

Newsletter

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From the President's Desk

Rapid, effective, and equitable emergency management has long been a challenge for various communities in India. Apart from the dangers posed by natural catastrophes like floods, cyclones, earthquakes, landslides, forest fires, volcanic eruptions, and so on, we also face human-inflicted threats of terrorism, warfare, organized crime, and attacks. Though emergencies may vary in terms of nature and cause, scope and impact, they all need to be handled efficiently and effectively to minimize damages to life and property.

The need of the hour is for governments, law enforcement authorities, and emergency managers to recognize potential vulnerabilities and develop strategies both for offering protection and building resilience, better and faster. Data and technology are the twin pillars of such a vision, enabling strategic preparation, response, and recovery.

Geospatial technologies are an integral component, allowing for innovative and optimized emergency management in the face of both natural and manmade hazards. The solid data framework established using Geospatial technologies enhances planning, collaboration, and communication under even the most challenging situations, considerably reducing response times. Governments all over the world can thoroughly assess affected areas, monitor support levels, supplies, and response teams in real-time, and update databases of people, spaces, structures, and utilities to plan evacuation and rescue more effectively using Geospatial technologies.

The introduction and continuous development of Geospatial technologies for emergency management is enabling greater opportunities for advancement of the sector, including tools for strong decision support, situational and operational awareness, impact analysis, resource optimization, and streamlined communications. As a forum for the exchange of ideas, techniques, approaches, and experiences by those who design, implement and use Geospatial technology solutions, AGI dedicates this Edition of its newsletter to the emergency management landscape in the country and the role of Geospatial technologies in its improvement.

We hope this Edition comes across as insightful and enjoyable. Stay tuned for more insights, stories, and analyses from AGI in the coming months.

Enjoy Reading,

Pramod Kaushik
President, AGI



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The NDRF plans to conduct 298 mock Disaster Management Exercises on various themes in 2022

We cannot prevent hazards from happening, but can surely prevent them from becoming disasters, notes **Director General NDRF, Shri Atul Karwal, IPS**



NDRF plans on conducting mock trials across all 700+ districts in the country to prepare all stakeholders in the face of disasters. What are some key focus areas for these trials and what type of disasters are to be covered?

NDRF in the capacity of lead agency in the field of specialized disaster response is also committed to make India resilient towards disasters. NDRF have been carrying out Mock Exercises in collaboration with a range of institutions/ stakeholder/ community/local Govt. to train and educate them in dealing with the perceived disasters that play a major role across country in terms of disaster response.

NDRF conducted Mock Exercises on various disaster themes across India. In 2020, the Hon'ble Home Minister also emphasized that mock exercises are essential at the ground level and must be conducted in all districts at least once in 3 years.

Every year the NDRF plans a yearly Mock Exercise Calendar and circulates the same to the NDMA, all State authorities, and other stakeholders. In 2022, NDRF planned to conduct 298 Mock Exercises on various themes across the country. Apart from this 49 Mock Exercises with Indian Railways has also been planned. NDRF also conducts MEXs with MAH/ PSUs units /Airport authorities on mutual coordination or directions of NDMA etc.

Key focus areas:

- To review Disaster Management Plan.
- To evaluate the Disaster Response Plan.

- To identify the efficacy of MEXs.
- To highlight the roles and responsibilities of various Stakeholders.
- Enhance coordination among Emergency Support Functions of various stakeholders.
- To generate public awareness by involvement of Local Government, NGOs and Public.
- To identify the gaps in resources, manpower, communications and in any other field.
- To enhance the ability to respond faster.

EVERY YEAR THE NDRF PLANS A YEARLY MOCK EXERCISE CALENDAR AND CIRCULATES THE SAME TO THE NDMA, ALL STATE AUTHORITIES, AND OTHER STAKEHOLDERS. IN 2022, NDRF PLANNED TO CONDUCT 298 MOCK EXERCISES ON VARIOUS THEMES ACROSS THE COUNTRY.

Type of disaster covered during MEXs:-

NDRF conducts Mock Exercises with stakeholder on natural & manmade disasters along with MAH/PSUs units on themes like Collapsed Structure Search & Rescue (CSSR), Flood Water Rescue (FWR), Chemical Biological Radiological & Nuclear emergency (CBRN),

Earthquake, Cyclone, Lightening, Landslide, Heat waves etc.

With the IDRN, NDMA and NDRF plan on providing decision makers with reliable, readily available data to combat emergency response. What data set are being disseminated, and how are they helping improve ground level coordination?

IDRN is a web-based platform, for managing the inventory of equipment, skilled human resources and critical supplies for emergency response. It provides the availability of equipment and human resources available with civil administration and private agencies along with central response agencies required to combat any emergency situation at a particular place. At the time of need during any disaster emergency NDRF can access this portal and may use the resource if needed although NDRF is self-contained rescue agencies having all kind of modern rescue equipment. This portal gives an exact picture to the district administration how much resources are available with them with different government and private agencies and can manage them effectively in the time of need.

Whether during cyclones, earthquakes, floods or landslides, the hampering of communication channels often delays response time. What are the existing tools/ technologies used by NDRF to improve field capabilities and situational awareness in such conditions?



At the time of disaster, the conventional communication setup like Mobile phones, landline phones, internet etc goes down. This is where professionalism of NDRF came and it is different from civil administration. NDRF has advance high tech communication equipment like Quick Deployed Antenna (QDA), Satellite Phones, HF / VHF sets, Body worn camera etc.

How NDRF using drone and satellite imagery for emergency response? Are you facing and challenges in the process?

Drones are presently under consideration in NDRF. NDRF has entered in collaboration with AGNI Mission Invest India to identify drones which can be effectively used in disasters including delivery drones and other surveillance drones which can work beyond the line of sight in non-GPS environment. The trial for the drones with start-ups engaged with AGNI mission is in process. Further, during the Chamoli Glacial Outburst, some start-ups showcased their capabilities with a view to appreciate ground situation and gauge the required upgradation and capabilities to meet the challenges in the field.

As far as satellite imagery is concerned, various startups provides different mapping and GIS enabled services to help with disaster preparedness and response coordination with flood modeling on 3D maps. It also provides 3D mapping of the specific region which can then be used for previous reference of the structure/ area to compare then and now situations after any disaster which ultimately helps in decision making by initial assessment of the situation.

AT THE TIME OF DISASTER, THE CONVENTIONAL COMMUNICATION SETUP LIKE MOBILE PHONES, LANDLINE PHONES, INTERNET ETC GOES DOWN. THIS IS WHERE PROFESSIONALISM OF NDRF CAME AND IT IS DIFFERENT FROM CIVIL ADMINISTRATION.

