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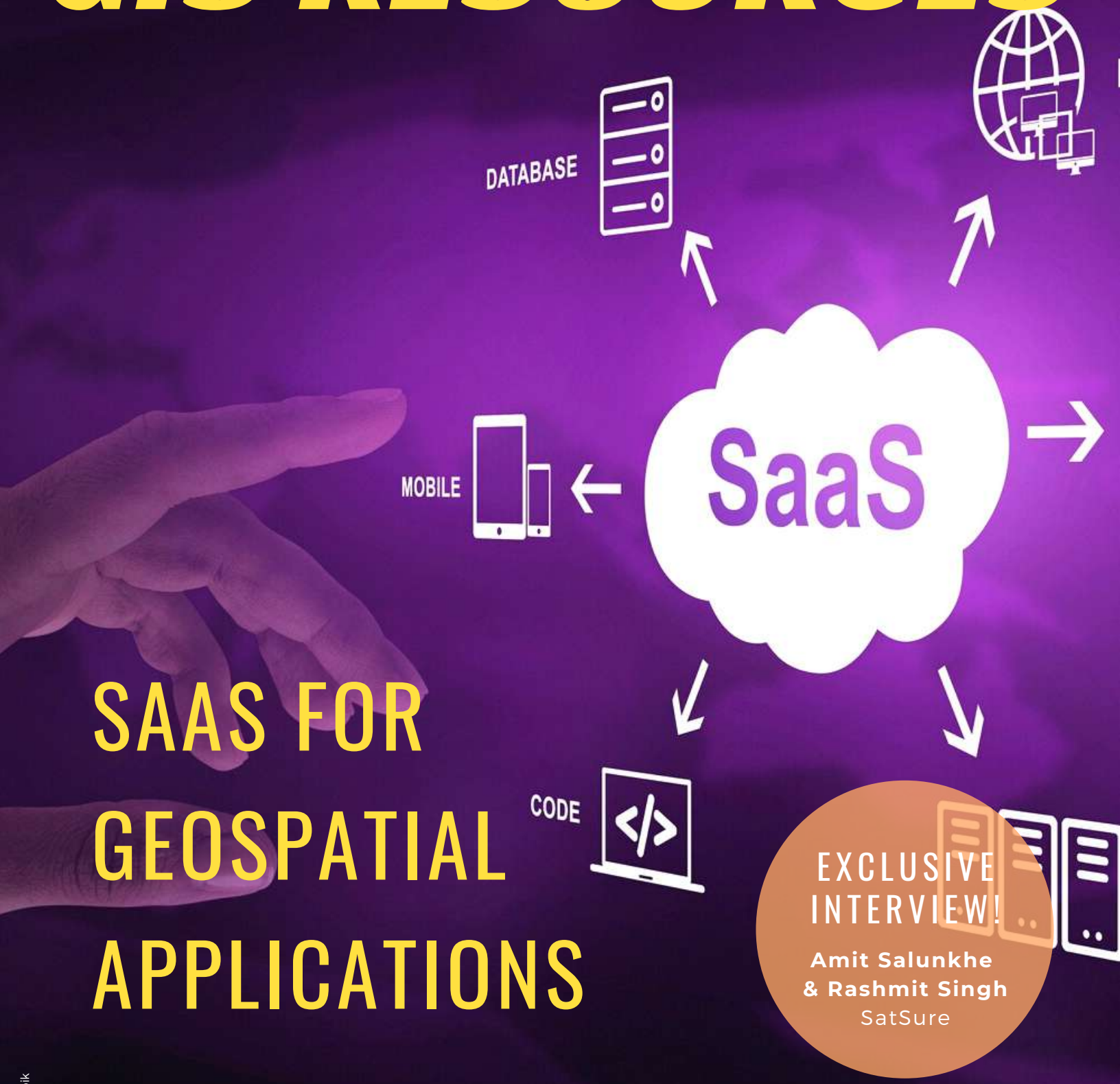
GIS RESOURCES



SAAS FOR GEOSPATIAL APPLICATIONS

EXCLUSIVE INTERVIEW!

Amit Salunkhe & Rashmit Singh
SatSure

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Providing a SaaS for Geospatial Applications

Cost-efficient Earth Observation Data to Increase Capacity and Improve Outcomes

How SaaS Elevates Cloud-Based Photogrammetry

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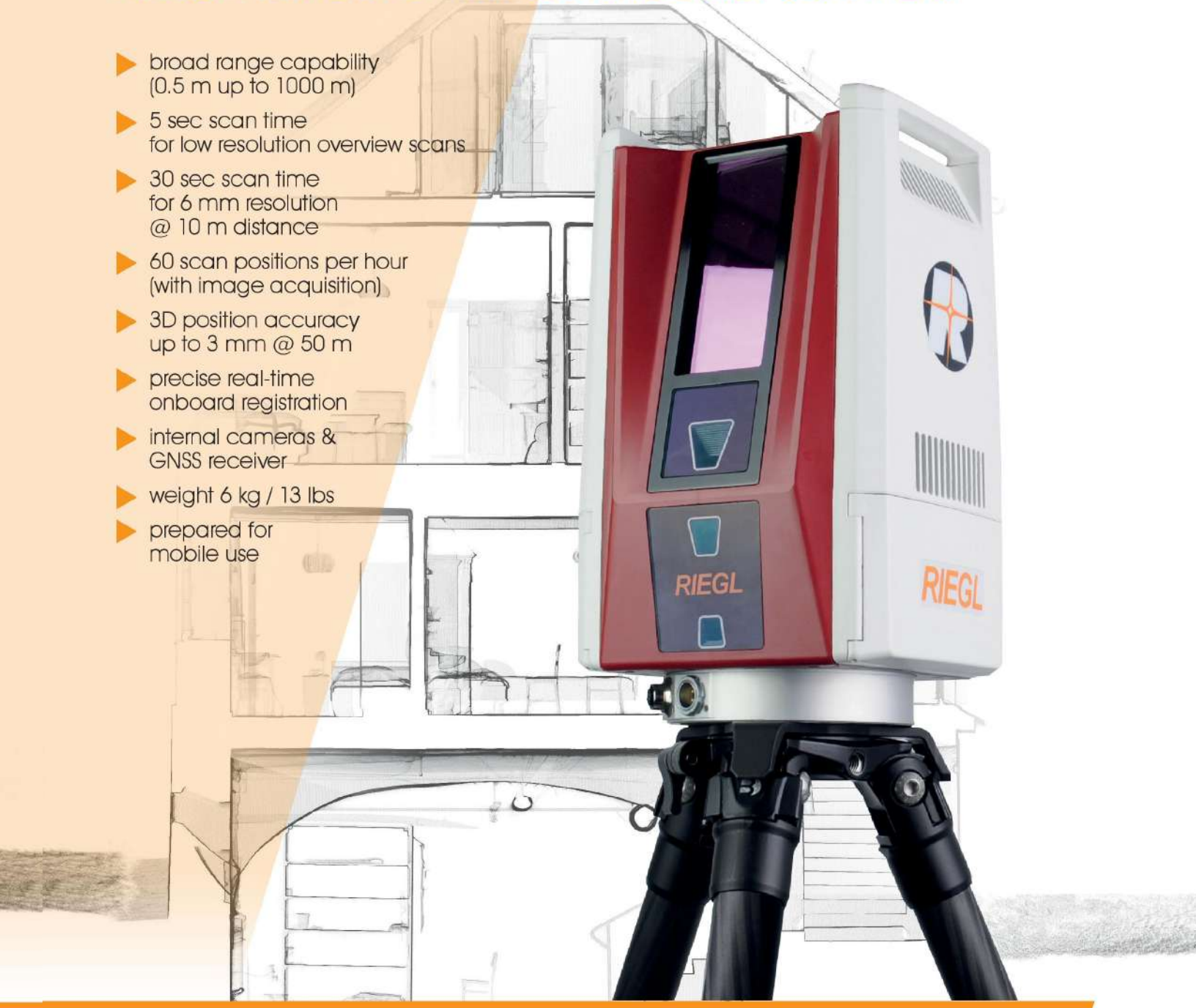

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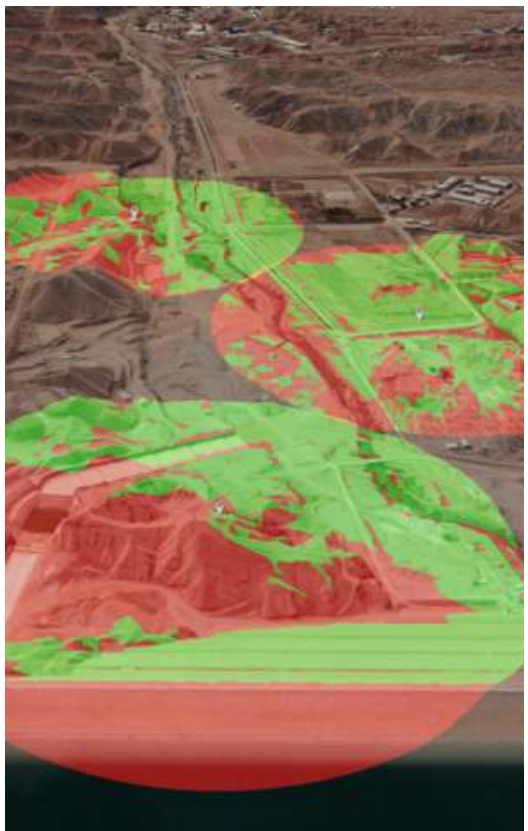

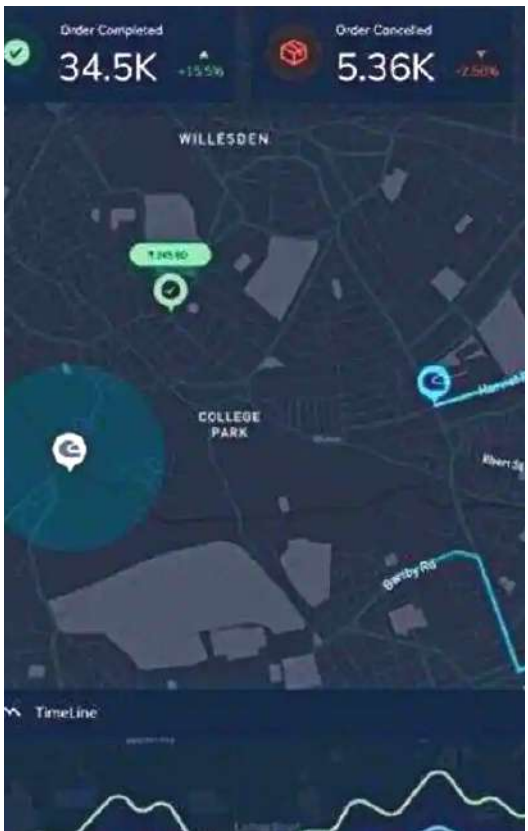

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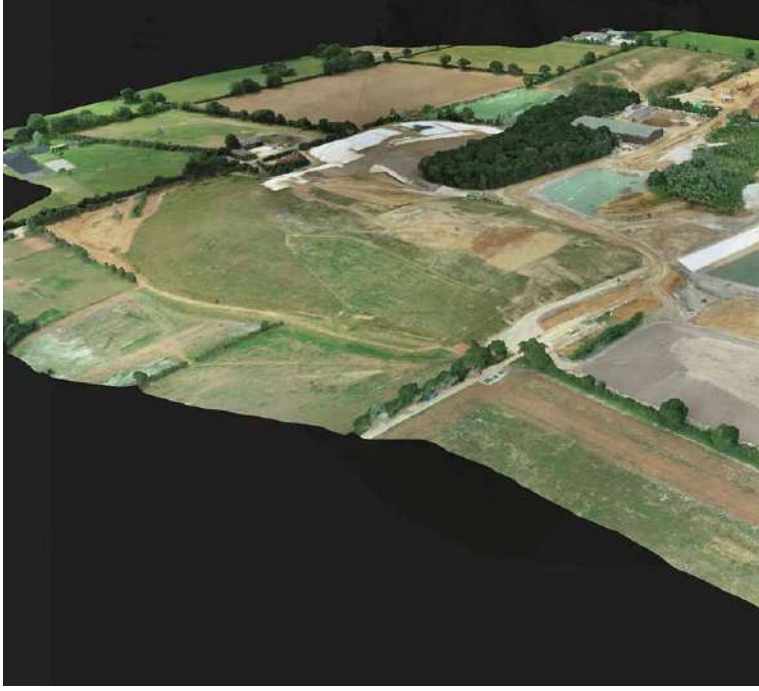
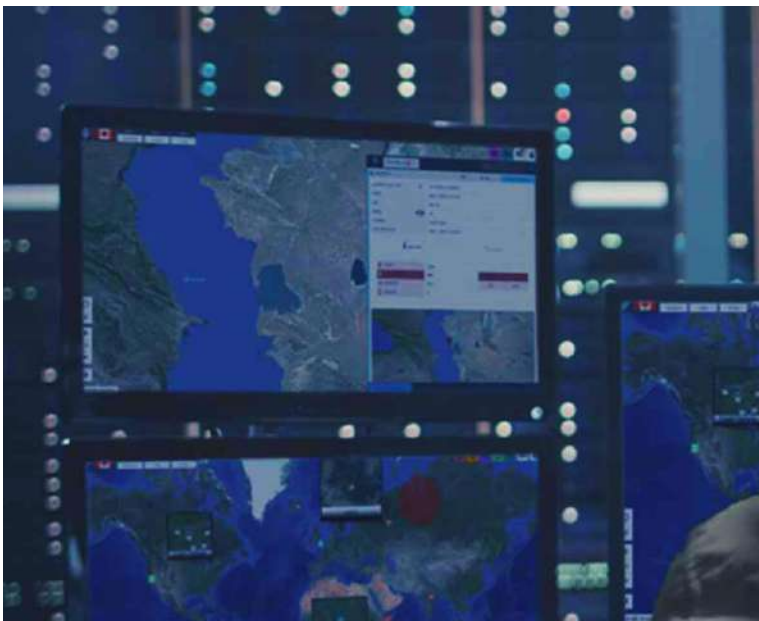




Editor's Note

By Ashok Prim

Digital Geospatial Data visualization, by way of mapping, began in India in the late 1980s and early 1990s. Map data was processed on a personal computer (PC) using a complete suite of software installed on the PC. The software had many capabilities but only a few were used as per the final output required. Dedicated hardware and the limitation of having to use a full software suite was cost-intensive and thus organizations, companies, and individuals who could afford the setup were limited to government organizations or large corporates.

The scenario has changed dramatically today with the availability of cloud storage and cloud computing, network bandwidth, and programming software. The driver of this technology is the sophisticated programming software, a vast amount of data available for free, the many applications that the same dataset can be used by different users as well the software platforms that are now available for a specific set of applications. A typical example is the popular Google Map API the gives distances, directions, best route visualization as per traffic, etc that makes it convenient for a traveler to reach his/her destination.

Dedicated Geospatial applications are available at a fraction of the cost and with greatly enhanced capabilities for all types of users. ArcGIS Online, Carto, and Hexagon Geospatial are some of the Geospatial SaaS platforms that are currently in use with many more being developed with specific capabilities and ease of use.

Powerful mobile technologies will make SaaS applications for Geospatial Technologies more versatile and precise, enhancing the possibilities of data and information processing at any time and at any place to arrive at solutions for decision-making.

