping programs, surveying of wetlands, lacustrine and riverine systems, submerged habitat detection and offshore mapping for renewable energy governance.

NavVis Announces Partnership with HERE Technologies to Support the Future of Mobility

NavVis, a global leader in mobile mapping and reality capture, and HERE Technologies, the leading location data and services platform, have teamed up to bring highdefinition indoor mapping and visual positioning to parking garage operators and transportation hubs. This partnership leverages three key technologies from NavVis: NavVis mobile mapping systems, NavVis IVION, and NavVis visual positioning technology.

Release of Bhuvan Wiki and Bhuvan Lite by ISRO

Bhuvan wiki is a web application designed for publishing information and engaging Bhuvan users for sharing and contributing their knowledge to other users. It is useful to all Bhuvan users in finding topics of their interest to explore. It provides information on users interest and helps to better connect with the users. A lighter version of Bhuvan, called "Bhuvan Lite" is developed for mobile platforms. Bhuvan, (lit: Earth), is an Indian web based utility which allows users to explore a set of maps.

ISRO's First Launch of the Year 2022, PSLV-C52 Successfully Launches EOS-04 and Other 2 Satellites

On Valentine's day, ISRO has given a gift to the nation with the successful launch of the Polar Satellite Launch Vehicle PSLV- C52 successfully launched EOS-04 Satellite from the first launch pad of Satish Dhawan Space Centre (SDSC), SHAR, Sriharikota. The PSLV- C52 launch vehicle lifted off at 05:59 hrs (IST) on February 14. 2022, in the opening of the launch window. The three satellites, named EOS-04, INSPIREsat-1, and INST-2TD, were successfully injected into a 529 km sun-synchronous polar orbit after a flight of approximately 17 minutes 34 seconds. The satellite EOS-04 is Radar Imaging Satellite (active remote sensing satellite as it transmits coherent EM waves at a target). The EOS-04 satellite provides high-quality images under all weather conditions for agricultural, forestry, soil moisture, and flood mapping applications. With its Cband sensor, it complements and supplements the data collected by Resourcesat, the Cartosat series, and RISAT-2B. Weighing about 1710 kg and generating 2280 W power, the satellite has a mission life of 10 years.

Phase One Unveils Wide-Area, 120MP Aerial Camera with Global Shutter Sensor Technology

Phase One has announced the iXM-GS120 aerial camera built to meet the demanding needs of national security and geo-intelligence gathering projects. Designed for use on UAVs, fixed-wing aircraft, and helicopters, the iXM-GS120 is the first wide-area, 120MP resolution camera designed around advanced global shutter sensor technology. Phase One designed the iXM-GS120 for reliable, maintenancefree operation in lengthy missions in remote areas, which often typify national security and intelligence gathering activities.

Yakima, Washington, Adopts ArcGIS Image for ArcGIS Online to Enhance City Services

For years, staff at the City of Yakima have managed all the geographic data for the municipality and used imagery as a tool to support the city's government, police, fire, transit, drinking water, refuse, and utility services. And while it's been integral for Yakima decision-makers and city advancement, managing and making the city's vast imagery archive accessible has been one of its biggest challenges. To centralize the imagery for citywide benefits, GIS department staff implemented ArcGIS Image for ArcGIS Online from Esri, the global leader in location intelligence. Now all Yakima's imagery is stored in the digital cloud and can be accessed by anyone through the city's GIS portal. Updating the new imagery, which previously could take up to a full day to complete, is a one-step process that's now finished in a matter of hours.

Golden Software Facilitates Map Making and Data Export In Latest Surfer Surface Mapping Package

Golden Software has enhanced the map-making functionality and data exporting capabilities in the latest version of its Surfer surface mapping package. The Surfer surface mapping software is used by more than 100,000 people worldwide, many involved in oil & gas exploration, environmental consulting, mining, engineering, and geospatial projects. The software has been relied upon for more than 30 years by users in numerous disciplines to easily visualize and interpret complex data sets. In this version, we focused on making it easier and faster for Surfer users to create the maps they envision without time-consuming workarounds or using other software.

Britain Seeks Alternative for Satellite Navigation

Recently, the UK Government has floated an interest to widen the search for a home-grown solution to the country's need for independent satellite navigation and timing system. Now, that Britain is no longer a member of the European Union and no longer involved with GALILEO, seeking for the sovereign system is therefore critical to the national interest. Defense Equipment and Support (DE&S) and the Defence and Security Accelerator (DASA) want to understand the range of technologies used for commercial positioning and navigation systems. The main area of interest is to know the location of the weapon during the midcourse phase of deployment with an accuracy of ± 5 meters.