The only challenge faced is the availability of real time imagery after any incident/ disaster.

Your recent field trials with modern technologies like analytic and extended reality portray a very progressive stance. How do you plan to implement these technologies in your operations in the near future?

NDRF is the premium agency in field of disaster response in the country. We cannot prevent hazards from happening, but can surely prevent them from becoming disasters and when they do happen, to minimise their effect in terms of loss of human lives and damage to infrastructure, by taking preventive and mitigation measures and for that needs to upgrade its equipment as per the latest technology.

National Disaster Response Force (NDRF) collaborated with the AGNI Mission of the Prime Minister's Science Technology and Innovation Advisory Council (PM-STIAC), executed at Invest India under the

Ministry of Commerce & Industry, held Technology Field Trials at Pune.

The two-day trial comprehensively mapped various Indian emerging technologies to NDRF's vast mandate, covering Flood Water Rescue, Collapsed Structure Search and Rescue, Rapid Relief Support to victim and enhanced Situational Awareness during disaster.

Following Innovations were demonstrated:

- 1) **Aquatic Capabilities:** SONAR equipped Remotely Operated Vehicles, Unmanned Marine Surface Vehicles, High-speed Rescue Lifebuoys for flood-water rescue operations.
- 2) **Force Training:** AR/VR based disaster scenario module delivered on headsets and controllers for advanced force training.
- 3) **Resilient Communications:** Secured Private LTE Network Systems for alerting authorities, coordinating relief operations, assessing damages and mobilizing support.
- 4) **Aerial Capabilities:** Nano-drones for Collapsed Structure Surveillance, Hybrid Unmanned Gasoline Helicopters for Aerial Mapping and Payload Delivery Autonomous Drones for delivery of essentials.

NDRF is evaluating to adopt the best suitable technology.

Vital opportunities opening up in high-density urban area mapping for emergency evacuation, right up to street level

Geospatial technology is helping coastal disaster managers make appropriate decisions and evacuation planning, notes **Director INCOIS Dr. Srinivas Kumar Tummala**



Round-the-clock ocean monitoring is imperative to identifying and warning against emergency scenarios. How does INCOIS deliver this and using what technologies?

INCOIS has set up an extensive network of ocean observing systems that transmits data in real-time. This is subsequently used to provide ocean information and advisory services against disaster events like Tsunami, storm surges, etc. For example, there is a network of seven bottom pressure recorders and 36 tide gauge stations that continuously provide sea level data transmitted in real-time through satellites for monitoring Tsunami. In addition, INCOIS is also monitoring extreme waves in the north Indian Ocean using a network of 15 wave rider buoys.

Starting from its establishment in 1999 to the present day, what kind of technological advancements has INCOIS seen within and without in terms of data capture, applications and research on ocean information in India?

INCOIS has come a long way since its establishment. From the initial days of daily satellite scene procurement in Compact disks (CDs) from ISRO, we now have three ground stations to download real-time data from multiple Indian and foreign satellites. We have also set up state-of-the-art storage and computing facility in-situ, including a dedicated setup for the Tsunami Early Warning

Centre (TEWC). The genesis of TEWC itself was in response to the 2004 Indian Ocean tsunami.

Built at war-footing, INCOIS today has been given the responsibility by Intergovernmental Oceanographic Commission of the UNESCO to alert all countries in the Indian Ocean-rim in case of an event. We are making our systems more and more indigenous with the INSAT communication system wherever applicable, to freely operate within the Indian EEZ. INCOIS has also been using unique platforms ranging from satellite telemetry fish tags and sea gliders to water quality monitoring buoys so that we can fulfil our data requirements for

WE ARE MAKING OUR SYSTEMS MORE AND MORE INDIGENOUS WITH THE INSAT COMMUNICATION SYSTEM WHEREVER APPLICABLE, TO FREELY OPERATE WITHIN THE INDIAN EEZ.

research and service improvement.

The data from our observatories are being channelled seamlessly on web platforms including LAS (Live Access Server) and Digital Ocean. As a result of these efforts, we now have multiple feathers in our hat. INCOIS is a

valuable partner of RIMES (Regional Integrated Multi-Hazard Early Warning System for Africa and Asia). It is also the designated NODC (National Oceanographic Data Centre) for India by IODE/IOC. At the same time, INCOIS hosts the Earth-System Science Data Portal (ESSDP) of the MoES and is the Regional Data Center for the Argo-float programme.

How would you describe the impact of INCOIS' services in the field of emergency management in India?

INCOIS services benefit in multiple ways to various maritime and coastal stakeholders of our nation. July 2020 Report of NCAER highlighted that by following OSF alerts and warnings conveying it was not safe venturing into the sea, fishermen avoided annually 9606 trips that saved Rs. 18.25 crores of operational cost annually.

Next, the benefits of Potential Fishing Zone (PFZ) advisories are reflected in fuel and time savings (by 30-70%), thus improving net profits by 2-5 times. The significant reduction in the country's carbon footprint is another massive advantage.

While the lifesaving benefits of the Tsunami early warnings are known, an evacuation avoided by giving a reliable 'No Tsunami Threat' advisory also has such significant economic implication amounting to hundreds of crores for any given event.



At INCOIS, we have also developed a prototype for satellite-based dissemination of service bulletins at-sea, called GEMINI (GAGAN Enabled Mariner's Instrument for Navigation and Information). We plan to popularize this device in collaboration with relevant ministries in the coming years to unlock more benefits for sustainable and safe ocean navigation.

The Coastal Vulnerability Index of INCOIS uses a comprehensive assessment of the entire Indian coast on a 1:1,00,000 scale. What are the various parameters studied for this purpose? Would more detailed, larger-scale maps be better suited?

INCOIS has prepared the Coastal Vulnerability Index (CVI) for the entire coastline as part of the Tsunami Early Warning System. CVI maps were prepared on a 1:100000 scale based on the assessment of probable implications to the coast due to sea level rise (climatic and momentary due to tsunami/storm surge), coastal slope, shoreline change rate, and coastal elevation, coastal geomorphology, tidal range, and significant wave height. These maps depict the regional scenario of the coastal zones on the coastal vulnerability due to future sea level rise and coastal stretches with different vulnerability classes, useful for regional coastal planning.

