ArcIndia News

COVER STORY

GIS
Making Impact Across Sectors

CASE STUDY
AGiSAC Facilitates Effective Governance in Himachal Pradesh using ArcGIS
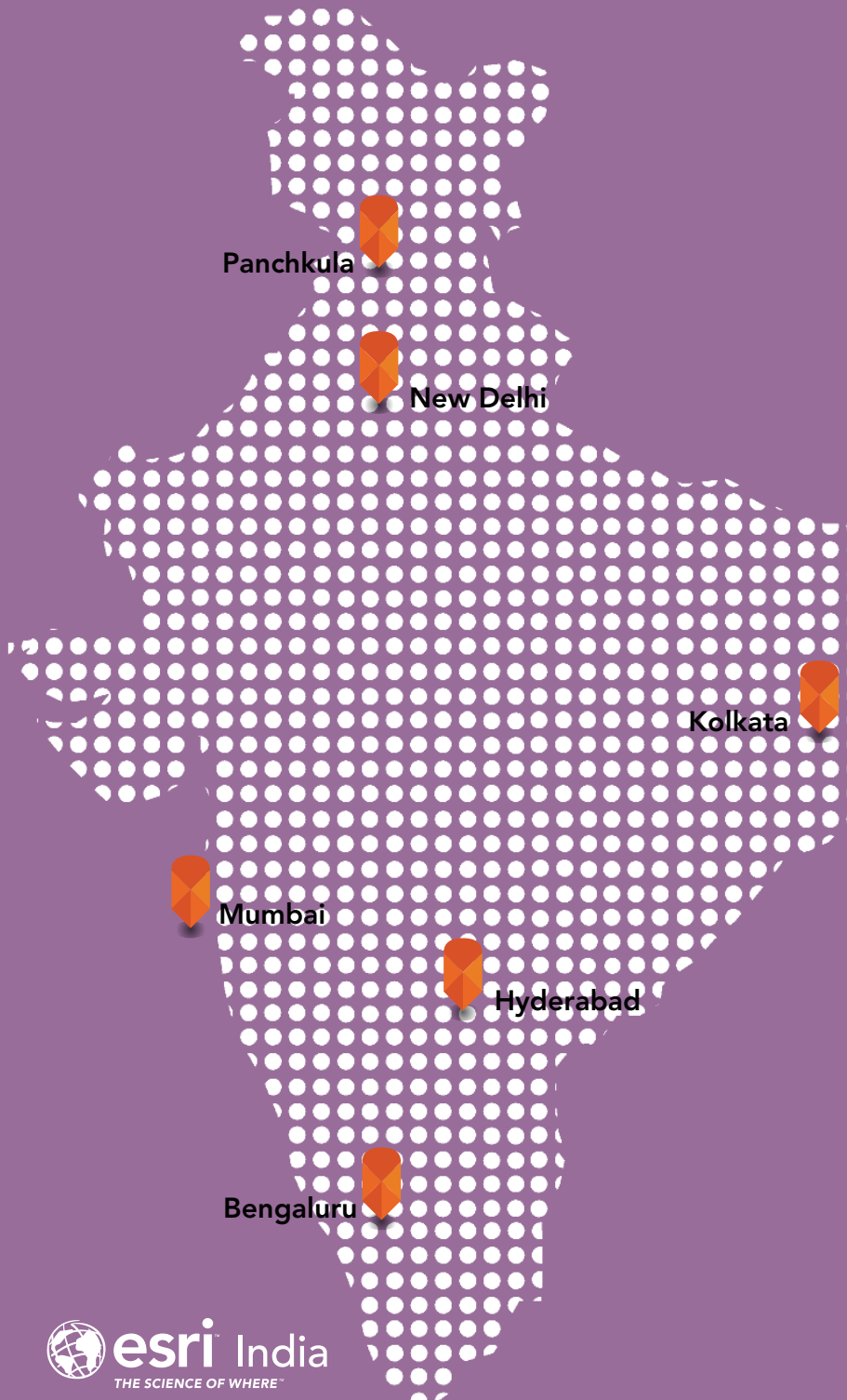
ARTICLE
Location Intelligence: A Game Changer for Enterprises