Doha, Qatar. Image Credit: Satellogic

Cost-efficient Earth Observation Data to Increase Capacity and Improve Outcomes

By Thomas VanMatre
VP of Global Business Development
Satellogic

Satellite-derived Earth Observation (EO) data is an increasingly accessible asset for many industries and sectors with an estimated 800 operational EO satellites in orbit today reducing costs and increasing capacity. From applications driving a clean energy transition to government initiatives focused on environmental conservation, this rapidly advancing source of geospatial intelligence is scaling up analysis and action.

For example, public sector organizations are adopting EO data to monitor environmental changes with a mandate to curb climate change. With EO satellites continuously monitoring forests and other natural habitats, the public sector can track progress, detect illegal activity, and plan for future resilience. Recently, Satellogic announced an agreement to provide satellite imagery for the GREEN+ Jurisdictional Programme, a global initiative to monitor all subnational protected forest areas. This objective of this new program will enable individuals, organizations, and global markets to accurately monitor the compliance of signatory jurisdictions to avoid deforestation. “This important agreement will make critical information on the loss of our planet’s biodiversity more widely accessible, and thus promote the development of solutions to reverse it,” said Emiliano Kargieman, CEO at Satellogic.

As geo-nerds, we at Satellogic are particularly excited about the future of Digital Twins. While a True digital twin will take into account much more than what can be observed from imagery collection, satellite-derived EO data will create the foundation and assist in critical change detection analysis to

keep the twin up to date. We are eager to help and collaborate on integrating specifics such as building information modeling (BIM) data, atmospheric data, IoT data, and more.

Digital Twins are the future, what's in the now?

Sustainable Operations

There is a renewed focus on the mining sector. Clean energy infrastructure, such as electric vehicles (EVs), charging station networks, and concentrated solar power, rely heavily on minerals like copper, cobalt, nickel, lithium, and tellurium. Extracting these materials will help to determine the success of a worldwide clean energy shift, which to many may seem counterintuitive. How do we increase mining activity while minimizing negative environmental impact?

EO data delivers powerful and timely insights for safe, sustainable operations across site development, production, and reclamation. Satellogic customers are utilizing high-resolution, global imagery to identify possible new sites, planning and tracking infrastructure development as well as monitoring operations for safety compliance. The transparency EO data provides enables both mining companies and regulatory agencies to monitor activities and mitigate risks, ensuring minimal impact on the environment during excavation as well as optimal outcomes following restoration.

Broadening the mining example, EO data is unquestionably the most valuable source for remote or large-scale asset monitoring. A key focus for the company, asset monitoring is the fastest growing application of EO across industries and a top priority for governments. The asset could be any critical infrastructure such as bridges and airports or key points of interest such as government buildings, borders, agricultural fields that may determine a country's food security status.

The Best Data from Space

We confidently say EO data is the most valuable source for asset monitoring because it offers clarity, capacity, and scale. Moreover, Satellogic confidently believes we offer the best data from space at the best price, because we deliver all that satellite-derived EO data can offer at the lowest cost in the industry. And leading the EO market in affordability has always been a part of the plan.

Satellogic co-founders, Emiliano Kargieman and Gerado Richarte, started the company in 2010 with the intent to completely reinvent the EO satellite. Why? Because traditional EO satellites are massive, cost billions, and are designed to last a long time. This not only limited the market to those that could afford expensive data, it also meant investing lots of time and resources into a technology that would be quickly outdated.

How often do you upgrade your phone? Technology advances very quickly on the ground, but not so much in orbit. Satellogic is changing the satellite industry with 3-year lifecycles, which allow for rapid iteration to ensure our customers have access to the most up-to-date technology in orbit.

Satellogic is the first vertically integrated Earth Observation satellite and data company. We design, manufacture, and operate our own constellation. Our proprietary NewSat model is in its fifth generation (NewSat Mark-V), each carrying two payloads with an additional bay for experimental and hosted payloads. As of November 30th, 2022, we have 26 operational NewSat spacecraft in orbit. The aim is to reach 200+ in orbit and become the first company to deliver daily global remaps of the Earth.

And yet, more satellites does not mean more expense. Emiliano, Gerardo, and team successfully achieved significant manufacturing cost-efficiencies. In comparison to other remote-sensing sources, such as drones, the scalability, quality, resilience, and price point of EO satellites–especially NewSat–can't be beat. Leveraging another commercial breakthrough, Satellogic signed a Multiple Launch Agreement with SpaceX earlier this year to continue to expand the constellation.

Figure 1: Satellogic EO Satellite - NewSat.

These cost-savings are extended to Satellogic customers with the hope that removing cost-barriers will accelerate the adoption of EO and enhance decisions at local, national, and global levels. A lower price point means greater volume of data is more feasible. And since change is the only constant, more frequent data ensures timely analysis plus opportunities for other advancements like building a national geospatial database and training algorithms.

Constellation-as-a-Service

The rise of the New Space Economy has created opportunities for commercial startups and enterprise, rapidly advancing technology previously reserved for government space agencies. But even the number of state-owned EO satellites, or those with EO capabilities, is minimal. A unique offering from Satellogic was developed to change that too, and empower more nations to enter the New Space domain.

Satellogic's Constellation-as-a-Service model allocates dedicated satellite capacity and priority tasking over a nation's sovereign territory. With no infrastructure investments or operational risks, a government gains geospatial autonomy for its own national interests. Instead of making do with what imagery is available, governments can task the exact areas and points of interest they need, when they need it. Plus, with 26 satellites and growing, customers have access to continuously increasing opportunities for tasking as well as software and hardware upgrades at no additional cost.

Our Constellation-as-a-Service programs are tailored to customer requirements and enable secure, direct data management via private cloud environments with end-to-end encryption. For example, Satellogic's recent three-year agreement with the Republic of Albania includes priority access to two satellites plus training of remote-sensing specialists within the Albanian Government to assist in the analysis. This offering has enabled Albania to deploy a national Earth Observation program quickly and affordably; a streamlined, reliable source of information for dissemination across ministries and derived products to bolster national security.

Constellation-as-a-Service customers can serve more needs and projects–from urban and green space development to census programs and emergency response planning-with consistency and timely updates. Every leader needs to understand how the world around them is changing and prepare for what's ahead. We believe this model has the potential to help humanity better understand our planet and inform a limitless future of sustainable applications.

Capacity for Change

Satellogic NewSat has two main payloads: a multispectral camera and a hyperspectral camera. Our multisensor NewSat spacecraft weigh less than 50 kg and average 51x57x82 cm in size, about the size of a mini-fridge. Currently, with 26 satellites in orbit, the constellation is capable of up to 7 daily revisits over points of interest.

With multiple launches scheduled per year, Satellogic capacity is expected to continue to increase and rapidly improve revisit rates. This is part of our mission to achieve daily global remaps across the entire surface of the Earth. It's an ambitious goal, but a vital one.

Each year, humanity faces more devastating natural disasters. In 2022, flash floods due to the monsoon rains significantly affected the Indian states of West Bengal and Assam, as well as parts of Bangladesh, impacting a reported 10 million people. Experts estimate that the floods have increased in volume due to climate change.

Disasters & Defense

Lessening the toll on human lives and material possessions caused by unforeseen disasters requires prompt action. Maintaining census records and maps with regular monitoring aid in risk mitigation planning like calculating resource distribution, identifying evacuation routes, and other preventative measures. EO data also assists in early detection

Figure 2: Mumbai Airport, India.

as well as post-event damage assessments, helping to prioritize emergency response and plan recovery efforts.

Rapid and comprehensive imagery analysis is critical in emerging situations, and could confirm the most vulnerable areas as well as the safest routes to reach them. Combined with pre-event imagery, this data holds the keys to helping communities identify and address environmental hazards for future resiliency.

And in reality, insurance providers also need access to this data. EO data enables insurance analysts to begin examining ground conditions, sometimes before boots can hit the ground due to severe flooding or ongoing events.

To develop new solutions for disaster response and climate change, Satellogic partners with organizations such as the International Charter “Space and Major Disasters”, International Justice Mission, World Geospatial Industry Council, Open Geospatial Consortium (OGC), among others. Our team participated in a successful OGC Disaster Pilot Program exploring ways to deliver Analysis Ready Data with Decision Ready Indicators for an expedited response to disasters. We helped demonstrate the power of EO data in the prediction and detection of disaster events, including floods and associated landslides.

Situational awareness is also pertinent for defensive strategies when conflict arises. The shockwaves of war reach beyond the battlefield: not only domestic, but global food security is at risk when major food producers are affected. EO data is used to monitor major transportation routes, remote energy corridors, border crossings, and facilities such as granaries, reservoirs, and warehouses. Satellogic offers more capacity for distressed nations to task exactly what they need, when they need it. We believe leaders need more autonomy to capture timely imagery rather than waiting at the mercy of other governments to release information.

Safe corridors, such as those used for food, can also be used to distribute medicine and other essential supplies. Continuously monitoring of these areas and early detection of potentially suspicious situations or military movement can keep teams on the ground informed and ready for evacuation if necessary.

Meanwhile offshore, hundreds of cargo ships were moored with port backlogs growing as the COVID-19 pandemic surged. The issue was exacerbated by the fact that many nations' port infrastructure has yet to evolve to accommodate the increase in global commerce, instead depending on antiquated methods of ship traffic control. EO data helps port authorities monitor their maritime domain to identify operational efficiencies for safety and to take a pulse on economic indicators.

Figure 3: Mt. Stromboli on Stromboli Island, Italy.

Smart Cities & Resilience

On a more positive note, EO applications for sustainable energy and smart city planning are maturing.
India currently holds the largest solar park in the world: the 57-square-kilometer Bhadla Solar Park in Rajasthan. Did you know EO data can help estimate solar output? It can also monitor the construction, operation, and optimization of vast sites such as the Bhadla Solar Park, and reveal insights for future projects.

Sustainable energy is only one aspect that city planners must consider before they build smart cities. Understanding population needs, growth expectations, economic opportunities, transportation and other logistics are key to a well-orchestrated smart city strategy.

Urban development and urban sprawl are rapidly increasing in many areas worldwide. Cities such as Lagos, Nigeria, have grown in population by a 3% yearly average since the turn of the century. Such growth — and its associated sprawl — has led organizations such as the World Bank to finance urban development projects. Urban developers working on sustainable projects can use EO data to gather additional demographic data useful for city-level spatial planning.

Due to their location and housing stability, low-income populations are more likely to be directly affected by natural disasters. They also face greater barriers to relief and care during and after such events. Combined with demographic data, Earth Observation can identify vulnerable populations and the most effective opportunities to update and expand these communities for more excellent resiliency and economic growth.

In a world that now hosts 8 billion people, the accessibility, reliability, and affordability of EO data will become a formidable tool in tackling our toughest challenges. From human conflict to natural disasters understanding and keeping up with our changing the world has ever been more important, or more possible.

Now You See

Satellogic is leading a new era in Earth Observation. One that can transform nearly every aspect of our relationship with the planet. But it will take a global village. This is a term we like to use when describing the collaborative effort true sustainable transformation demands. And we are diligently working to enable greater global participation by increasing capacity and reducing barriers to access.

About Satellogic

Founded in 2010 by Emiliano Kargieman and Gerardo Richarte, Satellogic (NASDAQ: SATL) is the first vertically integrated geospatial company, driving real outcomes with planetary-scale insights. Satellogic is creating and continuously enhancing the first scalable, fully automated Earth Observation platform with the ability to remap the entire planet at both high frequency and high resolution, providing accessible and affordable solutions for customers.

Satellogic's mission is to democratize access to geospatial data through its information platform of high-resolution images and analytics to help solve the world's most pressing problems including climate change, energy supply, and food security. Using its patented Earth imaging technology, Satellogic unlocks the power of EO to deliver high-quality, planetary insights at the lowest cost in the industry.

With more than a decade of experience in space, Satellogic has proven technology and a strong track record of delivering satellites to orbit and high-resolution data to customers at the right price point.

To learn more, please visit: http://www.satellogic.com

Figure 4: The Fimiston open pit mine, Australia.

Beirut - Digitizing the city after the explosion with PIX4Dcloud.

Using Photogrammetry SaaS for Modern Construction and Surveying

By Eloise McMinn Mitchell
Content Marketing Specialist
Pix4D

Software as a Service, or SaaS, is one of the best developments in the technology center. The idea of licensing software and delivering it as a subscription brings flexibility and accessibility to cutting-edge tools. It is an incredibly varied model; Netflix is a SaaS. So is Zoom, Google Workspace, and Salesforce. SaaS is not industry-specific and is instead a model of how a flexible sales strategy can work in the tech sector.

Pix4D is a specialized provider of SaaS. Pix4D is a photogrammetry software developer headquartered in Lausanne, Switzerland, with global offices around the world. Their software is centered on photogrammetry - the science of measuring with images. Photogrammetry can be used in a variety of industries, including surveying, construction, and public safety. The images used for photogrammetry can be captured by drone, plane, or phone. It's a versatile tool used the world over.

One of Pix4D's most popular products is PIX4Dcloud. PIX4Dcloud, as the name suggests, is an online platform for photogrammetry. Its workflow is simple: upload images captured aerially by drone or terrestrially with mobile devices, and the software will process your imagery to create usable outputs. It takes the burden of processing hardware off the user. Simply upload the imagery and await the email notification that processing is complete.

The outputs of PIX4Dcloud include 2D maps, 3D meshes and point clouds, and elevation models. PIX4Dcloud can be upgraded to PIX4Dcloud Advanced, which includes additional tools and features, such as a timeline for tracking progress over time as well as Overlay and Comparison tools. Currently, the software is tailored to suit construction or surveying professionals, as well as public safety operatives who want to recreate scenes in 3D.

Typical Applications of PIX4Dcloud

Before processing can begin, imagery must be gathered. Data collection for PIX4Dcloud is varied. Although Pix4D is owned by the Parrot group it is hardware agnostic and offers a huge range of compatible drones and cameras. Whether you are using a drone or a mobile device to gather imagery, the software can process the data. This variety means the software can be used for a range of projects and provide a useful service. PIX4Dcloud can process up to 4,000 images at a time whereas desktop software can process larger datasets, but requires expensive hardware to get results in a timely manner. The 4,000-image size project is plenty for most work- and multiple projects can be stitched together after processing if necessary for larger-scale outputs.

The Varied Applications of SaaS Product PIX4Dcloud

There is such a huge range of uses for cloud-based photogrammetry software, but here are a few key examples showing the direct benefits of using the technology.

Saving $100,000 on Construction with Cloud Drone Mapping

Multi-story buildings are massive construction projects that require precise site management - something that is achievable with drone mapping. After aerial image capture, maps made with photogrammetry can identify mistakes before they become a problem, helping save money and time, whilst also monitoring progress that can be shared with external stakeholders.

PIX4Dcloud Advanced was used by W.E. O'Neil Construction in Chicago. They were working on One Oak Brook Commons, a 17-story upscale apartment complex in Oak Brook. Monitoring the site was made easier with photogrammetry software - rather than sifting through hundreds or thousands of images, they can instead inspect 3D models or 2D maps over time. W.E. O'Neil used aerial imagery to map each layer of concrete as new decks were added to each stage of the building. They were working with post-tensioned concrete slabs, which are reinforced with steel cabling and tensioned after the deck has been placed. Getting it wrong, or misplacing a sleeve to hold the cables, would require expensive equipment to fix and rework. Ground penetrating radar (GPR) or X-ray has to be used to scan the deck to locate the cables and then re-organize the operation. It also requires the accurate coordination of deck penetrations prior to placement of the new concrete deck to ensure the size, quantity, and locations of penetration points are correct. One missed sleeve can cost $2,000 to fix.