AT INCOIS, WE HAVE ALSO DEVELOPED A PROTOTYPE FOR SATELLITE-BASED DISSEMINATION OF SERVICE BULLETINS AT-SEA, CALLED GEMINI (GAGAN ENABLED MARINER'S INSTRUMENT FOR NAVIGATION AND INFORMATION).

The high density of urban areas along coastlines poses a major hindrance to an emergency evacuation. How do you use Geospatial technologies for effective planning in these cases, and what are the challenges, if any?

Emergency evacuation in dense urban conglomerates is a real challenge and needs micro-level planning first and foremost. Geospatial technology provides vital opportunities in mapping the urban areas for this purpose, offering great detail up to street level.

In this light, INCOIS has generated 3D GIS maps of densely built-up urban areas in vulnerable coastal zones. We

mapped individual buildings in a 3D environment with realistic textures using areal and street mapping. Each building on the map was then associated with socio-economic data. The intention was to generate accurate building-level risk assessment in the face of a tsunami or storm surge during an event.

Geospatial technologies today are helping coastal disaster managers to make appropriate decisions early on and in evacuation planning. The high level of detail from the 3D GIS database also boosts micro-level planning initiatives further.

However, based on our experience of these projects so far, some challenges remain:

- o Conducting these projects is laborious and time-consuming.
- o Considering how big an exercise it is, mapping is not that frequent, meaning the data does not always account for dynamic changes in the urban environment such as urban sprawl, migratory population, and large variations in household populations.



Geospatial Technologies for Faster, Streamlined, More Effective Emergency Management

By Sakshi Singh

No matter how frequent or systemic, emergencies always come unannounced. They can also vary tremendously in terms of scope and impact – natural disasters like floods, earthquakes and wildfires, public health crises like epidemics and pandemics, acts of terrorism such as bombings or hostages, and radiation/chemical mishaps that cause widespread damage in a specific area can all be counted as emergencies.

Whether a result of natural or manmade causes, a scenario that classifies as an ‘emergency’ always requires a quick response and rapid decisions in the shortest time possible. It is impossible to rely on the regular routes of authority and communication to operate normally or effectively in an emergency. At the same time, faulty or miscalculated judgements in the heat of the moment can lead to severe, unprecedented losses, even to life and property.

To respond as soon as possible, agencies need systems and solutions that can help maintain situational and operational awareness, swiftly analyse the impact of an incident, assess the damage, deploy resources, and engage the public. The advent and constant development of new technologies are presenting greater opportunities to make emergency management systems more intelligent, streamlined, effective,

and fast, including tools for robust decision support, relay and monitoring in one.

Where Geospatial Fits In

If time is the single most critical parameter in emergency management, data is the most important driver. Emergencies are dynamic, which adds to their complexities. In such scenarios, the availability of the right information at the right time is key to taking the right decision.

The primary information that all stakeholders, from first responders to the highest authorities need always has a spatial component to it – the extent or area affected, population at risk, availability of resources, evacuation/relief routes, damage assessment, and so on. Timely and accurate spatial data is what ties together in-depth assessment, targeted planning, strategic interventions and effective communications for effective emergency management.

“Emergency incidents or disasters are spatial in nature and mitigating or protecting against them in today’s modern networked world requires an in-depth granular understanding of the geographic, environmental, and socioeconomic systems in the area. Geospatial technologies can provide the right data-driven insights for understanding, identifying, and building

strategies for resilience and response more effectively,” notes **Deepak Awari, Secretary AGI and Director – Strategy & Development, SECON Pvt Ltd**

This is where Geospatial technologies and tools step in. Through a robust assessment of affected areas, along with real-time monitoring of support levels and supplies, updated databases of populations, businesses, structures, and utilities, location of accessible evacuation routes and collation with emergency response teams using Geospatial technology, governments all over the world can reduce the response time to an emergency considerably, saving more lives in the process.

The Role of Geospatial Technologies in the Emergency Management Cycle

“Geospatial data is implemented in the complete emergency management cycle. It provides the most significant inputs for Mitigation, Preparedness, Response and Recovery,” notes **Amit Seymour, Sales Director (International), Satpalda Geospatial Services**. While these four key facets may vary slightly from one emergency scenario to another, the tasks they cover can all be improved using geospatial intelligence.

Prevention, Preparedness, and Mitigation

The adverse impacts of emergencies can be altogether prevented, mitigated

or at least better prepared against if authorities and communities have access to accurate, real-time data for effective emergency management. Location intelligence provides real-time data analysis and data insights, which allow departments to make better decisions during disasters,” notes **Dr V S S Kiran, Co-Founder & CEO of Garudalytics**. Through accurate assessment and awareness of the risk environment, considerable losses of life and property can be mitigated.

Geospatial technologies offer useful tools for identifying vulnerable or affected areas, monitoring, and supervising them, and gaining a better knowledge of their physical-socioeconomic characteristics and relationships. Aerial imagery from satellites and drones can be overlaid with digital information to quickly compare hazards and threats, potentially affected areas, and locations that require safety intervention. Such scientific analysis, simulation & modelling mechanisms using Geospatial technologies can help establish robust decision support systems for effective emergency management.

Take for example early warning systems, like the **Indian Tsunami Early Warning Centre in Hyderabad**, that send precise and prompt notifications to improve planning, timing evacuations, and prevent fatalities. The Kakinada Bay area’s critical land data was derived using ISRO’s IRS-1D, followed by the gathering and integration of in-situ data into a spatial framework for the analysis and classification of zones of varying vulnerabilities. A second example would be the interactive information system developed by the **Karnataka State Remote Sensing Applications Centre (KSRSAC)** using geospatial technologies, with a real-time fire monitoring component. KSRSAC was able to detect a total of 3,98,774 forest fires over 2 years using the system.

Response

The critical stage in the wake of an emergency and before relief/rescue measures are sent out is that of Response. It is here that decision-makers must accurately and quickly comprehend the extent of the harm to plan the next course of action.

Rescue and medical personnel must be dispatched right once to the worst-affected areas and any areas where stranded or injured persons might be found. At the same time, it is imperative to address key infrastructure breakdowns as soon as possible to maintain access to healthcare, food, energy, and water. The value of data and information are most pressing at this stage.

During such circumstances, geospatial technologies prove to be cornerstones of efficient communications and real-time information dissemination. With data from various sources, including aerial, in-situ, secondary, geographic, demographic, climatic, and more, organizations may use GIS to create shareable digital overlays. Such priceless information gathered in the wake of an emergency can assist in identifying the most important issues for developing an effective recovery mechanism, such as accessibility, the level of damage, the number of residents in danger, the current state of utilities nearby, and so forth.