PRODUCT REVIEW
ArcGIS Business Analyst

ESRI INDIA LOCATIONS

Panchkula

New Delhi

Kolkata

Mumbai

Hyderabad

Bengaluru

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Bengaluru - 560001, Karnataka

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Hyderabad - 500082, Telangana

KOLKATA
Urbanwrk Private Limited, 8th Floor, Technopolis
Building, BP Block, Sector V, Bidhannagar,
Kolkata - 700091, West Bengal

MUMBAI
AWFIS Space Solutions Private Limited,
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Navi Mumbai - 400710, Maharashtra

PANCHKULA
3rd Floor, Plot No 16, IT Park, Sector - 22,
Panchkula - 134109

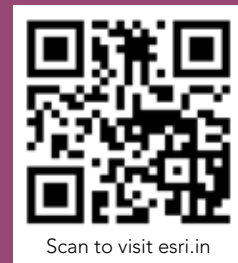1st Floor, Plot No - 1, South Block, IT Park, Sector - 22,
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CONTENTS

MD'S DESK

Agendra Kumar

Managing Director, Esri India

India's GDP growth rate of 8.4% in the third quarter of the fiscal year 2024 surpassed all expectations. The projected growth for the quarter was between 7.1% and 7.4%. Growth in sectors such as services, manufacturing, and construction significantly contributed to this increase in the GDP growth rate, with higher technology adoption being a crucial enabler. Technologies like GIS are driving progress across sectors by offering unique advantages like enhanced information sharing among multi-location teams, improved progress monitoring, superior asset management, increased productivity, and significant cost savings.

GIS is not just a tool; it's a strategic asset. Enabling every sector from infrastructure, utility, telecommunications, urban planning, banking, and retail to agriculture, GIS has emerged as the bedrock of India's national development initiatives. As a leader in the GIS space, we have been playing a pivotal role in these development initiatives by curating solutions that help the stakeholders achieve optimum efficiency in their workflows, leading to significant savings in time and cost in the projects.

To enable Indian industries, solve complex challenges more efficiently, we introduced an India-specific offering, Indo ArcGIS. Since its launch in 2021, we have witnessed a high growth in its adoption. Indo ArcGIS offers 200+ solution products and more than 900 layers of Indian geospatial content as part of ArcGIS Living Atlas, hosted on a cloud in India. The availability of these data layers has significantly increased the use of Esri's ArcGIS across industries in India, leading to our recent accomplishment of reaching the 'million users' mark. This increased user base is a testament to the fact that Indian government organizations and industries are widely harnessing the potential of GIS to achieve exemplary outcomes in their respective fields.

GIS provides a broad array of tools to perform analysis and derive insights for effective decision-making, implementation, and monitoring of interventions. Technological advancements like drone-based data analysis or machine learning algorithms are opening more ways for GIS applications in India. Cloud computing, 3D and digital twins, AR, IoT, and AI are some of the vital technologies that are making the technology more accessible. As these trends reach their peak all around the globe, more transformation will take place in the industries and organizations using these technologies.

As GIS technology continues to evolve, new ways of analyzing, visualizing, and managing spatial data will keep emerging, leading to more growth across sectors. We aim to constantly work with users in government, academia, and the private sector and help them achieve time & cost optimization in their work through effective GIS workflows. These efficiencies will positively impact India's economic growth, helping it to become a developed nation by 2047.

Esri India Achieves
1 MILLION USERS
Milestone

The accomplishment is a testament to the trust and loyalty of the company's wide customer base spread across diverse industries around the country.

With encouragement from the Geospatial Data Guidelines 2021, Esri India, as an Indian entity now offers more than 900 layers of geospatial data through the Indian edition of ArcGIS Living Atlas. These data layers are available through Indo ArcGIS to all its users. Indo ArcGIS also provides 200+ solution products for solving various India-centric challenges. Increased usage of these products in the country has led to the culmination of the 1 million user base.