Hexagon Develops Solution for Monitoring Chemical, Biological and Nuclear Threats for Canada's Department of National Defence Hexagon's Safety, Infrastructure &

Geospatial division has announced the successful delivery of a visualization and analysis solution for Canada's Department of National Defence (DND) to assist in the monitoring, detection, early warning and prediction of chemical, biological, radiological and nuclear (CBRN) threats. The solution was funded through DND's Innovation for Defence Excellence and Security program.

RMSI Develops Award-Winning Land Record Information Management System for the Department of Land Management and Archive, Nepal

RMSI, a global leader in geospatial and engineering solutions, was commissioned by The Department of Land Management and Archive (DOLMA), Nepal, to deliver a webbased solution, Land Record Information Management System (LRIMS), to capture land-related transactions, one of the significant initiatives of the project. DOLMA was awarded the "Digital Governance ICT Award", a prestigious information and communication technology award for its success in automating land transaction processes. DOLMA launched the service in all 126 offices covering 77 districts across Nepal alongside successful operation in 14 Land Revenue Offices. RMSI developed the bilingual land-based application in Nepali and English languages.

Applanix Introduces Next-Generation OEM Solution for Mobile Mapping Applications Using GNSS-Inertial Technology

Applanix has announced the Trimble® AP+ Land GNSS-inertial OEM solution for accurate and robust position and orientation for georeferencing sensors and positioning vehicles in land mobile mapping applications. This enables users to accurately and efficiently track and monitor fleets, produce highdefinition (HD) maps and 3D models, or act as a reference solution for advanced driver-assistance systems (ADAS) testing, even in the most challenging GNSS environments.

Transsion and HERE Partner to Enhance Location Accuracy Experience for Smartphone Users

HERE Technologies has announced that Transsion has selected HERE Network Positioning to improve its location accuracy capabilities in emerging markets such as Kenya, Nigeria, Ghana, Bangladesh, India, Pakistan, Indonesia and Thailand. By deploying HERE Network Positioning, Transsion will be able to identify accurate positioning of devices both indoors and outdoors. This works when satellite signals of GPS are not available, such as when the device is located indoor.

Counterpoint Research Ranks HERE as Top Location Data and Technology Platform

Industry analysts at Counterpoint Research have ranked HERE Technologies as the world's number one location platform. HERE maintains the top spot in Counterpoint's annual ranking of the capabilities and offerings from the largest 25 location data vendors. The annual ranking includes Google, TomTom, Mapbox and more. HERE takes the top spot in the annual ranking for the fourth time consecutively. The 2021 Counterpoint Research, "Location Platforms Evaluation and Analysis" evaluates the leading 25 mapping and location platform providers across seven categories, on more than 61 capabilities and ecosystem success parameters.

Refreshed HERE WeGo Navigation App to Introduce New Partners and Options for People on the Go

HERE Technologies has announced new partners for its free mobile navigation application, HERE WeGo. With additional options beyond pure navigation from A to B, HERE WeGo will offer a comprehensive end-to-end journey experience for people on the go. Starting in the first quarter of 2022, these options will include: Ridesharing with Lyft, accommodation reservations with Booking.com, ticketing for inter-city journeys with FlixBus and fuel payment with ryd. HERE WeGo is a free navigation app that guides local and global travelers on journeys both familiar and foreign. Built with a privacyfirst mindset, users don't have to create an account and opt-in to data sharing with HERE to calculate routes and navigate with the app. HERE WeGo is available for free as a download via the the Apple App Store, Google Play Store and the Huawei App Gallery.

Geospatial Buzz in Chennai: to Fight Crime and Criminal and to Map Public Utilities

According to recent news by New Indian Express, the Chennai police department planning to create a crime mapping system that will use Geographic Information System (GIS) to detect crime hotspots. The GISbased mapping system will improve police intelligence by giving datadriven, reliable information on crime and criminals. In terms of technology, Additional Commissioner (South) N Kannan told The New Indian Express that the new system will assist the police in making use of data and information to provide them with precise decision-making knowledge. In another news reported by the Time of India (ToI), soon, the city's public utilities, properties, and private land will be able to be appraised with pinpoint accuracy, Greater Chennai Corporation has purchased 32 hand-held DGPS (Differential Global Positioning System) equipment, which will be utilized to assess the number of street light poles, trees, street width, land coordinates, and other features in all zones and wards with a precision of 1 centimeter.