Prakash Narayanan, Vice President-Technical Services, Hexagon India shares, “Situational awareness plays a critical role in helping an emergency response operation. The ability to see what is going on at the site of a major event will give extra power to the decision makers to do the right thing”.

Take for instance the **UP Police’s Crime and Criminal Network Tracking System (CCTNS) project** that facilitates the mapping of various types of crime data for both citizen and departmental access. The state-of-the-art mobile application enables simplified crime analysis across zones and effective planning of countermeasures. The result is a considerable reduction in response times, as the nearest police officials are automatically detected during an incident.

Recovery

Following the provision of immediate relief and rescue, it is crucial to move forward with the reconstruction of crucial infrastructure in the short term, followed by gradually returning structures, connectivity, and other necessities of life to normal. “The aim

of the recovery phase is to restore the affected area to its previous state. Recovery efforts are concerned with issues and decisions that must be made after immediate needs are addressed,” notes **Parikshit Das, Director Sales, Emitech Infosystems**.

In this case, LiDAR can be used to gather high-resolution topographic elevation data to look for any geological or structural changes brought on by the disaster or attack. The usage of Digital Elevation Models (DEMs) can help to improve the processes for reconstruction and rehabilitation coordinated with sustainable planning and management initiatives.

With information from all essential aspects consolidated into a single digital interface that is accessible to all stakeholders—governments, on-field teams, and citizens—GIS data may assist outline conventional operational methods. Such platforms allow for the identification and updating of priority activities, which aligns the entire restoration effort for all participants for more structured management and quicker results.

Conclusion

“As an intelligent nervous system with enhanced situational awareness, GIS aids in sensing the health of ecosystems to not only plan and prepare well but also effectively respond, recover, and build resilience and collaboration in case of emergencies. At the national level, it can be described as a ‘System of Systems’ with data flow from districts to states and national emergency management organizations,” notes **Former President AGI and Esri India MD Agendra Kumar**.

Emergencies are chaotic situations, calling for data and tools that allow effective response without adding to the confusion, better yet clearing it up and providing a definitive course of action. Geospatial technologies have the potential to do exactly that, across the full emergency management lifecycle. From combining disparate data from various sizes, accuracies, and formats into a single platform to streamlining, modelling, mapping, and geographical decision support – Geospatial proves to be a powerful tool for each phase of emergency management.



GIS and Emergency Management

The frequency and intensity of emergencies that we are witnessing today are way higher than anything we have seen before. The economic, social, and environmental impact of these emergencies is immense, making it necessary to use 'technology' to effectively prepare, respond, and recover from them. Real-time data-driven insights from Geographic Information Systems (GIS) can lead to more efficient decision-making, right from preparation to recovery.

Prepare more strategically with GIS

Emergency management solutions powered by GIS aid in visualizing and analyzing risks, modeling and designing mitigation projects, and communicating with the whole community to build resilience from the ground.

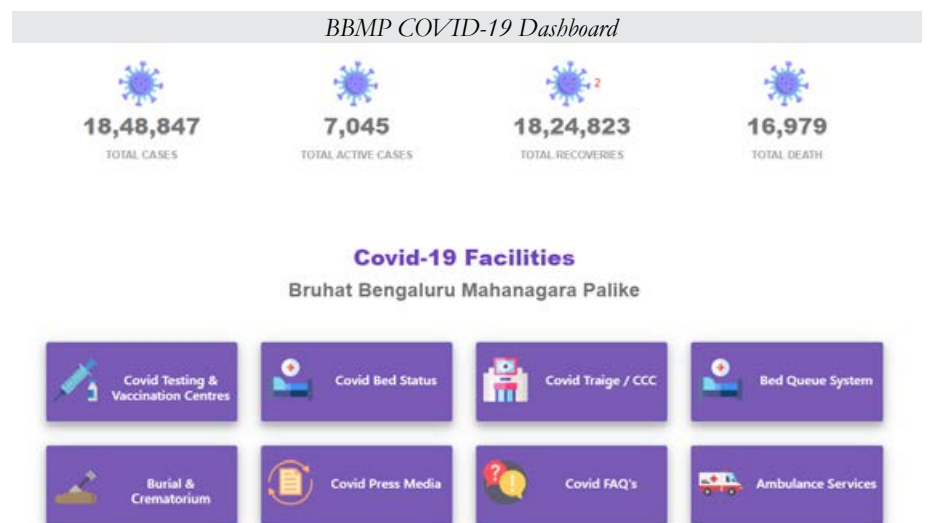
COVID-19 was an emergency of unprecedented magnitude that took the world by storm. As the country worked towards creating war rooms to fight the menace, GIS became the most important enabler. For instance, Bruhat Bengaluru Mahanagara Palike (BBMP) launched a war room to address the coronavirus pandemic on Mar 23, 2020.

It operated 24x7, collaboratively with multiple agencies to monitor cases and address the epidemic. The key activities included real-time information gathering for situational analysis and actionable insights and

also sharing the information with the citizens. With the use of GIS technology, critical and less critical zones in the city were mapped for effective quarantine measures.

ArcGIS COVID-19 templates and dashboards were used for obtaining date-wise, zone-wise, hospital-wise, age-wise, and gender-wise details on a daily

basis. This multi-layer comprehensive data visualization and spatiotemporal analysis proved to be very helpful in reducing the spread of coronavirus disease and saving citizens from the pandemic.



While COVID created a special environment for GIS adoption, on a regular basis, geographic advantage can be used by administrators to safeguard citizens from traffic bottlenecks, crimes, fires, riots, and more. Across the country, traffic administrators are using GIS-based traffic and incident management systems to operate roadways at their peak efficiency. ArcGIS dashboards are helping in monitoring bottlenecks, keeping travelers updated about traffic conditions, and preventing accidents by

identifying the hotspots and localities prone to accidents.

GIS dashboards also enable law enforcement agencies to identify crime hot spots, crime patterns, and even shifts in crime patterns in course of time. Such information becomes vital for curbing crime as it ensures effective allocation of personnel, patrolling, vehicles, etc. in crime-prone areas. GIS takes the center stage when it comes to other emergencies like fire as well. It enables fire service staff to perform a

comprehensive analysis to support the development of all types of plans.

Additionally, an integral part of emergency management is to prevent and reduce the harmful effects of both natural and man-made disasters. This is where GIS has been playing a pivotal role as well. Be it modeling through early warning systems or using decision support systems to understand which disaster is going to affect which area the most, the preparation becomes better, efforts become more directed, and responses are faster. To cite an example, Karnataka State Natural Disaster Monitoring Center (KSNDMC) uses ArcGIS to provide timely and proactive science and technology inputs to help relevant agencies prevent and actively deal with disasters.