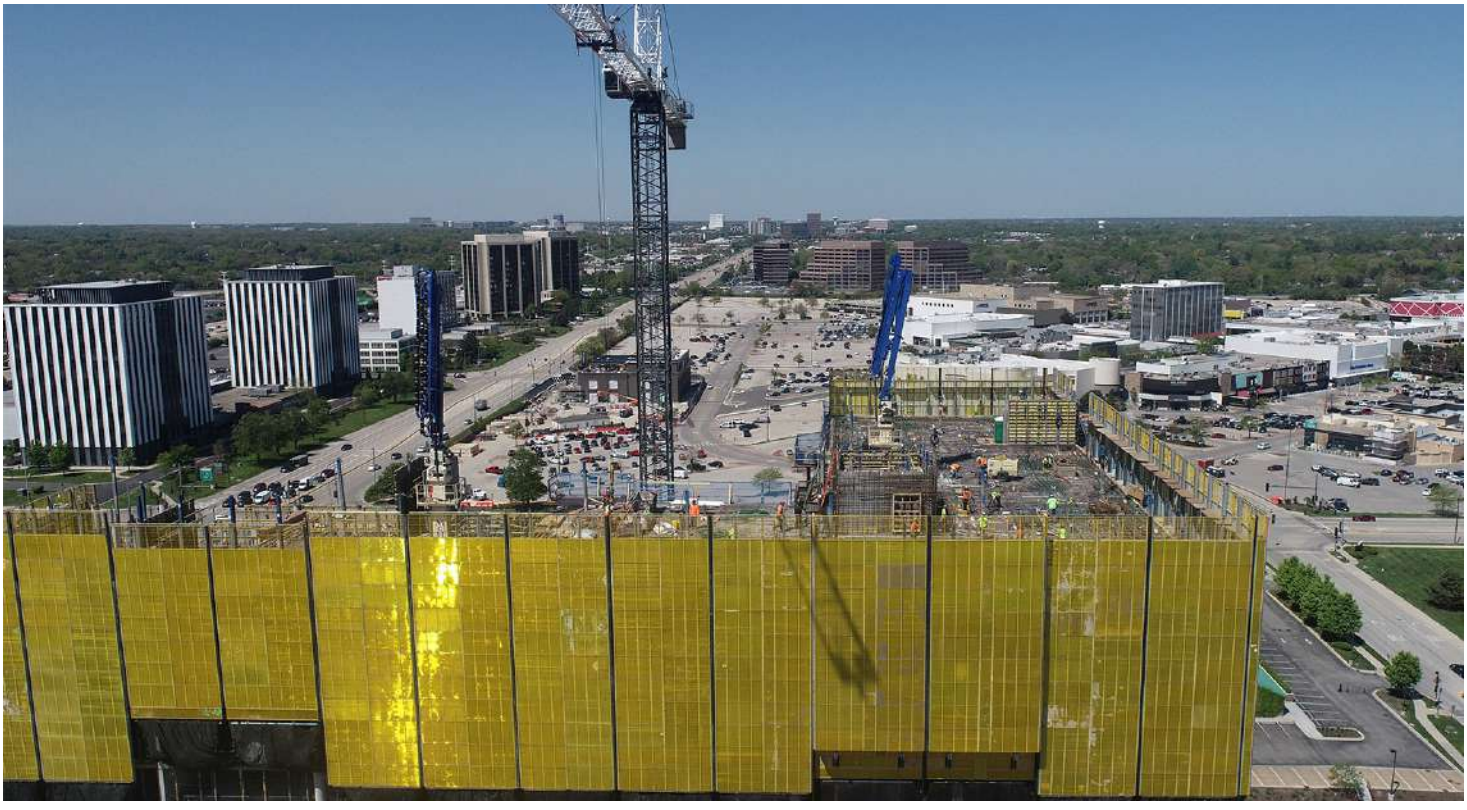


Figure 1: ONeil Building - managing a construction site is easier with aerial drone maps on PIX4Dcloud.

This is where PIX4Dcloud was used. To prevent expensive rework, W.E. O'Neil created maps of the deck of each floor with PIX4Dcloud to ensure the coordinated penetrations were completed correctly and compared the as-built map with the as-designed plans. PIX4Dcloud Advanced enabled them to overlay the as-built and as-designed elements to ensure clear comparisons and see if any errors had been made. From this project alone almost $100,000 were saved in the early identification of missing sleeves of concrete.

The benefits of using PIX4Dcloud included the fast data collection with drones (just 15 minutes of flight), the online processing making working on-site easy, and the ease of overlay. The entire process of capturing and reviewing took less than two hours from start to finish. Over the course of 2 months, the team mapped 12 floors in the building. They identified 48 missing sleeves prior to deck placement, saving money as well as time in avoiding rework that would delay construction.

Working on a Smaller Scale: Monitoring Urban Development

What if you're working on something smaller? What if you need permanent records for the authorities to use? Even here, the SaaS workflow with PIX4Dcloud has an answer. In Singapore, where the dense city requires fast-moving construction to avoid congesting the city, PIX4Dcloud was deployed by HSC Pipeline Engineering, who were installing underground pipelines in the city. They needed to digitize their sites for use in tracking progress, communicating with planners, and keeping up-to-date records of the underground infrastructure before it was buried.

Due to strict drone laws in Singapore and the urban setting of the project, drone mapping was not an option. Instead, they used the viDoc RTK rover and the app PIX4Dcatch for capturing data and PIX4Dcloud for visualization, analysis, and communication with stakeholders.

The viDoc is a handheld rover that attaches to certain mobile devices (both iOS and Android) and connects to NTRIP networks. It pairs with the free app PIX4Dcatch, which is used to gather photogrammetry data on the ground. Together, the software and hardware collect imagery that is tagged with geolocation data. When processed, the results are accurate to within centimeters. This workflow has been certified by the Bureau Veritas for Class A measurements and surveying.

HSC Pipeline Engineering used PIX4Dcatch and the viDoc to gather data on an iPhone 12 Pro Max, and then processed it online with PIX4Dcloud. When processing was completed, the engineers could begin digitally reproducing excavated trenches that they could present to stakeholders needing to complete inspections, reviews, and further planning. They could rely on the accuracy of the results thanks to the RTK data collected with the viDoc. On this project, they needed to dig trial holes every 30 meters. Over a typical month, HSC lays over 3,000 meters of pipes which can reach 67,200 hours of work per year and cost $1,800,000. With the viDoc, the operations on-site for surveying and monitoring the site have sped up by 30 - 50%.

Surveying with the viDoc and PIX4Dcloud means engineers can get highly accurate results from mobile devices. The use of a cloud-based SaaS model means that HSC can process their results as they work, which does not slow down construction. PIX4Dcatch has a live feedback model that ensures enough data has been collected prior to processing, so a trial hole may be filled whilst the 3D model is processed, saving time without compromising safety. The time savings results in cost-savings and an improved surveying workflow.

Figure 2: Laying pipelines - the viDoc helped collect data that was processed on PIX4Dcloud.

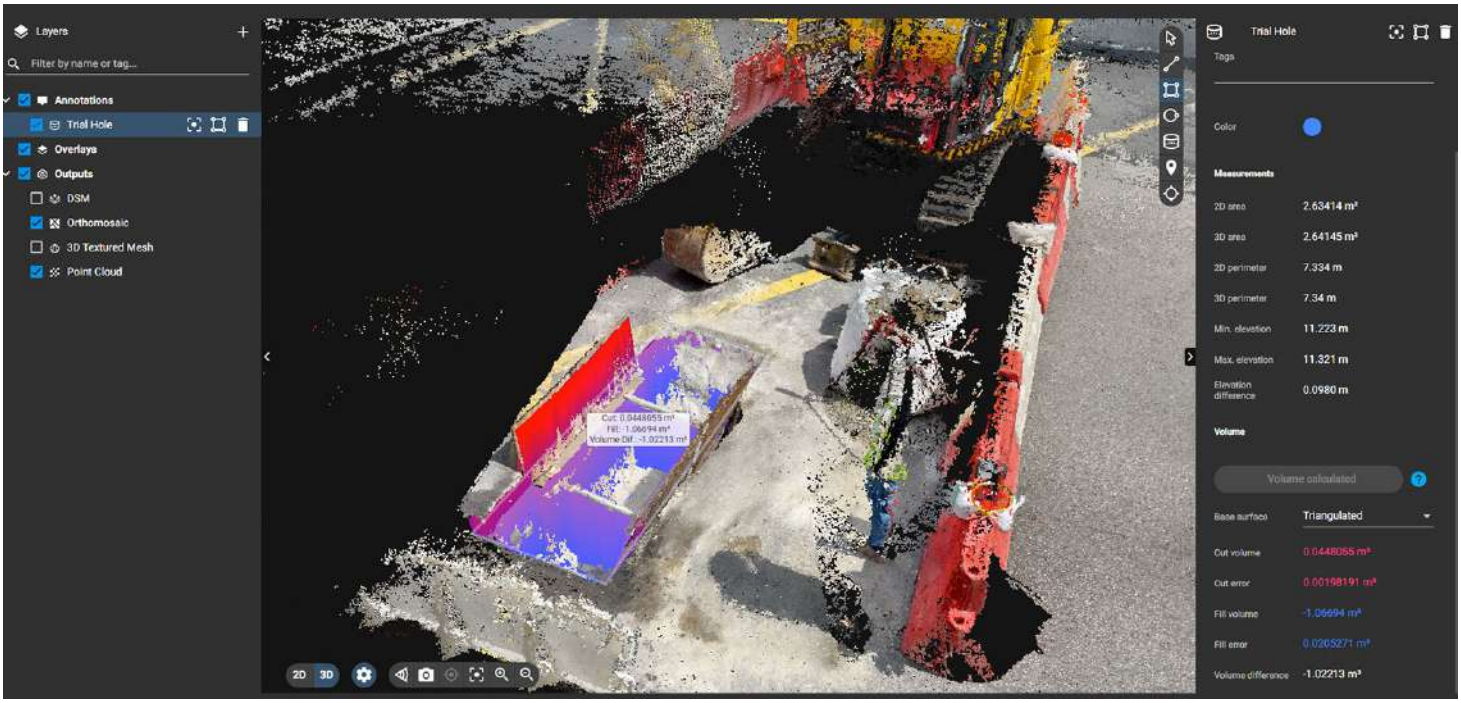


Figure 3: Laying pipelines - the trench reconstruction in 3D can be measured and analyzed off-site.

Monitoring a Volcanic Eruption with Cloud-based Drone Maps

PIX4Dcloud isn't just used for surveying or construction projects. It has also had an active role in public safety operations. In 2021, the Cumbre Vieja volcanic area on the Canary Islands erupted. The blast was the first in 50 years, and thanks to mild warning signs prior to eruption, scientists were on-site when the eruption happened on the 14th of September, 2021. A volcanologist from the National Geographic Institute of Spain (IGN) arrived a few days before the volcano erupted.

Once the volcano erupted, lava was spewed hundreds of meters into the sky and flowed across the island. The flow is very dangerous as it can have a very varied flow rate, engulfing buildings and infrastructure with little warning. IGN tracked the eruption for 85 days with PIX4Dcloud. They mapped the lava flows to the coast and measured the new land that was created by the volcanic flow, including volume and surface area measurements.

Drone mapping and a SaaS platform helped protect the volcanologists who could carry out detailed surveys of the volcano and track the lava flows without getting too close to the danger zones. The volume and distance measurements completed with PIX4Dcloud proved useful in quantifying the changes to the terrain. 1200 hectares were measured, resulting in orthomosaics and a 3D point cloud. After the eruption ended, the volcanologists flew a drone to the volcanic cone and measured it with PIX4Dcloud to assess how the volcano had changed after the eruption. This serves as a record for the authorities and will be used to track any further volcanic activity on this island - at which time, an extensive PIX4Dcloud license could be reactivated.

The Humanitarian Applications of SaaS

PIX4Dcloud is online and available wherever the Internet is. This makes it a key resource for sharing data - whether it's a terrain model or trench scan. The shareability and data connectivity led to it being a powerful tool in the recovery efforts of the Beirut explosion in 2020.

In August 2020, an ammonium nitrate storage facility blew up in the port of Beirut. The shockwave damaged buildings in a 5km radius. This disaster struck at a time when Lebanon was already facing political turmoil and the Covid-19 pandemic. The recovery project was immense and some were unsure where to begin. Augment, a Luxembourg-based company wanted to use data to assist recovery. They wanted to create a 3D model that would be shared between recovery teams freely. With special permission from the Lebanese government, they set out on collecting aerial data with assistance from Geospatial Minds and Falcon Eye Drones (FEDS).

The data was collected with an eBee X drone and 3D camera. The images were georeferenced with PPK to ensure the accuracy of the project. It was processed on PIX4Dcloud according to the neighborhood, resulting in 13 projects that were each PPK corrected with eMotion. Augment's team collected data throughout the city with permission from the local authorities. The drone captured buildings and their facades, showing the scale of destruction.

PIX4Dcloud created a dense point cloud, a 3D textured mesh, an orthomosaic, and a DSM. All of these outputs were hosted on Augment's website and shared with Open Map Lebanon. Anyone could download the models or view them online on PIX4Dcloud, whether they were residents trying to check if their street had been damaged or for public safety teams to deploy teams to certain areas. The software enables close analysis and thanks to the PPK, it was highly accurate.

PIX4Dcloud has a virtual inspector feature that means users could select a 2D or 3D point and see the images used to process that point, showing more angles and details as well as the map/model. The timeline view also allowed Augment to overlay previous maps to compare the damage and showcase which areas needed the most help. The uses of this 3D model also include blast modeling, emergency reconstruction, damage assessment, flood risk monitoring, urban planning, and infrastructure planning.

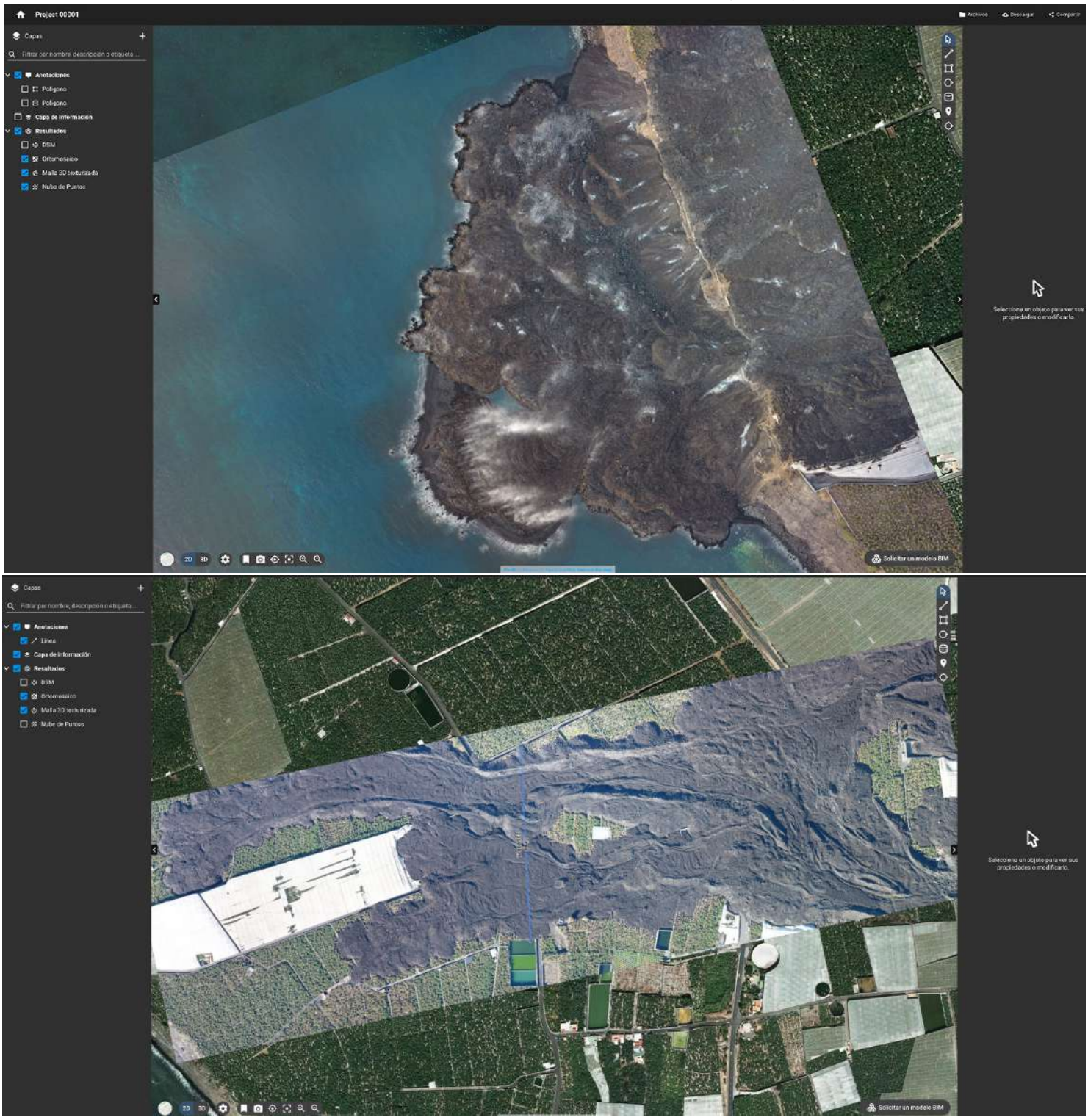


Figure 4: Volcano monitoring new land formation with PIX4Dcloud (top). Overlaying maps with the lava flow on PIX4Dcloud (bottom). Image credit: Stavros Meletlidis.