Bentley Systems Recognized as the Microsoft Asia Pacific Region Social Impact – Sustainability Changemaker Partner of the Year

Bentley Systems has announced that it was recognized as the Microsoft Asia Pacific Region Social Impact – Sustainability Changemaker Partner of the Year 2021. The announcement was made at the Microsoft Singapore & Asia Pacific Partner of the Year Awards 2021. The Microsoft Asia Pacific Partner of the Year Award 2021 celebrates and recognizes regional partners who are focused on customer and community success by delivering unique and differentiated solutions built on core technologies across the Microsoft Cloud platform.

Pix4D Wins Tender to Monitor Railway Infrastructure for Deutsche Bahn

Pix4D is pleased to announce that it has been awarded a competitive tender for Deutsche Bahn to provide solutions and services for upcoming railway infrastructure projects through the analysis and visualization of drone images. Pix4D will be using its products PIX4Dcloud, PIX4Dmapper, and PIX4Dmatic for processing and analyzing drone imagery for construction progress monitoring and quality assurance.

Copernicus Land Monitoring Service: Consortium of GAF, GeoVille and VITO starts HighResolution Layer Vegetated Land Cover Characteristics Project

The European Environment Agency (EEA) recently awarded a contract to a consortium under the lead of GAF with the partners GeoVille and VITO to implement the new High-Resolution Layer (HRL) Vegetated Land Cover Characteristics (VLCC), as part of the pan-European Copernicus Land Monitoring Service (CLMS). Its rich product portfolio will ensure both the continuation and evolution of successful precursor HRLs, such as Forest and Grassland, and the establishment of new HRL products focusing on crops and agricultural practises. The implementation of HRL VLCC will happen with funding by the European Union.

SurvTech Using SimActive Software for Energy Infrastructure Projects

SimActive Inc. is proud to announce the use of its Correlator3D product by Survtech Solutions, Inc. for use in energy infrastructure mapping and monitoring. Using aerial imagery to colorize lidar point clouds, a visual element is added to enhance the processing and development of mapping products.

Airbus to Provide Imagery Services that Enable IntelinAir's Crop Analytics Platform

IntelinAir and Airbus has announced a multi-year collaboration agreement that will provide high-resolution. Airbus satellite imagery as an input to IntelinAir's artificial intelligence (AI) powered crop analytics AGMRI™ platform to deliver a complete view of every acre, every field from planting to harvest. With satellite and other aerial imagery sources, farmers receive a new perspective of the agronomic conditions in the form of emergence, plant health, weed detection and harvest readiness in their fields throughout the growing season. From this perspective, product performance and crop damage issues become visible so timely management decisions can be made to protect yields and optimize financial returns.

UltraCam Eagle Delivers Efficiency and Quality for Arrowhawk Imaging

Arrowhawk Imaging selected an UltraCam Eagle Mark 3 aerial camera system with a 100-millimeter (mm) lens as its first airborne imaging system. Since purchasing the sensor from Vexcel Imaging in 2019 and installing the unit in a Cessna 206 single engine aircraft, the mapping company has successfully completed numerous projects.

Orbital Insight Wins Department of Defense Contract to Develop Technology to Identify Intentional GNSS Disruptions

Orbital Insight, the leader in geospatial intelligence, has announced that it has been awarded a contract from the U.S. Department of Defense (DoD) to deliver a new technology platform for identifying intentional GNSS interference and manipulation operations across the world.

PRODUCT LAUNCH

December 16, 2021 - March 15, 2022

New Leica AP20 AutoPole — the World's First Tilt-compensated Total Station Pole Solution

Leica Geosystems, part of Hexagon, has announced the introduction of the Leica AP20 AutoPole — an innovative solution for automated total stations that boosts productivity to the next level through tilt compensation, automatic pole height readings and unique target identification. The AP20 AutoPole combines an intelligent sensor module with the new AP Reflector Pole and operates with Leica Geosystems' existing automated total stations to create a unique solution for autonomous workflows. The tilt compensation of the AP20 AutoPole increases efficiency when working with total stations. There is no longer a need to level the pole for measurements and stakeout.