Realizing the benefits of GIS-based solutions for having a safer world, the Government is also increasingly

investing in making geospatial and satellite data more widely and openly available. This is leading to increased public-private partnerships to create innovative solutions and data products to prepare, mitigate and recover from disasters more efficiently.

Esri India has also recently developed Indo ArcGIS, which among the 100+ solutions data products and applications, includes a specially curated solution for disaster preparedness and management. It provides automated alerts and live feeds for active hazards and possible disasters. Indo ArcGIS already has more than 500+ India-specific datasets readily available which can aid in solving crucial problems in the realm of Burnt Area Assessment, Carbon Sequestration, Forest Fire Management, Forest Incidents, Locust Watch, Volunteer Registration, and a lot more.

Esri India's Indo Arc GIS offers out-of-the-box GIS solutions and data products to solve India's most pressing challenges



Respond rapidly with GIS

When an emergency strikes, it becomes vital for emergency management professionals to remain informed at all points. This makes response efforts quicker and directed. GIS helps them in maintaining situational and operational awareness, quickly analyzing the incident impact, assessing damage, deploying needed resources, and educating, informing, and warning the public. ArcGIS dashboards can enable the stakeholders to make the right data-driven decisions and help the emergency responders save lives and property quickly.

GIS also aids in identifying the location

of the event and the availability and proximity of appropriate first responders and can be used to provide an operational understanding of risks associated with the call or possible routing hazards such as flooded roadways, damaged bridges, and so on. A GIS-integrated emergency response solution provides more actionable information and capability.

Any emergency requires a well-coordinated and collaborative response to handle the situation. GIS ensures coordinated response and more collaboration by connecting users across roles, agencies, and jurisdictions. ArcGIS Dashboards provide the perfect way to communicate what's

happening right now, including displaying clusters of damage. This information enables planners to prioritize critical facilities for priority restoration.

Indo ArcGIS' disaster preparedness and management solutions also help in locating available resources for efficient disaster response and mitigation. For assessing population and area under disaster impact, it provides simple to use apps that aid in effective decision support in the middle of the crisis.

Recover methodically with GIS

GIS can also largely help in rehabilitation and post-emergency reconstruction. Recovery efforts can take years, and it's critical to avoid missteps that delay progress. It can help in documenting and managing the situation, planning, and distributing resources where they are needed most for the community, and monitoring and evaluating recovery indicators while providing transparency when it is needed the most.

In case of disasters, effective damage assessment facilitated by GIS helps in gaining accurate results in damaged infrastructure, the number of households damaged, families displaced, casualties and injured, etc. This accurate estimation leads to the more effective delivery of relief measures to the right people at the right time. Furthermore, by facilitating the establishment of a communication network, GIS helps in re-establishing communication in the aftermath of a disaster.

Conclusion

With both man-made and natural hazards increasing in frequency and severity, effective emergency management has become essential. Using geospatial technologies like GIS, it is possible to minimize the potential risks by developing early warning strategies, preparing, and implementing developmental plans to provide resilience and even rehabilitation and post-disaster reconstruction can be expedited. Emergency management strategy can take the most innovative and useful form with geospatial technology.



Geographical Information System (GIS) and Emergency Management

Emergencies do not strike with warning. Throughout world history, humankind has witnessed mass deaths due to poorly managed disasters because there was no scope for detecting them early on. Instances such as this have taught administrations of disaster epicentres that certain measures can either prevent destruction or significantly reduce its impact.

The role of technology in this sphere is only increasing every day. Let us assess some examples and use cases where advanced technologies can help tackle emergencies in a better way.

Common Emergency Scenarios that Reflect Poor Management

When a multi-storeyed building is engulfed in fire, it might be difficult for the firefighters to locate the fire exhaust equipment in the building, wasting much of their valuable time. The command centres likely know little of the building layout, and its occupants have neither been exposed to regular fire drills nor are aware of escape mechanisms. The main culprit here is the lack of prompt, accurate information, often resulting in a higher loss of lives.

A hurricane or a cyclone may potentially destroy property worth several millions of dollars and kill several citizens in the absence of technical and technological assistance to the administration on time. The tsunami that killed thousands of people in 2004 is a living example of mass destruction born out of unsound emergency preparation and knowledge.

During floods, Governments struggle to differentiate between inhabited and uninhabited places to provide relief supplies due to inadequate data and information.

WHEN A MULTI-STOREYED BUILDING IS ENGULFED IN FIRE, IT MIGHT BE DIFFICULT FOR THE FIREFIGHTERS TO LOCATE THE FIRE EXHAUST EQUIPMENT IN THE BUILDING, WASTING MUCH OF THEIR VALUABLE TIME.

While there were no channels available in the past to handle the flow of information during such emergencies, the world today has cutting-edge technologies like GIS, IoT, Digital Twins and the Metaverse to thank. With accurate data collection platforms and transformative end-applications, these technologies are helping decode, even predict emergencies early on, and prevent deaths and destruction to a significant extent.

GIS

GIS technology acts as a catalyst for other Geospatial technologies through its powerful visualisation and advanced analytics. Historical information on disasters and emergencies can be stored and visualized on GIS platforms, rendering much-needed inputs for strategizing and implementing preventive measures in frequently affected areas.

During an emergency, GIS can be used to guide disaster management teams in routing resources and supplies efficiently. Some of the most prominent use cases of GIS for emergency management include:

- Flood hazard mapping for areas likely to be affected based on historical data.
- Analysing the path and speed of hurricanes or cyclones to assess which areas need to be evacuated.
- Using remote sensing to assess initial destruction to infrastructure in case of earthquakes.
- Tracking the location and supply levels of support and rescue teams following an incident.
- Creating computer-generated maps of infrastructures, including road networks, rail networks, power lines, water, gas pipelines etc. for ease of reference in preparedness, emergency, and recovery efforts.
- Designing databases for wide-ranging entities like populations, businesses, schools, and others for quick and easy access
- Setting up command-and-control centres at convenient locations for police, fire personnel, etc., for the quickest possible response.

- Displaying and analysing data from aircraft and satellite sensors to observe suspicious events for national security and integrating that information with other key layers like security troop positioning, habitation and deserted areas, and so on.
- Assisting with ongoing updates on damage assessment and needs following an incident.

Digital Twins

Far more advanced and efficient compared to conventional GIS is the Digital Twin technology, and Emergency Management is its biggest differentiator.