What's Next for SaaS and Geospatial Applications?

There is clearly a huge market for the applications of software like PIX4Dcloud. It is versatile and industry agnostic. Whilst these are some examples of its work, there are dozens of use cases around the world where it has been used in different ways. As it is a SaaS platform, it is available as needed, giving people control over their projects. For industries like construction, where there can be a slowdown during specific seasons, professionals have better control over their running costs by using the SaaS license as and when they are needed. Surveyors, they can take advantage of using a constantly evolving product that is frequently updated with new features integrated.

So where is it headed next? SaaS will continue to grow in popularity as more and more technology develops to make everyday life easier and more straightforward. For surveying and GIS purposes, expect to see continuing developments in more accurate projects, as well as larger datasets with faster processing times. With the continued development of the hardware used for processing, cloud and desktop services alike will unlock new capabilities.

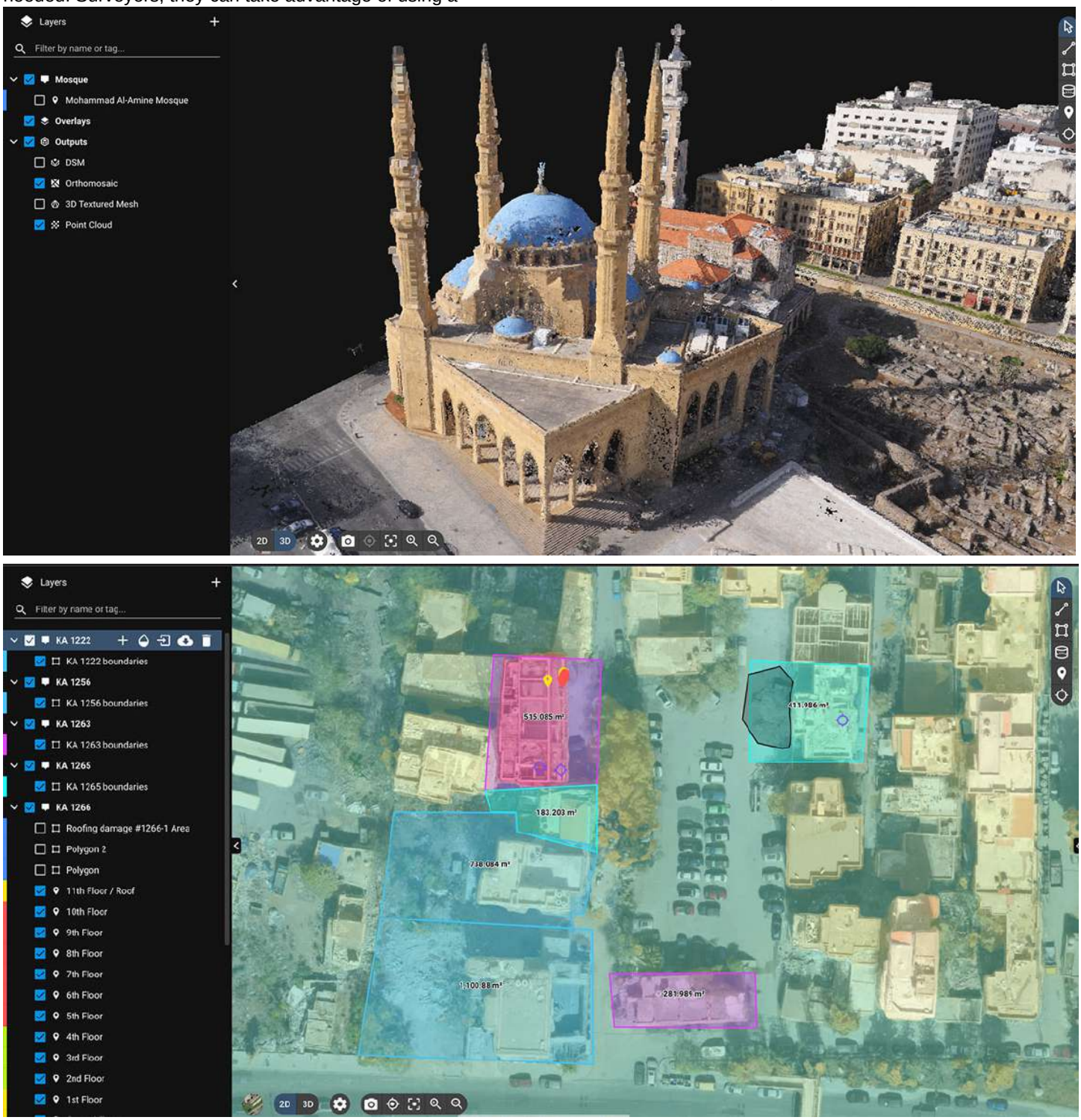


Figure 5: Digitizing Beirut city after the explosion with PIX4Dcloud (top). Individual areas were inspected with PIX4Dcloud and assessed for damage in Beirut city (bottom).

Forest cover monitoring and mapping.

Providing a SaaS for Geospatial Applications

By Olya Ryabinina
Head of Growth
Orbify

Many organizations today are not sufficiently benefiting from geospatial insights to drive their critical business decisions. Orbify's unique self-service SaaS helps such organizations to quickly create and deploy their own applications to start gaining new insights.

Why Earth Intelligence is the Next Big Element for any Sustainable Business

While geospatial data access has been democratized greatly over the last few years, businesses are not able to monetize on the insights that can be derived from it. Although there are multiple reasons that explain why this is the case, one major reason is that organizations misperceive their own resources, what is on offer in the market and how to match both.

To put it differently, organizations that can and should be benefiting from geospatial insights are still under the impression that they need to have a whole data warehouse and specific talent on board in order to be able to have access to such applications. In reality, this is no longer the case: a large number of earth intelligence startups are filling up that void today.

Why Companies Are Missing Out On Relevant Insights Today

Though there is more geospatial data being captured today than ever before, companies are not benefitting from the

insights that could be derived from such data. In other words, there is a large gap between data providers and potential end users. The real problem lies in the analytical software to derive insights from raw earth observation data and its end users: there's a mismatch between the end users, who are not the analysts working with the data but non-technical stakeholders who need the insights that can be derived from earth observation data to take better business decisions. The analytical software used by geospatial data engineers is often targeted at academic use instead of commercial business, which often offers a poor user experience which increases the barrier to entry. Equally complicated can be a large amount of data sources and analysis tools, increasing the time to market for solutions that do make a difference for commercial use.

However, today's cloud technology, combined with AI/ML, no code tools, and publicly-available earth observation datasets offer opportunities never encountered before to benefit each and everyone who needs insights derived from geospatial data to drive their business decisions. Let's discover how Earth Intelligence startup Orbify combines each of these components to offer a unique value proposition for different stakeholders, including commercial businesses, NGO's and a variety of startups/scaleups.

How Orbify helps Businesses to Unlock the Value of Geospatial Data

Orbify is a cloud-based platform that enables transforming satellite imagery and geospatial data into fully functional web applications, interactive dashboards, and reliable APIs. This makes it easier for different stakeholders to unlock the potential of geospatial data and use it for critical decision-making. More specifically, Orbify helps companies do realize the following goals:

- Unlock the full potential of geospatial analytics, without the time, cost and expertise required to-date
- Visualize and share geospatial insights with internal and external non-technical stakeholders
- Improve the quality of current service offerings via customer self-service and web interface
- Scale and expand the current business offering, build new solutions, manage large numbers of users and adapt to the cloud.

With this SaaS offering, Orbify responds to the growing demand for geospatial analytics. Accelerated by climate change, the market for geospatial analytics is growing by double digits and amounts to €60B. Players of all sizes are seeing the need for geospatial insights, including the energy sector, the public sector, finance and insurance, and food and agriculture. The following graph shows the global outlook for geospatial analytics, which is huge:

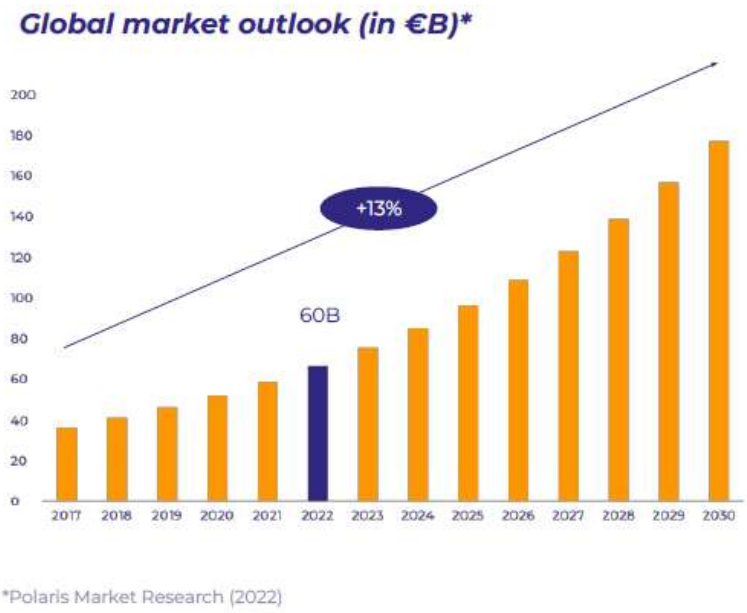


Figure 1: Global market outlook for geospatial analytics in €B.

Orbify Platform Components

Let's have a closer look at the different components of Orbify's SaaS: data, algorithms and visualization tools.

Data and satellite imagery

Orbify provides its users all publicly available satellite imagery (optical, IR, SAR) and geospatial data. For use cases where public level data is insufficient, commercial data from commercial vendors that offer for example a higher revisit time than public level data providers. Finally, Orbify enables its users to bring in their own, private data that they can upload and process on Orbify, such as LiDAR coming from UAVs.

Algorithms and visualization tools

Data is only the foundation for analysis because raw data in itself cannot be analyzed. Therefore, Orbify provides algorithms based on AI/ML and heuristics to process data in the form of high-level components to reach conclusions. In addition to data and algorithms, Orbify provides visualization components for building actual web GIS applications for its end users, such as intuitive charts, maps, interactive UIs, AOI exploration and user management.

These components let non-technical stakeholders create geospatial intelligence via data dashboards, web applications and API/web services. For example, they can interact with maps in a browser-based app, draw charts and make basic reports. End users such as foresters, fishermen, firefighters and farmers expect an application that is easy-to-use and self-explanatory. In addition to

these visualization components, Orbify provides builders with components for managing user access, and billing clients through integration with services such as PayPal and Stripe. Data processing occurs in either Google Cloud or AWS. Orbify enables integrations with Ellipsis Drive, a cloud-based service for spatial data exchange comparable to Dropbox.

Orbify Offers Both Coding and No Code Tools

Orbify builders have the option to use a no-code interface to create applications, but there's also a Python editor for engineering experts. This approach is comparable to WordPress, where users can use drag-and-drop components, or upload their own HTML or CSS to style a website the way they want. Everything Orbify offers is cloud-based given the scale of computational challenges to be presented in a quick manner. Orbify uses a freemium pricing model, meaning that it's free to start using the platform, but users who require more features may need to start paying for using Orbify's services.

Current Popular Use Cases for Orbify's Saas Platform

While satellite imagery is used for a large number of use cases, the most popular use cases for Orbify's platform are currently forest monitoring, air quality monitoring, urban planning, and water quality monitoring:

Forest monitoring

Orbify built a rainforest monitoring solution for an NGO in Ecuador. Because of the humidity in that part of the earth, there are lots of clouds, and the area of interest is located in the mountains. This meant that SAR data was an option: the lops of terrain caused problems with interpreting the back cut. Because of both the clouds and the revisit time of the area, it was impossible to build cloud-free images. The solution was to use commercial data from a vendor with higher revisit times.

Air quality monitoring

Satellite images help identify where pollution exists and its origins, such as fires, dust or sand storms, volcanic eruptions, etcetera. Understanding the sources of air pollution can help in defining measures to improve air quality. For example, haze may be caused by local traffic, industry (such as a coal-burning power plant), or another source farther away. On a larger scale, satellite imagery is used to track methane emissions, which are one of the largest contributors to today's climate change and global warming.

Urban planning

High-resolution satellite imagery is used to gain accurate historical records of surface temperature recordings in cities, in order to identify neighborhoods negatively affected by urban heat islands in the past. With better knowledge about hotspots for heat, officials and NGOs can optimize locations for cooling centers, build partnerships to amplify heat warnings and raise awareness for adapted coping strategies for urban heat stress.

Water Quality Monitoring

Equipped with various high-resolution sensors, satellites are capable of analyzing, modeling, and forecasting explosive growth of algal populations called HAB (Harmful Algal Bloom) which may severely destabilize and devastate surrounding ecosystems. Remote sensing technologies enable quick and reliable monitoring HAB activity and acquire an insight to better understand conditions suitable for blooms, in order to better predict when and where they may occur so that resources and mitigation efforts can be allocated accordingly.