Agendra Kumar, Managing Director, Esri India shares, "As we celebrate this momentous accomplishment, I want to extend my deepest gratitude to each one of our users who has helped Esri India achieve this milestone of having a million users of Esri technology in India. This increased user base is a testament to the fact that Indian government organizations and industries are widely harnessing the potential of geospatial technologies to achieve exemplary outcomes in their respective fields. The raised awareness along with conducive policies announced by the Government of India in 2021 and 2022 have encouraged users in government, academia, and the private sector to adopt GIS to address mission-critical challenges and build applications that can be collaboratively used by a large number of people in the organizations. We aim to constantly work with the geospatial community and help the users achieve time & cost optimization in their work through effective GIS workflows. These savings will positively impact India's economic growth, helping it to become a developed nation by 2047."

Esri India counts the central government, various state government departments including forest and water resource departments, about 200 municipal corporations, smart cities, and other urban local bodies; national mapping agencies; leading manufacturing and telecommunication companies; utilities, and over 800 degree-granting colleges and universities amongst its customer base of more than 6,500 organizations. The company is poised to add many more credible names to its customer base in the years to come.

Esri India enjoys association with a wide network of partners across the country. It has partnered with leading private and government cloud infrastructure providers to deliver affordable, scalable, and robust GIS solutions to its users. It also offers a complete portfolio of managed services – on premise or on cloud for meeting the users' enterprise GIS needs. Globally, Esri reinvests 30% of its annual revenue into research and development.

Young Scholar Program
2024 Results Announced

Esri India's Young Scholar Program provides students with a platform to showcase their GIS projects and gain recognition for their innovative work. By participating, they stand a chance to win exciting prizes, gain access to exclusive learning resources, and expand their professional network within the GIS community.

Highlights of this year's program included:

- Along with India, the program was launched for the first time in Nepal
- There was a **100% increase in registrations**
- Over **100 universities** actively participated in the program

After following a rigorous evaluation, the following students were selected as the winners of the Young Scholar Program 2024.

Winner

Navjoth B.
Indian Institute of Technology, Kharagpur

1st Runner Up

Raihan Ahmad Khan
Birla Institute of Technology, Mesra

2nd Runner Up

Suchitra Kumud
Indian Institute of Technology, Roorkee

3rd Runner Up

Pondharshini A
Bharathiar University, Coimbatore

VNIT Nagpur Associates with the MMGEIS Program to Empower Students in Geospatial Innovation

The Master Mentors Geo-enabling Indian Scholars (MMGEIS) program, which is the brainchild of Esri India, and the Centre for Knowledge Sovereignty (CKS) was launched in December 2023. On 9th May, Visvesvaraya National Institute of Technology (VNIT) Nagpur became a part of this unique initiative.

Under the purview of the MMGEIS Program, VNIT hosted a series of activities aimed at fostering understanding and collaboration in the realm of geospatial technology. The various activities saw a convergence of academic leaders, industry experts, representatives from prestigious institutions, and students for knowledge exchange on geospatial technology, its applicability, and its significance in contemporary times.

Over 250 students from VNIT and various other schools in Nagpur participated in the activities, where they got the opportunity to interact with **Shri AS Kiran Kumar, Former Chairman of ISRO, and Chair of the MMGEIS Board.** Shri AS Kiran Kumar delivered an enlightening address on the applicability of geospatial technology and its significance in contemporary times.

As part of the MMGEIS Program, VNIT Nagpur students will have access to multiple resources and opportunities to explore geospatial technology and its applications. Under the mentorship of experts in the field, students will gain practical skills and insights that can be applied across various fields, from urban planning to environmental management.