Take for example a Smart City Digital Twin that could alert first responders against any emergency occurring within the city. They can be provided real-time updates and predictions on the extent of the emergency in the critical initial minutes. Utility agencies like those for power grids and water supply can be notified immediately in case there is a need for increased resources. Traffic signals can be adjusted to divert traffic away from the scene and allow first responders to arrive on the scene quickly.

Potential disaster scenarios can be tested repeatedly to ensure that the best solutions have been identified and are also compatible with improving the sustainability and livability standards of the city. A living, breathing Digital Twin allows authorities to assess the complete study and modify the effects of one action so that other components in the city's functioning are not disturbed.

The Metaverse

Future emergency management solutions will increasingly leverage the Metaverse, Digital Twins and IoT technologies integrated with GIS for managing emergencies. While the Meta Twins (Metaverse in combination with Digital Twins) can help simulate interconnected real-world experiences and action plans, IoT can be used to directly feed live information and aid the dynamic decision-making process.

Tech Mahindra's Expertise in Emergency Management Systems

Command & Control Centre Management

In India, Tech Mahindra has implemented and is managing an Emergency Response Centre and multiple Command & Control Centres for facilitating quick, traceable emergency responses irrespective of the

location. Our efficient system assures 15 mins response times in urban and 20 mins in rural settings.

At the same time, it allows language selection and provision for persons with special needs. The comprehensive system also captures the geo-location of the caller, the nearest patrolling van & trace data of the calls.

Handling Power Outages

Emergencies such as storms and cyclones may lead to sudden, undesirable power outages, often inhibiting critical workflows. Such cases demand quick power restoration besides constant data sharing with the affected people.

Tech Mahindra has developed and deployed a web portal that helps people view the outage information and Estimated Time of Restoration (ETR) on top of the GIS map layers. The portal helps disseminate accurate outage time and restoration information to end customers, while also improving reliability in the service provider.

Monitoring Real-Time Vehicle Position

Tech Mahindra has developed and is managing a system capable of monitoring the real-time position of concerned vehicles and maintaining information on the vehicle as well as trips. This system has been helping streamline Government ambulance dispatch and routing effectively. The advanced tool has been helping cater to around 300,000 emergency request calls a month and save around 200K lives a year.

Quick-Response Evacuation Mechanism

Tech Mahindra has developed a decision-making analytics dashboard for a major Oil & Gas company in the USA. The

IN INDIA, TECH MAHINDRA HAS IMPLEMENTED AND IS MANAGING AN EMERGENCY RESPONSE CENTRE AND MULTIPLE COMMAND & CONTROL CENTRES FOR FACILITATING QUICK, TRACEABLE EMERGENCY RESPONSES IRRESPECTIVE OF THE LOCATION.

dashboard aids in hurricane evacuations while also tracking all movable platforms, ridges, boats, and helicopters with Person on Boat (POB) count.

This solution has helped reduce the time needed to make informed decisions during an emergency. It has on average saved around 6 days of production yearly by optimizing the evacuation process. The dollar savings achieved were around \$8 million per year on evacuation costs.

Tech Mahindra is relentlessly working in the direction and adding more Case Studies to the portfolio, to mitigate the risks of disasters and support the process of Emergency Management, and Geospatial technologies are a key driver for that vision.

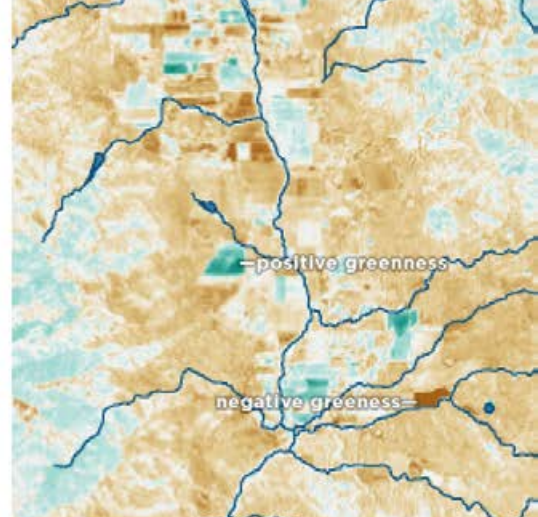




June 8, 2020



June 6, 2020



Vegetation Index 2021-2020

Using NDVI Differences to Measure Drought in the Russian River Watershed

Problem Statement

On April 21, 2021, California Governor Gavin Newsom declared a drought emergency for the Russian River Watershed following two years of critically dry conditions in the region. The watershed is an essential zone within the northern Sonoma and southern Mendocino counties, covering 1,485 square miles of land and serving as the primary source of drinking water for 600,000 people. As of July 16th, Lake Mendocino and Lake Sonoma—the watershed's two reservoirs—were at 33.8% and 51.5% water supply capacity, respectively.

Unprecedented climatic conditions in the Western United States continue to ravage the region's ecosystems and the communities that rely upon them. Drought is the underlying factor for many of the region's problems. As water supply continues to deplete at alarming rates, monitoring its change has never been more imperative. Planet's remote sensing data have been helping assess vulnerable areas where the effects of climate change are most critical.

Solution

Planet surface reflectance basemaps enable generation of Normalized Difference Vegetation Index (NDVI) values over large regions and at frequent temporal intervals to visualize California's drying landscape. NDVI is a measurement of vegetation density and indicates plant health at a given location. The index ranges from -1 to 1, where low NDVI values (0.1 or less) represent bare rock, sand, or snow, moderate values (0.2 to 0.5) as sparse

vegetation, and high values (0.6 to 0.9) as dense, green vegetation.

To visualize drought in the Russian River Watershed, NDVI values were subtracted from the first two weeks of June in 2020 from the same two weeks in 2021. By taking the difference between the two sets of data changes in vegetation within the watershed over a one-year period were quantified.

AS OF JULY 16TH, LAKE MENDOCINO AND LAKE SONOMA—THE WATERSHED'S TWO RESERVOIRS—WERE AT 33.8% AND 51.5% WATER SUPPLY CAPACITY, RESPECTIVELY.

Four areas of interest within the map (Wallbridge Fire, Agricultural land, Undeveloped land, and Kincade fire) were studied to highlight what the NDVI index reveals about drought response in different ecoregions of Northern California. Positive signs of regrowth were recorded in these areas over the course of a year, helping identify suitable planting dates and detailed knowledge of the region's ecosystems.