Orbify's Unique Value Proposition

Contrary to many geospatial analysis applications on the market, where the analyst and the end user are many times one and the same person, Orbify makes it easy to share geospatial data analysis done by a technical expert with a non-technical end user. As an example, Orbify offers an online demo app showing Amazonian deforestation in a browser window, together with a

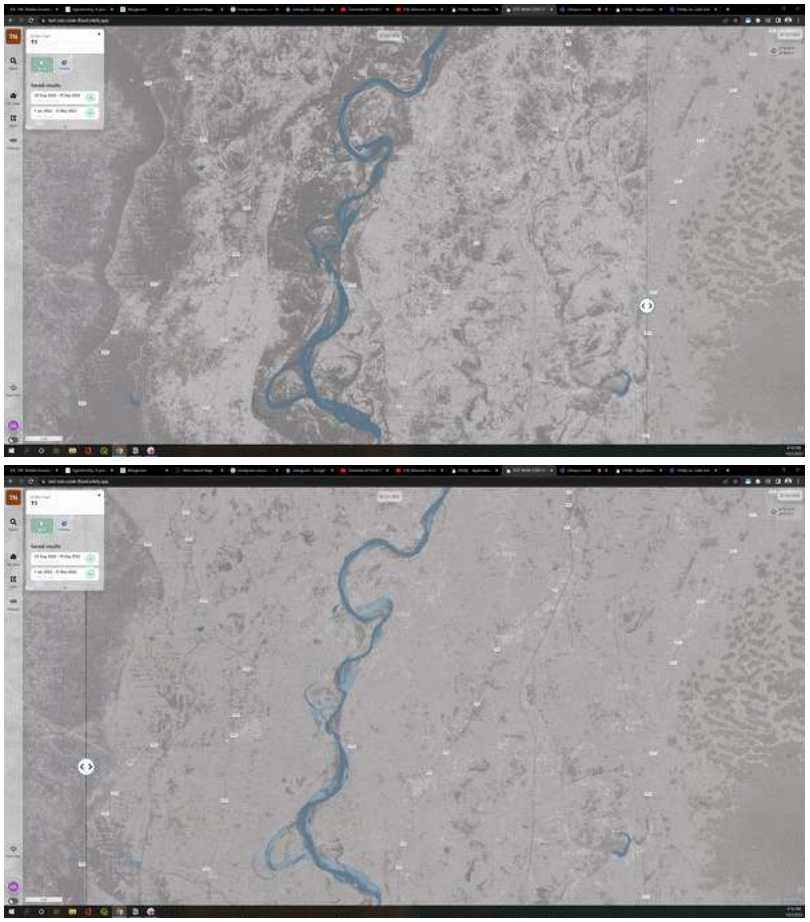


Figure 1: Orbify interactive UI for change detection - before (top) and after (bottom).

graphical representation of an analytical workflow, consisting of an overview of all input data, data calculations/ transformations, and visualization of the results.

All Orbify apps can be created from a template, while an existing workflow can be adjusted easily by the builder, as well as those who are granted access to the application, possible pricing plans, and high-level computation algorithms. All these design choices are hidden from the end user, who is presented with an easy-to-use and easy-to-understand client application. That way, it becomes impossible to break anything. It is this separation of concerns or dichotomy between builders and end users that makes Orbify unique.

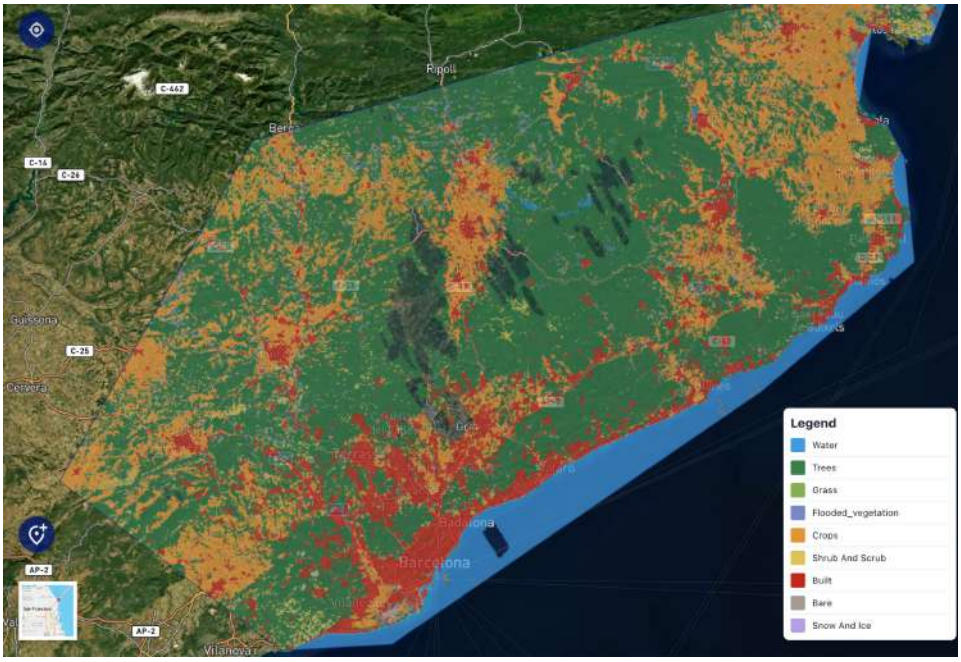


Figure 2: Land cover mapping.

Bringing Orbify's Platform to the Next Level

Even though currently in beta, Orbify currently has over 600 activated users with over 400 applications created. It received over 6000 early access requests, and is currently talking to more than 300 prospects, of which 52 are at an advanced stage. These include both startups and larger entities. The target is to reach 100 paying app builders and a community of 3,000+ active app builders in the coming 12+ months.

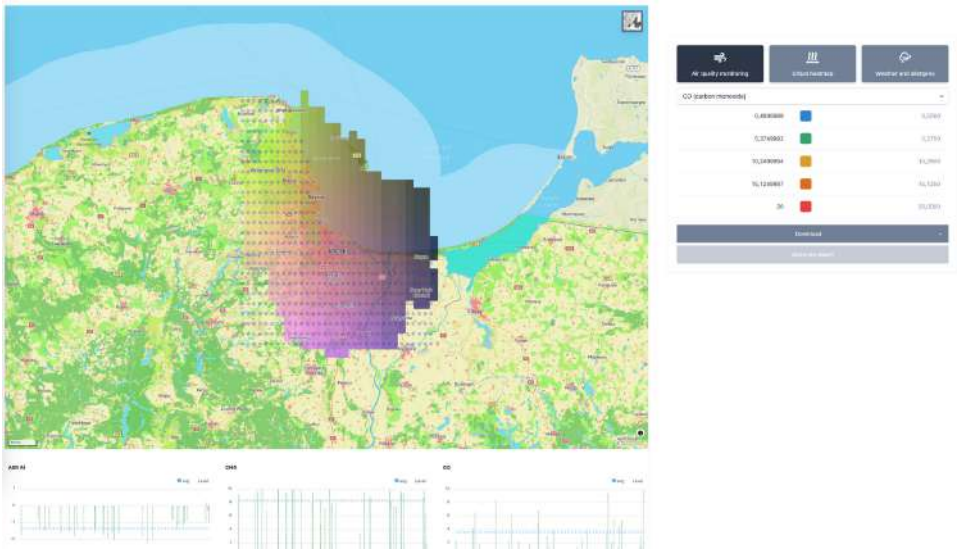


Figure 3: Air quality monitoring and mapping.

Currently, Orbify is working on an online marketplace where builders who may be deep into earth observation, but maybe less focused on marketing commercial aspects of business development can offer their apps to end users. Thanks to Orbify's app marketplace (O Store), they will be available for those looking for applications developed by others that solve their business problems without having to build an app themselves. Another big release is that the Orbify platform will be open to everyone from January 1st 2023. Until now, the platform was only accessible for users who signed up for early access.

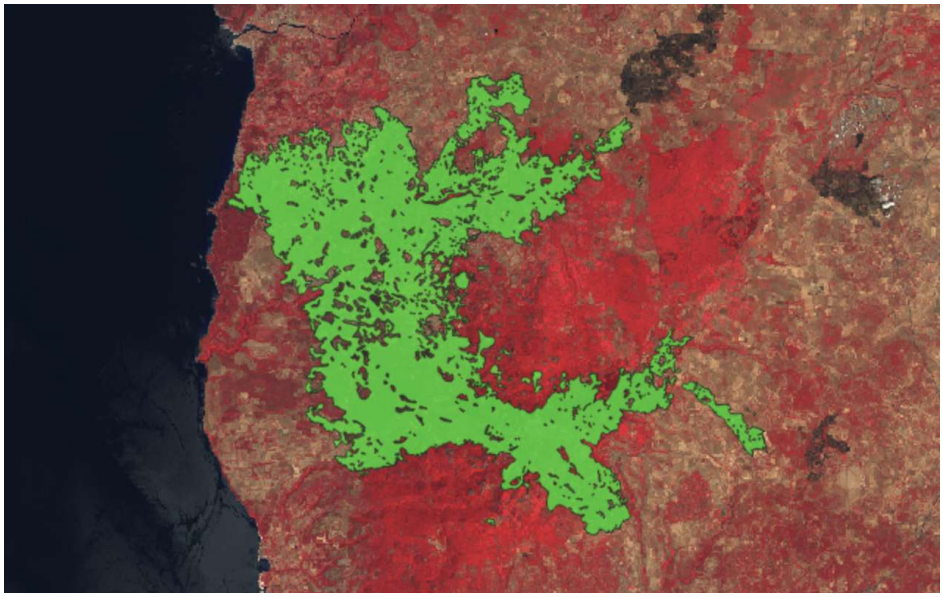


Figure 4: Forest cover monitoring and mapping.

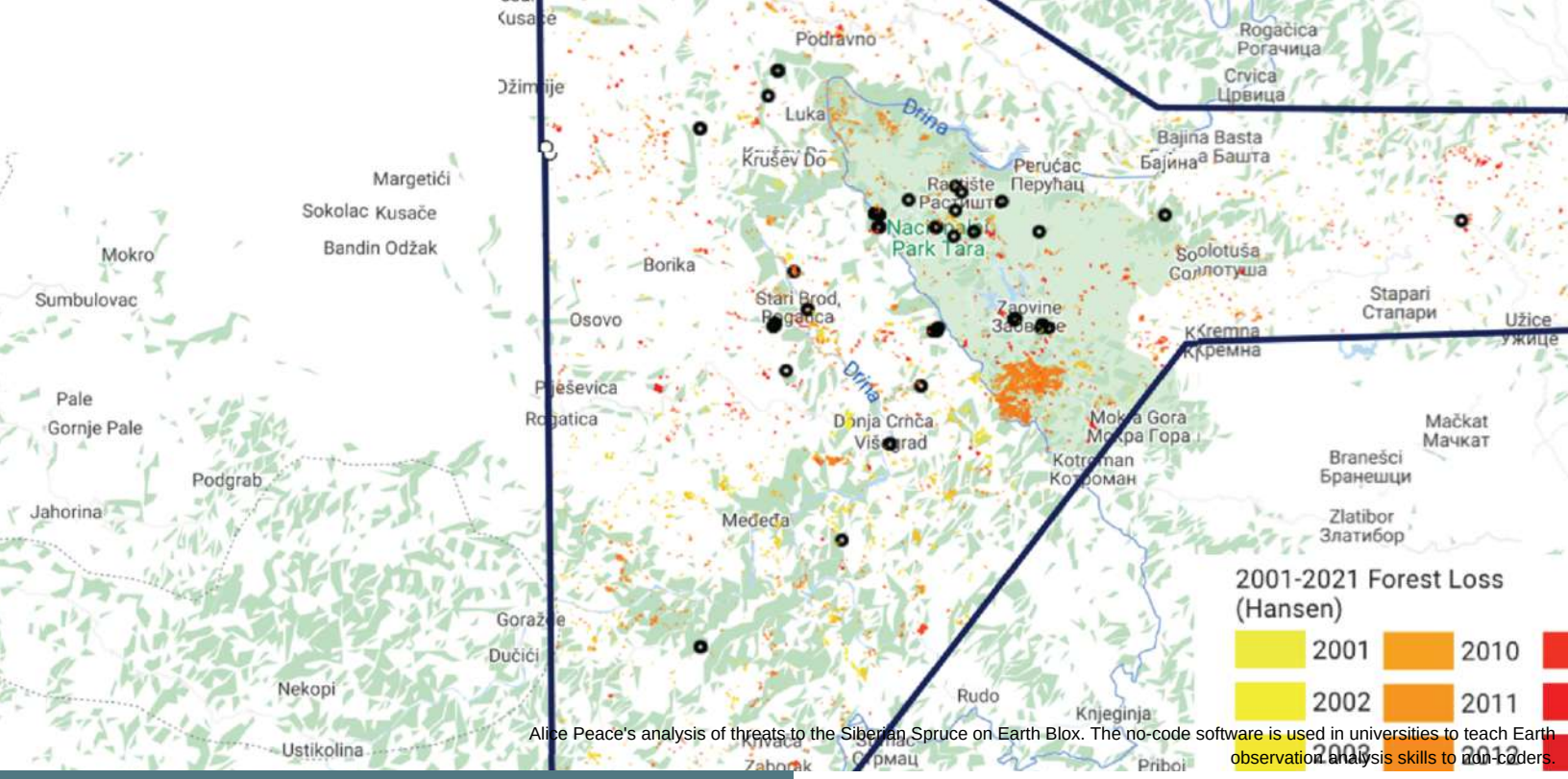
This article explains why organizations are missing out on the insights that can be derived from geospatial data. They think they need to have their own in-house data warehouse, but this is not the case: a SaaS offering such as Orbify offers organizations

the tools, data, and cloud infrastructure to build applications that analyze geospatially and visualize the results. Next, the different components of Orbify's SaaS offering are covered, and how the dichotomy between builders and end users is what makes the company unique from competitors. The most popular current use cases are covered, which are air quality monitoring, urban planning, water quality monitoring, and forest monitoring.

Orbify aims to grow significantly in the coming 12 months, by bringing in new users, and builders and opening the platform to everyone. Finally, an online app marketplace (O Store) is planned for launch in 2023.

Check for yourself how easy it is to showcase insights on deforestation using Orbify through this online demo app.

Figure 5: A screenshot from Orbify's demo app showing Amazonean deforestation levels.



Alice Peace's analysis of threats to the Siberian Spruce on Earth Blox. The no-code software is used in universities to teach Earth observation analysis skills to non-coders.

Scaling Nature Based Solutions: The Role of No-code Geospatial Software in the Fight Against Climate Change

Cassie Anderson
Head of Marketing
Earth Blox

Nature-Based Solutions (NbS) were high on the agenda at COP27 last month, with the Presidency urging collective action and financing from governments and organisations. In what is expected to be a defining decade for the climate, we explore the role of no-code geospatial software in helping to scale NbS for the mitigation of climate change.

What are Nature-Based Solutions?

Nature-Based Solutions (NbS) is an umbrella term coined by the World Bank in 2008 to stress the importance of habitat conservation in the fight against climate change. NbS are defined by the UN Environment Assembly (UNEA) as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."

Investment into NbS is expected to triple by 2030 and increase four-fold by 2050 in order to meet global climate change, biodiversity and land degradation targets. A recent report, Decent Work in Nature-based Solutions, by the International Labour Organization (ILO), the United Nations Environment Programme (UNEP) and the International Union for Conservation of Nature (IUCN) estimates 75 million people work in the sector today with the potential to grow to almost 100 million by the end of the decade if this investment is secured.

From monitoring, reporting, and verification of projects, to quantifying and evidencing their impact, geospatial data has a vital role to play in supporting in scaling NbS. The European Union Agency for the Space Programme (EUSPA) reported that the Earth observation (EO) value-added services market is projected to grow from £1.86bn in 2021 to £3.97bn by 2031. Many of the top sectors projected for growth, such as agriculture, climate services, energy and raw materials, have an interest in NbS.

In order to support the scaling of NbS there are three key requirements for geospatial technology - easy access to big Earth data, affordable and user-friendly software, and education to train the future workforce. Let's explore them here.

Access to Big Earth data

In 2010, Google launched Earth Engine at COP15, marking the entry of the tech giants into the big Earth data market. Microsoft and Amazon Web Services would later follow. Today, all three provide access to extensive Earth observation and satellite imagery databases, including Landsat and Sentinel-2 data, along with the cloud's computational power needed to process and analyse the images.