Topcon Announces GTL-1200 Scanning Robotic Total Station

Topcon Positioning Group has announced its latest scanning robotic total station - the GTL-1200. The GTL-1200 solution combines the power of a robotic total station with a best-in-class laser scanner, enabling users to perform digital layout and capture highresolution 3D scans, all with a single setup. This combined technology approach eliminates workflow steps for scanning applications and greatly reduces the need for post-processing because the captured scan data is already on survey control or job site coordinates. In addition, the GTL-1200 workflow includes seamless integration with ClearEdge3D software for as-built and advanced construction QA workflows. The GTL-1200 provides several features and improvements as compared to its predecessor.

'KISAN' Mobile App for Dissemination of Agromet Advisory Services

IIT Roorkee under Gramin Krishi Mausam Sewa (GKMS) project has launched the 'KISAN' mobile app for dissemination of Agromet Advisory Services. IIT Roorkee held a regional farmers' awareness programme as part of the Gramin Krishi Mausam Sewa (GKMS) project and as part of the 'Azadi ka Amrit Mahotsav' series. 'KISAN' mobile app is launched for easy access to these services for farmers on their mobile phones. The app is able to meet the meteorological needs of the farmers.

Rural Connectivity GIS Data is Now Available in the Public Domain

Shri Giriraj Singh, the Union Minister for Rural Development and Panchayati Raj, Government of India, has made the Rural Connectivity GIS Data available to the public. This comprises GIS data for 800,000+ rural facilities as points, 1,000,000+ habitations, and 25,00,000+ km of rural roads, all of which were collected and digitized using the PMGSY GIS platform. Link to download PMGSY Rural Connectivity Datasets (PRCD) as released: https://geosadak-

pmgsy.nic.in/OpenData

Landsat 9 Satellite Data is Now Available to Download

Ensuring all checks after first 100 days of Landsat 9 satellite launch (September 27, 2021), the data products acquired by Landsat 9 sensors – the Operational Land Imager 2 (OLI-2) and the Thermal Infrared Sensor 2 (TIRS-2) were made available from early February 2022 through USGS ErathExplorer , Machine to Machine (M2M), and LandsatLook.

GEO EVENTS

March 30-31, 2022 Commercial UAV Expo Europe Amsterdam, The Netherlands https://www.expouav.com/europe/

May 10-12, 2022 Geospatial World Forum 2022 Amsterdam https://geospatialworldforum.org/

June 1-2, 2022 GEO Connect Asia 2022 Singapore https://www.geoconnectasia.com/

June 20-23, 2022 Hexagon Live Global Las Vegas, USA https://hxgnlive.com/global

June 20-25, 2022 8th ICCGIS 2022 Nessebar, Bulgaria https://iccgis2020.cartography-gis.com/

August 23-28, 2022 FOSS4G 2022 Firenze, Italy https://2022.foss4g.org/

September 6-8, 2022 Commercial UAV Expo America Caesars Forum, Las Vegas https://www.expouav.com/

November 7-9, 2022 Trimble Dimensions+ Las Vegas, USA https://bit.ly/3liYm5T

November 15-17, 2022 Geo Smart India 2022 Hyderabad, India https://geosmartindia.net/

February 13-15, 2023 GeoWeek 2023 Denver, CO, USA https://www.geo-week.com/

The Next Big Issue

Subscribe to Our Quarterly Magazine and never miss another issue again.



For enquiry, write us at support@gisresources.com



SEP. 6-8, 2022 CAESARS FORUM / LAS VEGAS

DRONES FOR SURVEYING & MAPPING

- Photogrammetry & Lidar
- Topographic Surveys
- Asset Management & Inspection
- Integrating drone data into GIS programs
- New sensor options



Registration will open in May.

Use code **SAVE100** for an additional \$100 off a Full Conference Pass!

expouav.com

LEARN

Expansive education program with solutions-oriented presentations & workshops from UAS thought-leaders

CONNECT

Facilitated **networking**, **matchmaking**, and focused **roundtables**, with drone industry professionals from over 70 countries

EXPERIENCE

Cutting-edge UAS solutions providers, live outdoor drone demonstrations & exclusive training







Terravlew

Produced by Diversified Communications

THE COMMERCIAL UAV EVENT FOR:













Public Safety & Emergency Services



Security