Key Benefits

Drought is a pervasive problem in the West that will continue to impact California's ecosystems, industries, and residents for years to come. Leveraging satellite imagery to capture, measure, and assess the extent of its reach is a powerful and necessary tool in combating this crucial consequence of the climate crisis.

Planet's satellites allow users to photograph, process, and analyze global changes at a high spatial and temporal resolution. As climate change continues to impact Earth's environments and the communities that rely on them, better understanding these changes as they are occurring is imperative for making informed decisions to benefit the world.



UP 100 – Police Emergency Management System

Safety and security concerns at the community level are always a priority for the well-being of citizens, thus calling for more sophisticated and advanced risk management strategies by law enforcement officers. The UP 100 – Police Emergency Management System is a milestone development in this direction, established to provide integrated emergency services related to public safety across the state of Uttar Pradesh on 24x7 basis.

Problem Statement

The most populous state of India, Uttar Pradesh has a population of 229 million approx. (2022) spread over 689 towns and cities and 75 districts. Emergency management and response for such a vast population has naturally always been difficult for even the largest police force in India – the Uttar Pradesh Police.

Not only were the UP Police unable to take all calls and emergency requests from the general public, but also ended up considerably delaying the response. The emergency interception and management systems in the state were outdated and fragmented, and coordination between police officers or between officer and public was poor and unmonitored. Several challenges ensued, including faulty assignment of PRVs across the state, response times over an hour, lack of collaboration with other agencies, and so on.

Aims and Objectives

Aim:

To provide prompt integrated emergency response for public safety and security to all persons anytime, anywhere in Uttar Pradesh

Key Objectives:

- All urban, semi-urban, rural and even remote areas to be covered
- Provide round-the-clock availability of operational 100 numbers
- Empathetic response to all calls
- Statewide coverage of Police Emergency Response services
- Prompt response for Police Emergency services
- Same standard of service to be provided to all citizens.

Solution

The UP 100 Police Emergency Management System was developed and deployed in the state of Uttar Pradesh to combat the above-mentioned challenges and enhance incident management and agency-wide reporting in India's most populous state. More than 29 lakh points of interest were collected on a GIS-based mobile app along with 1,07,409 village boundaries, followed by integration on CAD application.

HERE's GIS-based ERMS proved beneficial for efficient patrol dispatch and management. Wrong assignments of PRVs were detected and analyzed (500 on a daily basis), to improve operational efficiency. Suitable analytical techniques were deployed to develop mathematical and statistical models for the accurate deployment and redistribution of PRVs across the state. The deployed number of PRVs were correlated with event count, response time, population and area, followed by simulators for what-if analysis for preventative action. Fuel consumption patterns of PRVs were analyzed to gain insights and optimize fuel expenditure.

Previous festivals were studied to identify potential incidental areas and reports created to release advisories to all district and police stations. Negative feedback from citizens on public safety was analyzed to improve ERMS services. The calls received on UP 100 were analyzed to detect patterns and improve event registrations and PRV dispatch over time, gradually leading to more streamlined capturing of events.

Key Benefits

- Captured events across the state increased from 2,500 per day to 13,000 per day.
- Response time reduced from 1 hour+ to less than 13 minutes on an average.
- 4800 dedicated patrolling vehicles available on dispatch 24x7
- Seamless integration with other agencies such as medical services, GRP, fire services, and ICCV (Kumbh).
- Noticeable increase in police accountability because all incidents recorded prior to police intervention
- Police impartiality ensured due to more power to citizens and regular checks and balances through PRVs and police station
- Reduced leakage of sensitive information as ~98% of information on incidents passes on mobile devices to vehicles directly
- Assured transparency with all calls recorded by non-police officers and complete automatic digital trail of all actions at different levels
- Much-needed police reform with all call records stored for judicial purposes, RTI queries replied at district levels, uploaded documents available for investigations.

Rescue Radar: New-Age Emergency Management Solution

Remember Lance Naik Hanamanthappa? The soldier was buried under an avalanche in Siachen for six days before the rescue team pulled him out, alive. Never in history had anyone been rescued alive days after he was buried under about 25 feet of snow. But six days is a long time, and he eventually succumbed to his injuries.

Now imagine a scenario where rescue teams were laden with technology that could penetrate through snow and provide the coordinates of a buried victim. These teams would have been able to locate and rescue Hanamanthappa within hours of the avalanche. He would have survived the disaster.

What was impossible then can easily be done today in India... with Rescue Radar.

How Does Rescue Radar Work?

The low-maintenance Rescue Radar case has two parts: A tablet and a Rescue Radar System. All that an operator is required to do is place the system at a fixed location in a disaster-afflicted zone and monitor changes on the tablet.

This is how Rescue Radar works:

- Radar sends Ground Penetrating Radar (GPR) signals into the subsurface to detect movement once the system is switched on.
- GPR signals penetrate snow, soil and building materials to varying depths.
- Enhanced signal analysis senses periodic motion such as breathing or heartbeats; and within seconds, the distance between the victim and the system is displayed on the tablet.
- A consistent life status symbol over several cycles (time lapses) confirms to an operator that the victim is alive, thus reducing false alarms and saving precious time and effort of the rescuers.

Rescue Radar is designed for the harshest weather conditions, and can operate from -40°C to +50°C, besides detecting survivors up to the depth of 30 meters. It comes in an All-in-one package, is handy and requires no additional setup.

Why Does India Need This Technology?

Climate change and India's unique geo-climatic conditions make it one of the most disaster-prone countries in the world. It ranks 14th in the list of the most vulnerable countries in the world, as per the Global Climate Risk Index report 2019.

According to the National Disaster Management Authority of India, nearly 12% of the country's total land area is prone to floods, and more than 58% of the landmass is earthquake prone. The hilly areas are vulnerable to landslides and avalanches. Moreover, out of a 7,516-km long coastline, close to 5,700 km is exposed to cyclones and tsunamis.

Disaster risks are further compounded by man-made calamities like building collapses, fires, mining accidents, bomb blasts etc. As per the National Crime Records Bureau, an average of seven people die every day due to the collapse of various structures in India (data available between 2001 and 2015).

Major disasters usually damage infrastructure, causing loss of life and injury as people get trapped under debris. The difference between life and death is a matter of hours in these calamities. Hence, the life-saving response needs to be quick.

Who Can Benefit from Our Technology?

Rescue efforts are often coordinated efforts among various specialized SAR agencies. The National Disaster Response



Force (NDRF), the specialized force for responding to all kinds of disasters, is often supported by other agencies depending upon the nature and scale of the devastation, including State Disaster Response Forces (SDRF), state police, fire services, Indo-Tibetan Border Police (ITBP), and the Indian Armed Forces. All these agencies can benefit from the use of the Rescue Radar to reduce response time and save more lives during emergencies.