Open access is typically given to academics and NGOs for environmental and research purposes. However, earlier this year, Google announced its commercial offering for Earth Engine through Google Cloud in response to demand from businesses and governments for access. Earth Engine's public data archive comprises over 900 datasets and contains over forty years of historical imagery and scientific datasets that are continuously updated.

Access to big Earth data was a crucial driver in the development of the Strata, a climate risk analysis platform designed to assist over 130 United Nations (UN) country teams to bring together data from diverse sources and give them greater clarity on where climate stresses are at their highest. The project was delivered through a collaboration between the United Nations Environment Programme (UNEP), the University of Edinburgh, Google Earth Engine, the Group on Earth Observations, and Earth Blox.

Strata supports the UN in determining where environmental and climate stresses are converging and contributing to increased risk of maladaptation, fragility, migration, and conflict. Strata integrates environment and climate stressors whose outputs can be analysed on Earth Blox, encompassing precipitation, flooding, fires, tree loss, and land productivity, among others.

Today, the Strata Climate Risk Analysis platform is used by over 300 UN staff and enables international collaboration. Complex analysis of Earth Engine and other datasets can be rapidly implemented and customised at the click of a button, allowing them to become more efficient with satellite and other geospatial data and spend more time delivering high-quality project outcomes.

David Jensen, Head of the United Nations Environmental Peacebuilding Programme, described Strata as "version 4+++ of what's available on the market." Adding that it "could deliver a significant impact for climate and environment risk management."

Affordable and User-Friendly Software

While access to big Earth data is easier than ever before, being able to analyse and interpret the information is not as straightforward. Earth Engine, Microsoft Planetary Computer, and Amazon Web Services make their data available through APIs and online coding interfaces that require computer programming skills to use them. To use Earth Engine, for example, you need to be able to code in Python or JavaScript.

These restrictions led a team of remote sensing scientists and academics to build Earth Blox. They understood the only way to accelerate the adoption of Earth observation insights in the fight for our planet was to make it more accessible. The team developed the no-code software for Earth data analysis and

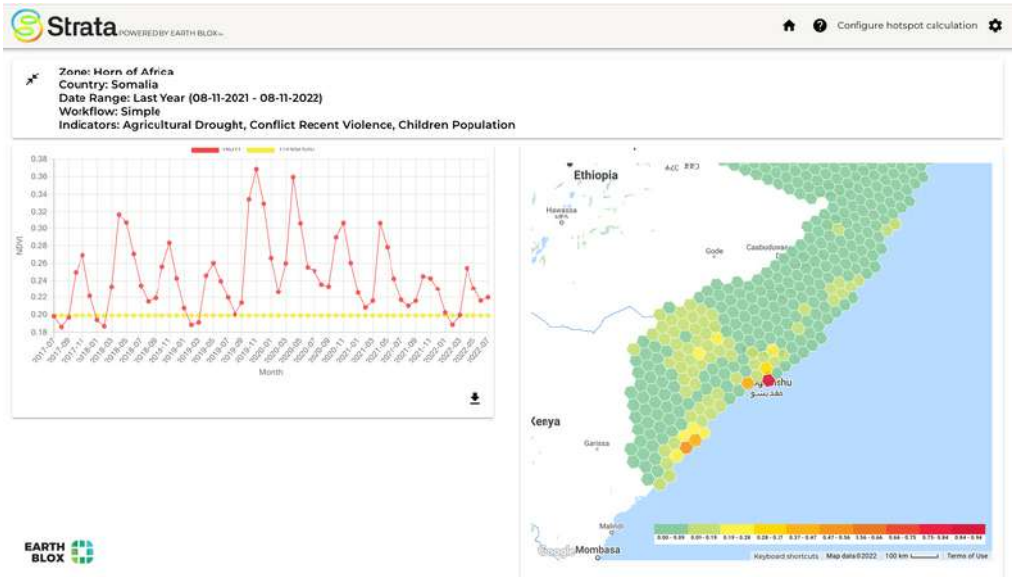


Figure 1: The Strata Climate Risk Analysis platform, powered by Earth Blox, provides easy access to big Earth data.

launched it in 2019. Earth Blox provides access to the entire Earth Engine catalogue and can add additional data sources as needed.

No-code software has experienced significant growth in recent years. The no-code movement empowers people to create without code. It offers non-technical professionals such as project managers and analysts the tools to build custom applications without needing to understand computer programming languages. They provide a low barrier to entry and allow users to iterate quickly. They are also flexible and can be tailored to fit specific workflow needs. The global no/low-code platform market is forecast to reach USD 65 billion by 2027.

Increasingly businesses and enterprises are turning to no-code solutions to address operational inefficiencies. One such example is a major oil and gas provider that is working to scale its NbS investments as they strive for net-zero. Their in-house NbS team is tasked with assessing project viability for investment. They found many of the questions asked of the geomatics adviser in the early stages of an assessment were repetitive and relatively basic, for example, "Can you look at the land cover and land cover change history over the last ten years?" This was fast becoming a blocker, with commercial leads sometimes having to wait up to four weeks to get an answer to a basic question in the initial stages of an assessment.

After thoroughly assessing alternative solutions, including geospatial software providers and consultants, the customer selected Earth Blox for its intuitive, drag-and-drop interface and pre-built workflows.

Through Earth Blox, the customer can access the entire Earth Engine data catalogue. And unlike other solutions that focus on single datasets, such as forests or land cover, Earth Blox allows users to layer multiple, diverse datasets to build comprehensive insights into how different environmental factors, such as fire, flood, land cover change, forest, mangroves, combine to provide the most accurate picture of what's on the ground.

Today, the NbS commercial leads can conduct initial assessments in 30 minutes rather than waiting up to four weeks for the information from the geomatics adviser. As the team grows, so too does the number of assessments, and Earth Blox unblocks this funnel by enabling commercial leads to conduct initial assessments. Without a solution for non-geospatial experts, the client would need to grow their geomatics team or hire external consultants to support the increasing workload. Using Earth Blox, a commercial lead can assess ten opportunities in the time it would take for the geomatics adviser to respond to one query within an ever growing workload.

Geospatial Education for the Future Workforce

Until recently, geospatial data and insights have traditionally only been accessible to domain experts. Equipping tomorrow's NbS workforce with the skills to use this data without having to have a PhD in remote sensing is critical to growing the workforce. The ILO's Decent Work in Nature-based Solutions report calls for universities to integrate NbS into their mainstream curricula.

In response to the Covid pandemic, Earth Blox worked with the University of Edinburgh, the European Space Agency and the UK Space Agency to develop Earth Blox Education so that students could continue learning from home. The no-code software gives universities a hands-on web tool for teaching practical geospatial data handling and interpretation without having to learn how to code.

Dr Anna Hogg, Associate Professor, EO of polar regions, at the University of Leeds, says, "With cross-faculty modules, students come with different levels of programming expertise. The aim of my course is not to teach programming but to teach them to understand, interpret and process satellite data. Earth Blox enabled me to make sure that there was no 'programming block' on achieving that objective."

When conservation and biodiversity scientist Alice Peace was

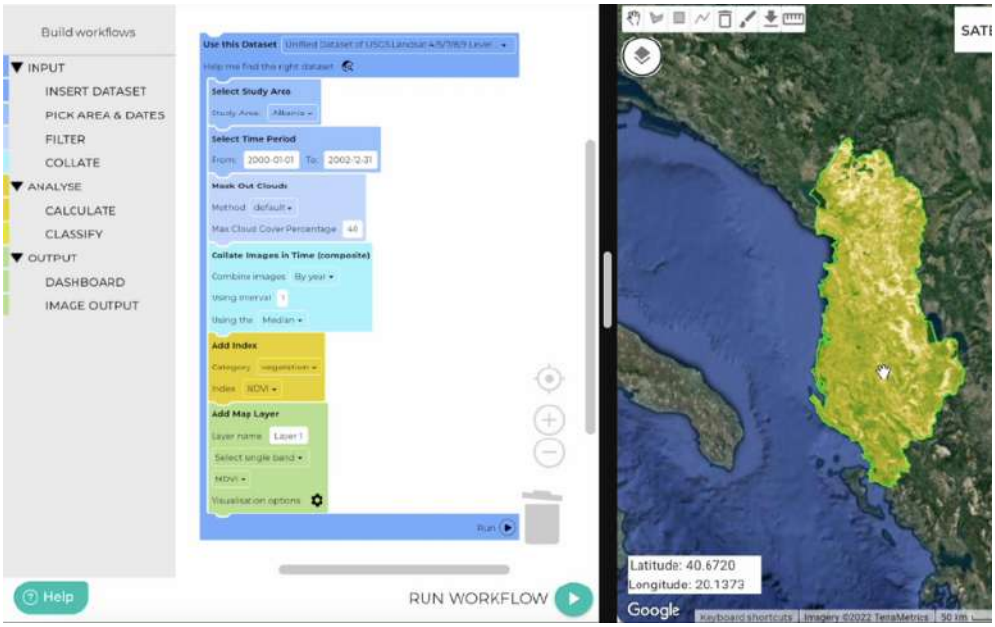


Figure 2: No-code software like Earth Blox makes it easy for non-experts to analyse Earth observation data.

studying for a Master of Science in the Biodiversity and Taxonomy of Plants at the Royal Botanic Garden Edinburgh, she collaborated with the International Conifer Conservation Society (ICCP) to investigate the threats to the Serbian spruce (Picea omorika).

She designed a research project that combined novel satellite remote sensing data, species occurrence records, and present and future climate data to map and quantify the threats to the conifer across Europe. Alice planned to carry out most of the analysis in R, using Maximum Entropy Modelling for future climate projections and visualising results using QGIS. However, with a limited coding background, she found learning how to write and adapt code time-consuming. "I didn't have the skills to understand where my code wasn't working or the time to commit to learning this within the three months that were allocated to this project," she says.

"After several weeks of struggling with R, I was introduced to Earth Blox through my supervisor as an alternative. Earth Blox allowed me to work with data, run analyses, and visualise results in a way that was easy for me to understand with a limited coding background. I was able to access Google Earth Engine datasets to calculate annual forest loss and fire damage for Picea omorika over the last twenty years using the inbuilt workflows, which were easy to edit. The ability to import occurrence data, run analyses and visualise results on the map, then export these as graphs and charts saved a lot of time and provided a series of excellent figures for my thesis," says Alice.

With today's primary school students learning to code in the classroom using Scratch, a high-level block-based visual programming language, we can expect an increased expectation of no-code tools from future generations as they progress through university and into the workforce.

No-code geospatial software is a viable way for businesses to scale their activities in NbS. It removes barriers like coding and the need for specialist skills in Earth observation or remote sensing, enabling a wider range of users to work faster and more efficiently. Cloud processing and software-as-a-service subscriptions allow businesses to control costs and only increase usage when necessary. In the current climate, no-code tools offer hope as we face one of the biggest challenges of our time.

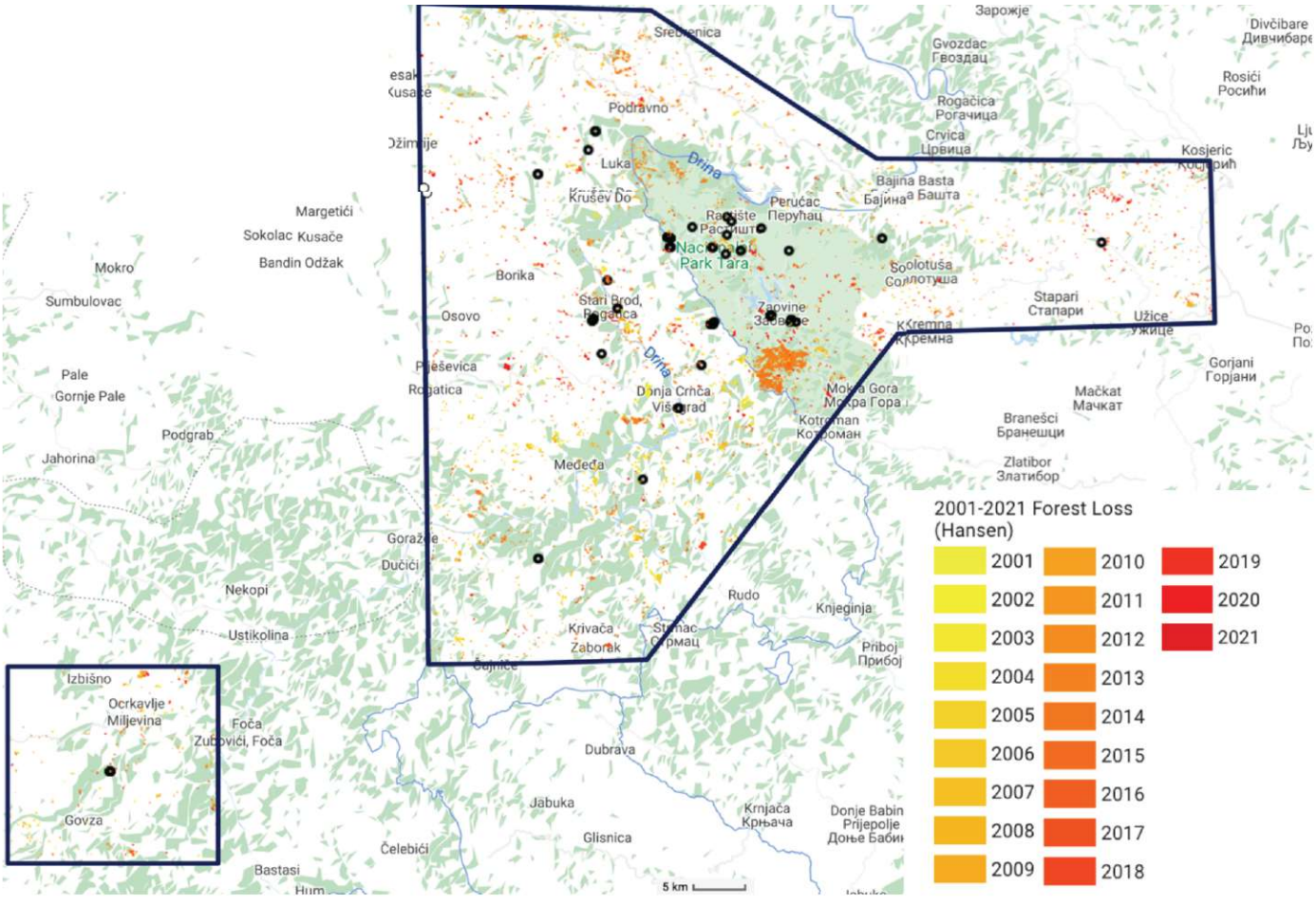


Figure 3: Alice Peace's analysis of threats to the Siberian Spruce on Earth Blox. The no-code software is used in universities to teach Earth observation analysis skills to non-coders.

Analyzing Mining Influence on Brazilian Amazon Vegetation

Sofia Minashkina
Email: sofiamin@gmail.com

Various branches of production and human activity harm the environment, being sources of atmospheric pollution and an increase in temperature on our planet. Today, environmental protection is necessary and requires significant efforts from humanity. Climate change, which causes the weather to become unsustainable, affects life on Earth as we know it. Rising temperatures are causing glaciers to melt, and extreme weather events damage farm productivity, jeopardizing global food security. There are many more reasons to be concerned, and effective measures to protect the environment should be taken, which can be helped by active and passive remote sensing.

Maps that present spatial data are increasingly crucial for environmental planning and management. The development and improvement of data analysis methods made it possible to obtain more than descriptive maps but perspective maps with a visual display of spatial relationships. Platforms that make it possible to display graphical information obtained from spatial data include a set of powerful tools called GIS systems.

Sources in space or the air provide valuable mapping data. The science of obtaining information about our planet from its surface using satellites or high-flying aircraft is called remote sensing. Sensors attached to devices that capture the radiation reflected from the Earth are responsible for collecting data. The machines perform active or passive

remote sensing depending on the type of sensors. Passive sensors detect natural energy emanating from the Earth's surface. Active ones, on the contrary, use internal stimuli to collect data, including a laser to project it onto the Earth. The sensor measures the time it takes for the beam to be reflected.

GIS makes it possible to use natural resources more efficiently and reduce the negative impact of human activity on the environment. Different types of remote sensing provide data collection, while geospatial systems provide visualization.

This solution is vital for managing natural resources and solving environmental problems. Furthermore, data and maps help assess and manage the impact of earthquakes, droughts, floods, and other natural disasters. GIS information is also being applied to address climate change, habitat loss, pollution, and population growth. It is a reliable way of monitoring and getting information about the location and current resources.

Monitoring Mining Environmental Influence

All stages of mining activity, from exploration to mine closure, have a direct and indirect impact on the environment. The maintenance and operation of a mine can lead to changes in land use, as well as negative impacts such as deforestation, pollution of water sources, and more. The liquidation, decommissioning, and conversion of mines can also result in similar significant environmental impacts, such as soil and water pollution. The infrastructure needed to operate a mine can also affect wildlife habitats and migration routes.

Remote sensing provides benefits for studying the impact of mining operations on the environment in the form of multispectral imagery, repeated coverage, and synoptic coverage. This technology has also been successfully applied to study the effects of underground mining, sedimentation, and the processes occurring after the disposal of production waste.

Monitoring changes in former mines is critical since landscape changes after this type of activity can cause the release of harmful substances into the atmosphere and lead to extreme events. Hyperspectral remote sensing provides vital information about land use, mine effluent location, vegetation cover, and water source conditions.

Monitoring Illegal Mining in Brazil and its Influence on the Brazilian Amazon Rainforests

The Amazon region covers 9 Latin American countries and is the largest rainforest in the world and the most extensive river system. Another important fact about this region is that it accounts for 10% of global biodiversity. Due to its ecological characteristics, the Amazon Basin is the most critical part of the world's environmental system and plays a crucial role in climate regulation. It also plays an essential role in the economic well-being of the region.

Illegal mining in Brazil has several hotspots in 9 states. Many of these points are in the Amazon. Yanomani and Munduruku are indigenous reserves also known as areas of illegal mining. In 2018, 30 tons of gold were illegally mined in Munduruku. Moreover, known centers of illicit gold mining are interior cities, including Itaituba and Jacareacanga.

Satellite Imagery Analysis by EOSDA Analytics

EOS Data Analytics helps 22 industries make better decisions by providing them access to products and solutions based on satellite data using AI algorithms. The company provides reliable satellite imagery analytics to commercial, scientific, and government organizations, enabling them to implement sustainable practices in various industries. EOSDA's mission is to use satellite technology to make accurate and sustainable data-based decisions in various sectors, including agriculture, forestry, and mining.

The negative impact on the environment is one of the most critical problems for the mining industry today. EOSDA solutions enable monitoring remote and hard-to-reach areas and analyzing the data. Thanks to the company's products, you can access vegetation, soil, water bodies, and subsidence information. It contributes to the improvement of planning and prevention of emergencies.

For instance, the company provides data to study the contamination of the Tapajós River due to illegal mining. Tapajós River is one of the largest tributaries of the Amazon, which passes through 65 municipalities in Brazil and plays a vital role in the development of the country. The area of the river basin exceeds the size of the territory of France. Two-thirds of the region is covered by tropical forests, home to various species of animals, including rare species. There are also more than 300 species of fish in the river.

There are other crucial species here, namely 1.4 million people, including ten indigenous tribes, who also depend on the river for jobs, food, water, and other resources. The Tapajós River basin is also essential for agricultural production in the region. Environmental problems associated with the pollution of the river by waste from mining endanger the region's economic well-being and the existence of all living things in it.

Case 1

EOSDA Crop Monitoring is an all-in-one precision farming solution developed by EOS Data Analytics. This online satellite platform provides reliable field monitoring and helps farmers make timely crop protection and resource use decisions.

The solution gives access to data on the state of the soil, vegetation, and field activities. Reliable historical weather data from 1979 and a 14-day forecast make it possible to improve the planning of field activities and track and study factors that affect crop yields year after year. The values of NDVI and other indices are a source of critical data on vegetation throughout the growing season. Human eyes can quickly identify a healthy green plant or detect a problem when leaves or other parts turn yellow. Developing plants contain large amounts of cellular structures and chlorophyll, absorbing red light and reflecting near-infrared light. In unhealthy plants, the reverse processes occur.

Satellite sensors are a source of data for NDVI analysis, as they measure the wavelengths of light that green plants absorb and reflect. In this case, the main difference between passive and active remote sensing is that with active remote sensing the imagery for analysis can be obtained at night, which increases the possibility to get a cloudless picture. On the EOSDA Crop Monitoring platform an array of indices is available.

Vegetation density estimation is not only crucial for farmers, however. This feature of the EOSDA solution can also be applied to other industries, such as mining. The image below shows the same active mine in 2017 and 2022 (Itaituba, State of Pará, Brazil). Even though the size of the mine has not increased during this time, the effects of this activity on the region are permissive.

Red marks areas without vegetation, which increased after washing the soil. As a result, it can be seen that even without the construction of new mines, the region has 50 hectares less vegetation. It is evidenced by the data analysis using the EOSDA Crop Monitoring platform.

The multispectral device SENTINEL-2 became the source of images for analysis. This broadband multispectral mission provides geographic information on any scale (from local to international) and measures 13 spectral bands. This mission is characterized by a high frequency of return visits and provides reliable monitoring of soil, vegetation, and water cover. The data can be used to track agricultural and crop health, environmental issues, forests, water sources, and space planning.

Case 2

Converting satellite data to NDVI values enables creating images that provide information about the type, condition, and the number of plants that cannot be seen with the naked eye. To calculate the indicators, NDVI calculators take images from an optical satellite. As a result, they create a georeferenced raster result.

Having a value for each pixel in an image makes it possible to assign different colors to different ranges of NDVI values. Thus, obtaining a map of NDVI changes in false colors is possible. It is possible thanks to various GIS systems. There is no standard color map, and the most widely used maps are those with realistic colors, on which high NDVI values are highlighted in green.

A comparison of imagery from 2017 and 2022 shows deforestation (on the latest one) in one of these "mines" and then the formation of clearings and the opening of roads in

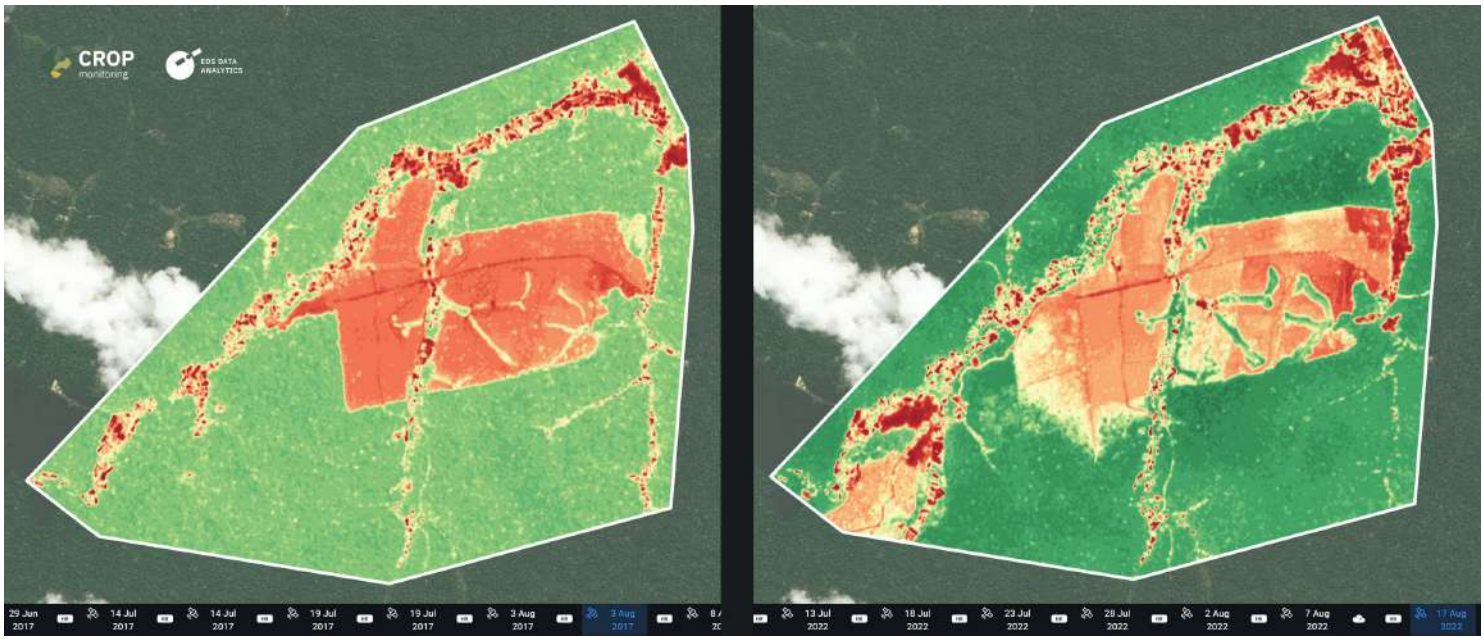


Figure 1: Before (left side) - Satellite image date - August 3, 2017. After (right side) - Satellite image date - August 17, 2022.
Satellite - Sentinel-2 and Resolution: 10m. Coordinates - 7.2737° S, 56.3011° W
The area of the zone is marked with a white line: 1560 ha.

places of illegal mining. The water used in the extraction washes the soil, and the residues end up in the waters of Tapajós River.

The NDVI scores obtained using the EOSDA Crop Monitoring platform demonstrate the effects of harvesting and the negative impact of side effects. The area of open land increased by 66 hectares.

Case 3

The ingress of sewage into the Tapajós River leads to pollution and ecological imbalance. Outwardly, the consequences of pollution are expressed in the fact that parts of the river differ in color. Calculating the normalized difference chlorophyll index (NDCI) on the EOSDA Crop Monitoring platform enables detection of vegetation on the surface of water bodies. In a shallow area of the Tapajós River, a "bloom" formation was found. Near the rocks, algae grow, harming aquatic inhabitants and the ecosystem.

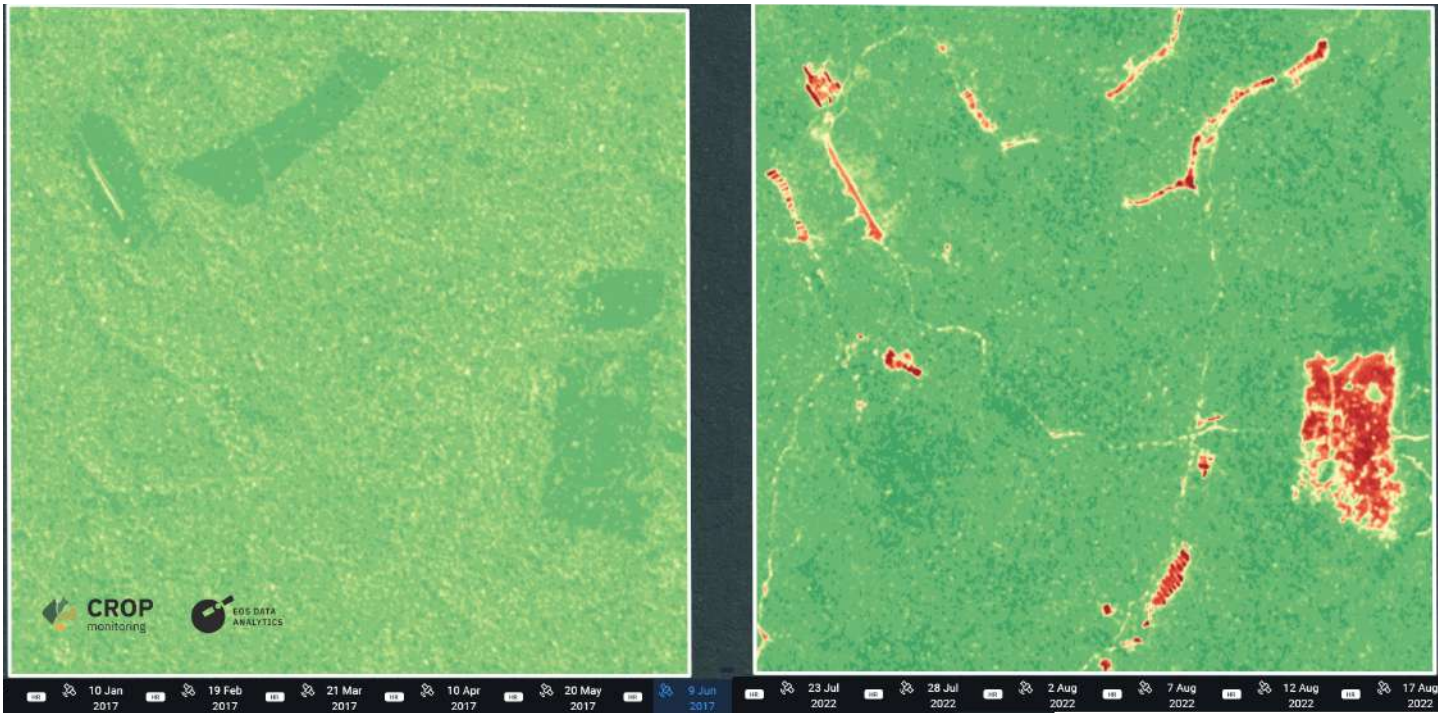


Figure 2: Before (left side) - Satellite image date - June 9, 2017. After (right side) - Satellite image date: August 22, 2022.
Satellite - Sentinel-2 and Resolution - 10m. Coordinates: 7.4784° S, 56.6089° W
Region: Itaituba - State of Para, Brazil. Total area in the screenshot: 1900 ha.