Conclusion

NDRF is the first Indian agency using the Rescue Radar to locate and rescue buried people. Given the country's vastness and vulnerability to disasters, every agency dealing with SAR operations must have up-to-date equipment that can quickly detect people under debris.

Imagine if only India had Rescue Radar with it in June 2013 when the Kedarnath floods occurred, how many more people could have been saved?

Roter Precision Instruments Pvt Ltd (www.apiroter.com) is an exclusive distributor of Rescue Radar, a product from Sensor & Software, Canada. For more information the undersigned can be contacted:

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AGI India Members Updates

A round-up of some of the major milestones, activities, announcements, and achievements by AGI members in the last quarter.

Amazon Web Services

www.aws.amazon.com



Launched a dedicated accelerator 'Innovation Pod for Drones' in partnership with AGI, Intel Corporation, Telangana State Innovation Cell, World Economic Forum, and Ag Hub. Out of the 358 startups that had applied for the accelerator, 10 have finally been shortlisted.

MapmyIndia

www.mapmyindia.com



Released the RealView feature for panoramic street view and 3D metaverse maps service on the Mappls App on Android and iOS, and Mappls.com on the web for mobile and desktops, merged with house-address level 2D maps, satellite imagery library, and data from ISRO's earth observation systems for an immersive metaverse experience.

Esri India

www.esri.in/en-in/home



Completed majority stake transfer to Country Managing Director Agendra Kumar, marching ahead with 51% Indian ownership. With this step, Esri India will again be recognized as an Indian company under the guidelines of DPIIT and DST.

Marvel Geospatial Solutions

www.marvelgeospatial.com



Recently opened a new office in London, United Kingdom. The office will be the service point for the company for the Europe market.

Garudalytics

www.garudalytics.in



Launched the first MVP of their product – PaaS-based Geospatial Artificial Intelligence platform Garudalytics Smart Mapping that can be relayed across 24 target industries – on their 1-year corporate anniversary. Garudalytics also made it to the Finale of the Forest AI Grand Challenge by the Telangana AI Mission (T-AIM).

Nebula Cloud

www.nebulacloud.ai



Launched the the 'Nebula Cloud Workbench for GIS professionals' in the Indian market, focusing on the Geospatial industry, especially Remote Sensing, GIS, LiDAR, UAV/UAS, and drone service companies. Also launched the Agisoft Metashape Professional Edition on Nebula Cloud for Indian customers, completely hosted in India. The photogrammetry and digital image processing software generates 3D spatial data to be used in GIS applications.

Genesys International

www.igenesys.com/



Announced a strategic alliance with AGI member Esri India for the former's program to make the Digital Twin of entire urban India - encompassing 3D data for the top 100 cities of the country.

NeoGeoInfo Technologies

www.neogeoinfo.com



Announced an MoU with Drone Destination for undertaking the prestigious SVAMITVA and LSM projects in the country. The MoU also covers future projects where drone and geospatial technologies can combine to give powerful solutions.

Google

<https://about.google/>



Launched the Street View feature with a 360-degree panoramic view on Google Maps, in partnership with AGI members Genesys International and Tech Mahindra. The feature was launched for 10 Indian cities, and 50 more will be covered by the end of 2022, mapping over 700,000 km.

Roter Group of Companies

www.apiroter.com



Inaugurated India's largest and Uttarakhand's first drone manufacturing facility in Roorkee, in the presence of Hon'ble Chief Minister Shri Pushkar Singh Dhami. The factory features premium production processes & R&D and manufactures high-end drones and solutions to serve the requirement of aerial-based surveying, mapping & surveillance across India and beyond.

Hexagon India

www.hexagongeospatial.com/



Announced the introduction of the next-generation Leica BLK360 laser scanner globally and in India for creation of photorealistic digital twins within just 20 seconds. The new BLK360 delivers speed, portability, ease of use and efficiency for applications across industries.

WHY GEOSPATIAL IS FUNDAMENTAL TO URBAN INITIATIVES

From *Traditional* to Ecosystem Approach

04 August 2022 India International Centre, New Delhi

Thinking Spatial.



AGI Urban Report Launch

The Association of Geospatial Industries (AGI India) released a detailed report on how Geospatial technologies can transform the Urban sector on August 04, 2022. The industry report has been endorsed by leading think tank, the National Institute of Urban Affairs (NIUA), which works closely with the Ministry of Housing and Urban Affairs (MoHUA).

The Report was launched by Smart Cities Mission, MoHUA, Director Rahul Kapoor, and Ghaziabad Municipal Commissioner IAS Mahendra Singh Tawar, along with AGI President Pramod Kaushik and Senior Vice President Nikhil Kumar at an in-person event in New Delhi on 4th August 2022. The event was attended by other senior officials from MoHUA, NIUA, Ghaziabad Municipal Corporation, Delhi Development Authority, TCPO, NCR Planning Board, and IIT Bombay, among others.

A major driver of socioeconomic growth, urbanization is an inevitable phenomenon for a developing country like India. The share of the urban

population has already reached one-third of the total population, bringing both opportunities and challenges left to be addressed by Governments. AGI's comprehensive report throws light on this state and pace of urbanization in India, and how active engagement among stakeholders using spatial planning tools as the foundation alone can pave the way forward.

The report also talks about the evolving governance framework behind various national-level programmes and initiatives, and the increasing relevance and capabilities of Geospatial technologies across urban development verticals. In response to the challenges that remain to be addressed, the report puts forth several recommendations, the crux being establishing a stronger relationship of central, state, and local self-government institutions in the country with the Geospatial industry and other stakeholders.

For the Geospatial ecosystem, urban development is a key area of application. Land surveys, satellite and aerial imagery, drone surveys, and so on, are just some of the tools

helping in spatial data production, analysis, updating, visualization and management for smart urban development. The case studies and global initiatives included in the report highlight the application of Geospatial technologies in various contexts. Lastly, a list of openly available Geospatial and digital tools by global, national, and sub-national level organizations are available for reference in the annexure.

AGI's Report on the Role of Geospatial Technologies for Urban Affairs is free to download and available on the AGI website. The apex industry body for the Geospatial industry in India invites all stakeholders to use the Report as a ready reference for the Urban sector and the transformative potential of Geospatial technologies in it.

Report Download link:
www.agiindia.com/industry-reports/

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