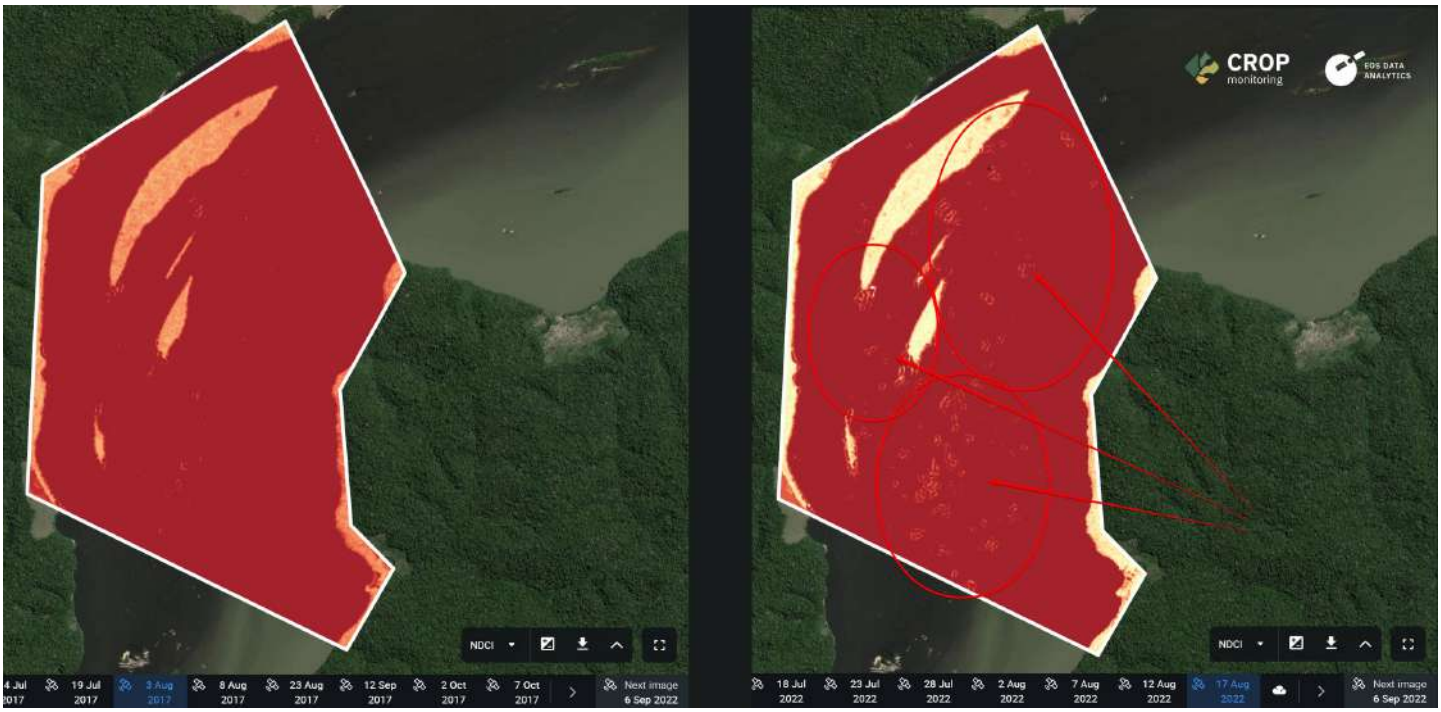


Figure 3: Before (left) - Satellite image date: August 3, 2017. After (left) - Satellite image date - August 17, 2022.
Satellite - Sentinel-2 and Resolution: 10m. Coordinates - 5.5942° S 57.2139° W
Region: Ponta do Bacabalzinho, Itaituba - State of Pará, Brazil. The area of the zone is marked with a white line: 1120 ha.

Case 4

The red spots in the image indicate that there will be an increase in tree felling in 2022. This process leads to an expansion of the area of open land plots and infrastructural buildings that are used for mining.

The images are taken from the Landsat 8 satellite, equipped with an operational ground imager (OLI) and a thermal infrared sensor (TIRS). These two sensors perform different functions.

OLI is designed for the imagery collection and application of 9 spectral bands with different wavelengths of visible, near-infrared, and short-wavelength light. It is necessary to monitor 185 kilometers of land (115 miles). A 15-30 meters resolution makes it possible to distinguish between different land-use objects.

TIRS enables Landsat-8 to support new applications and continue thermal imaging. With this sensor, it is possible to measure the rate of evapotranspiration, which helps to manage water resources effectively.

Some sectors of human activity negatively affect the environment, and mining is one of them. This industry leaves behind hazardous waste that has to be isolated from wildlife after the mines are closed. However, this is impossible if the mining was carried out illegally and no one took care of the integrity of the waste storage facilities. Subsequently, toxic substances enter the soil and pollute water sources, without which humanity is unlikely to be able to survive. Modern technology, fortunately, makes it possible to track both the condition of the former shah and detect illegal mining activities. GIS, microwave remote sensing active and passive, and satellite imagery enable the timely detection of various environmental threats.

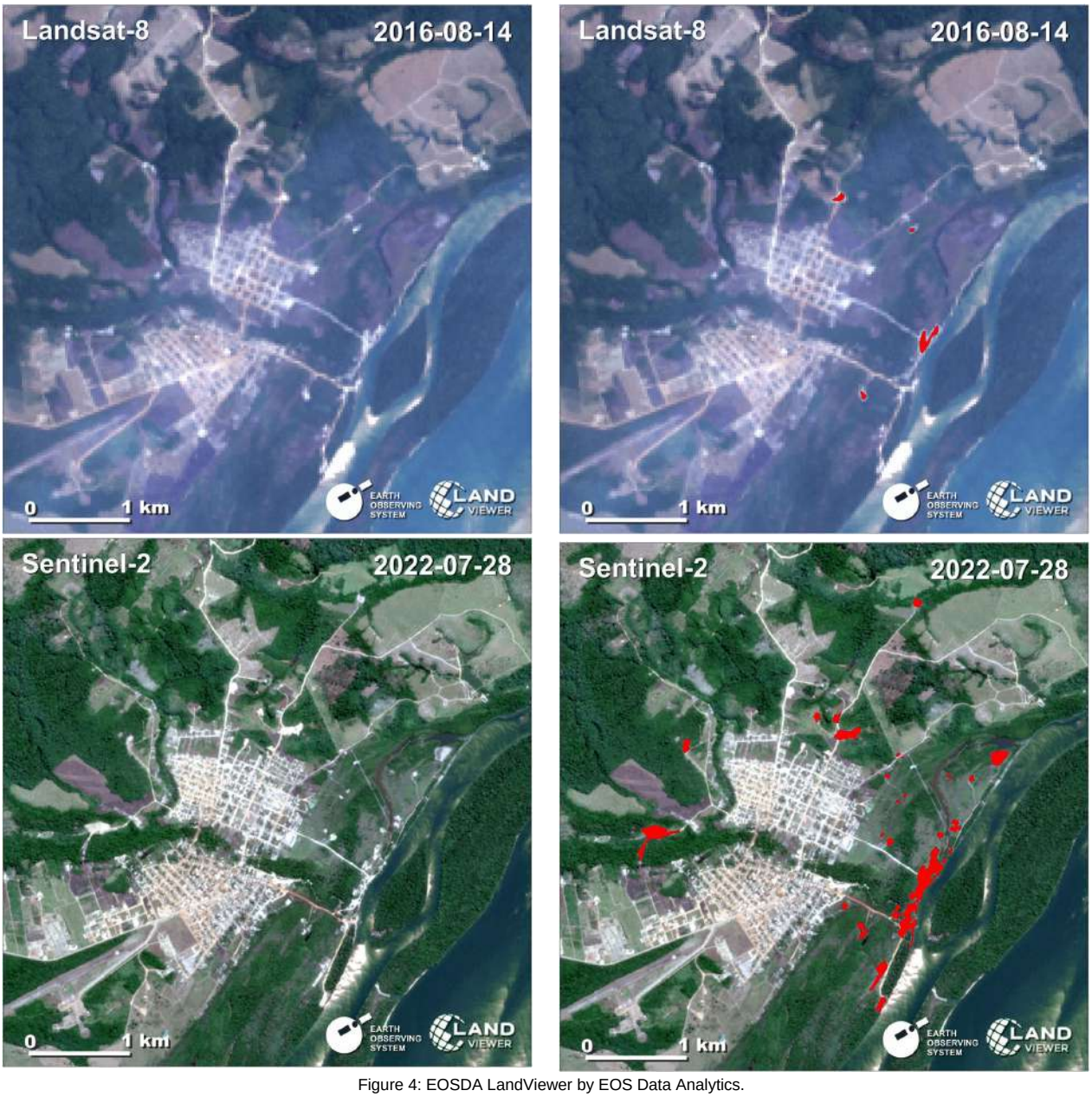


Figure 4: EOSDA LandViewer by EOS Data Analytics.

SatSure - Delivering Decision Intelligence from Space

A Talk with Amit Salunkhe and Rashmit Singh Sukhmani

SatSure aims to be the most successful global space data application company involved in solving sustainability and financial inclusion challenges.

SatSure leverages advances in satellite remote sensing, machine learning, big data analytics, and cloud computing to create products and solutions which help enterprises and their people make smart decisions.

We had a chance to have a small questionnaire with Amit Salunkhe and Rashmit Singh Sukhmani from SatSure. The team has shared some interesting insights about the company's vision, its success, and thoughts on changing geospatial market trends.

The questionnaire follows as...

GIS Resources - You have created an effective solution in the Space Tech domain for which you have secured funding and won applause. What has been the idea behind a successful start-up and its journey in the last five years?

Rashmit - We have always wanted to use space technology to create products and solutions which are able to solve some large-scale problems our society faces. Our journey has been a learning experience for both us and our clients, whom we consider equal contributors to our growth to date. Working with certain key clients in the early days like ICICI Bank inculcated the philosophy of jointly building a product or a solution with our clients, keeping their problems and decision-making systems in mind. Thus, the understanding of the bottlenecks in their business processes and alignment of our technology according to their systems and strategies has over the years helped our clients make smarter decisions at scale.

We had our fair share of ups and downs. However, what has kept us going and growing is definitely the willingness to win together, which is a core value we cherish at SatSure. Here at SatSure, we are working towards the aim of becoming a successful global player to leverage advanced technology for the benefit of man and society, through a focus on the sustainability nexus of financial inclusion, food security, and sustainable infrastructure.

GIS Resources - Tell us about the latest innovations in SatSure and what role would it play in the transition to more intelligence-driven and informed decision-making.

Rashmit - Our innovations are driven by a purpose. A purpose for advancement in technology or to help clients make better decisions or build a better world. Thus, our innovations focus on technology, business and products.

Amit Salunkhe

Chief Commercial Officer

Rashmit Singh Sukhmani

Chief Data Officer

For instance, we recently launched a joint product with TransUnion Cibil which combines the power of credit information provided by TransUnion Cibil and crop information generated through geospatial analytics by SatSure. We can get the intent and the characteristic information through credit scores whereas we, by using complex deep learning algorithms and earth observation data, provide capacity information that helps the bank to understand the behavior of the farmer and the performance of the crops through a data-driven, informed decision-making approach.

Another innovation is the technology stack we have built with a capacity to churn out petabytes of data and generate geospatial insights by delivering it through APIs directly integrated with the client's platform. This is thus a service-level innovation.

SatSure Cygnus, a data product built in-house by our data science team, reconstructs optical data from SAR data to provide the ability to monitor vegetation even in the presence of heavy cloud cover, as optical satellite data fails in such scenarios.

GIS Resources - Tell us about your flagship products and offerings.

Amit Salunkhe: SatSure has three products, SatSure Sage, SatSure Skies, and SatSure Sparta.

SatSure Sage is a suite of applications that facilitate smart decision-making in the management of agricultural loans by lending institutions. It leverages the power of satellite data and location intelligence to bridge information gaps, which helps lending institutions to smartly scale while reducing operational costs, and at the same time, helps farmers to get access to credit.

SatSure Skies is a high-resolution change detection product suite that delivers solutions for the infrastructure, energy, and utility sectors.

SatSure Sparta is a data analytics platform, where we are providing ready to analyze crop data derived through remote sensing. The datasets can be consumed through APIs by users to build their in-house applications for the agricultural and climate action value chains.

GIS Resources - How will the SatSure solve some of our real-world problems when integrated into something like agriculture, climate resilience, and emergency response?

Amit Salunkhe: The areas mentioned are in fact some of the areas where SatSure's products and solutions are used at scale. Let me provide some examples of real applications we executed with public, private, and multilateral organizations.

We work across the agricultural value chain in sectors like agriculture finance, insurance, agricultural input, etc. Most of the current work is focused on the digitization of processes and datasets to create a more favorable data infrastructure for scale. This journey of digital transformation in agriculture has been implemented by SatSure for loan lifecycle risk management with banks like ICICI bank and credit bureaus like TransUnion Cibil, crop registry digitization for the Government of Telangana and insurance risk management and mitigation with Reliance General Insurance.

We have worked with multiple organizations on areas of climate resiliency agriculture through projects like the Project on Climate Resilient Agriculture (POCRA) by the Government of India and sustainable agriculture in bio-diverse areas.

In the 2018 Kerala floods, we joined hands with multiple private players like IBM to build a quick product which led to the decision-making of evacuation plans by the Government of Kerala leading to more than 12,000 civilians being rescued.

The way we are able to build solutions in such diverse sectors is because we closely align with the problems, systems, and requirements of our clients to create products that are aimed at solving the key decisions which the client wants to make.

GIS Resources - What do you think are the main technology trends for the space sector, and what role would SaaS play?

Rashmit: The main trend in the space sector is seen on the downstream side, where companies are using Earth Observation data to solve problems at the nexus of a wide variety of sectors, starting from agriculture to climate actions. Now the industry is evolving to SaaS play in order to leverage data generated from upstream markets to create large -scale solutions. New startups are evolving in the downstream side as barriers to entry are much easier as compared to upstreams which are CapEx heavy. This is supported by the evolution of big data technology and huge cost reduction on the cloud infrastructure which is helping companies to create scalable solutions. Initially, Satellite data was primarily used as an military intelligence or for the purpose of R&D whereas now it's moving towards productionizing of the geospatial data which could be seen in the policy changes happening on the remote sensing side.

GIS Resources - Could you briefly tell us about some of the projects you are working on and the partners you are involved with?

Amit Salunkhe: While we cannot name all the clients or partners we are engaged with, we can definitely broadly answer the areas our products and solutions are used in today:

1. Agricultural Credit Lending
2. Agriculture Insurance
3. Forest Monitoring
4. Power Transmission Lines
5. Aviation
6. Carbon and ESG
7. Agriculture inputs
8. Agriculture machinery

GIS Resources - What are your takeaways from dealing with clients in terms of what the industry needs, and how do you prepare for that?

Amit Salunkhe: In most of the cases, geospatial technology is either a fairly new entrant or has some level of awareness, but again a very limited understanding of its capabilities and limitations. Thus, with every client, we have to figure out their awareness of geospatial technology and their organizational preparedness to adopt the technology. Many times, even when awareness is there, the organization's infrastructure for instance is not prepared to integrate geospatial technology and the insights from it.

Thus, our approach, as mentioned by Rashmit, is to first spend time understanding the problem statements of our clients, their long-term and short-term goals, and digital infrastructure and then jointly build and deliver the solutions. I believe that is the current state of affairs, where even with a product developed, 80% would be a direct product adoption, and 20% has to be consultancy on both ends, clients and us.

GIS Resources - What are the kind of business models that you anticipate in the near future?

Amit Salunkhe: As the industry is maturing, newer business models are evolving in the area of geospatial analytics. There is definitely a transition towards productization in the geospatial sector, which means possible GTM partnerships at different stages of client onboarding and implementation. More system integrators will be a part of the ecosystem moving forward, which is what we can clearly see is slowly happening today. Additionally, a single provider may not be able to cater to large requirements, which will require a multi-sensor approach. This also means, players in the geospatial industry will have to collaborate and partner to deliver the necessary insights as per the growing expectations of the industry.

GIS Resources - Final question, give some advice to GIS Resources readers and budding entrepreneurs who would like to turn their ideas into a profitable business.

Rashmit: The space industry is niche but the applications derived using geospatial data are huge. In order to leverage Earth Observation-based applications, budding entrepreneurs need the conundrum of doing everything. Entrepreneurs need to first understand the business problems one at a time in order to solve and create a scalable solution around them.

The entrepreneurs end up in the silos problem when they start using earth observations data, but they need to understand it will only solve the problem to some extent analytics derived has to be used with a wide variety of datasets coming from different sources with different types, velocities, and varieties.

Profitability really boils down to the industry and business models one builds a product for. One may start with multiple areas as a part of exploration, however, find a product market fit by possibly finding opportunities with key clients who shall be the mentor for the product development.

Also, developing products over services allows better control over quality and scalability which positively impacts profitability in the long run.

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