Agendra Kumar, Managing Director, Esri India, said, "VNIT Nagpur's collaboration with MMGEIS Program is geared towards empowering students to spearhead geospatial innovation. Through this program, students will have the opportunity to explore the practical applications of geospatial data across various domains. As they learn from academic and industry experts, they will emerge as leaders who can harness geospatial insights to address real-world challenges and drive positive change."

Vinit Goenka, Secretary, Center of Knowledge Sovereignty, said, "We believe in harnessing spatial thinking to empower individuals and nations. Through initiatives like MMGEIS, we strive to democratize access to geospatial knowledge, enabling every scholar to become a catalyst for positive change in their communities and beyond."

Dr. P M Padole, Director of VNIT Nagpur, said, "VNIT is at the forefront of technology innovation, and initiatives like MMGEIS hold immense potential to empower our students and serve as a force multiplier, significantly boosting capacity building and fostering a culture of excellence in geospatial technology."

The MMGEIS program aims to engage up to 5,00,000 students over the next five years and thus will be rolled out in multiple schools and educational institutions in the near future. It aims to foster a strong IP framework to enable more patents from India in its journey towards becoming a global geospatial innovation hub.

ArcGIS StoryMaps Contest - New Dates Announced!

Every year, the Esri India ArcGIS StoryMap Contest aims to inspire and empower individuals and teams to harness the power of geographic information and storytelling to address critical issues, foster creativity, and share compelling narratives about India's diverse and dynamic landscape. This competition serves as a platform for participants to demonstrate their ability to convey complex spatial information in an engaging and informative way using Esri's StoryMaps technology.

The Themes for this year's contest are:

Sustainable Cities

Explore the challenges and opportunities in building sustainable, smart, and resilient cities in India. Participants can focus on urban planning, transportation, waste management, or innovative solutions for urban development.

Environmental Conservation

Highlight the natural beauty and environmental conservation efforts in India. Stories may encompass topics like biodiversity, conservation initiatives, climate change impacts, or sustainable agriculture.

Social Impact

Showcase the human stories that reflect the positive impact of GIS and location-based solutions on communities and society at large. This could include topics like healthcare access, education, disaster response, or public service improvement.

Cultural Heritage and Tourism

Celebrate the rich cultural heritage of India and its contribution to the tourism industry. Participants can create stories that promote cultural landmarks, historical sites, and indigenous traditions. Participants can also create stories that delve into sacred places, rituals, festivals, spiritual practices, or the coexistence of various spiritual traditions within India.

The deadline for submitting your entry is Sunday, August 18, 2024

The details of the contest can be explored here: esri.in/en-in/programs/storymaps/overview

Winners of
Esri India ArcGIS StoryMaps Contest 2023

SHIVAJI UNIVERSITY KOLHAPUR

Hidden Gems: The Geological Treasures of Bandivade's Legacy

Dr. Abijit S Patil

The Story of Spectacular Polygonal Basalt Columns: Bandivade Village, Panhala, District Kolhapur

HARYANA FOREST DEPARTMENT

Soulful Odyssey: Sadhika's Cultural Quest

Aanchal Sood

Discover the Journey of Devotion: A visual pilgrimage through India's 12 Sacred Jyotirlingas

HEXAMAP SOLUTION

Hidden Gems of India: Exploring India's Cultural Landmarks

Dineshperiyasamy K

Exploring India's Cultural Landmarks, Historical Marvels and Indigenous Traditions

ITC, UNIVERSITY OF TWENTE, NETHERLA

Reducing the Impacts of Assam Floods on Croplands

Snigdha Dev Roy

The state of Assam in India is currently witnessing devastating floods due to exceptionally heavy rainfalls in the Brahmaputra valley, which began on June 14th, 2023.

KIIT UNIVERSITY

Building Greener Cities

Naman Agarwal

Terrain data is pivotal in designing cities resilient to climate and urbanization challenges. Geospatial World reports a 20-25% reduction in development costs with its integration.


DIRECTORATE OF CENSUS OPERATIONS

Puri - The City of Mysterious Temple

M. Rajeswari

Puri is a historic city located in the state of Odisha, India, along the eastern coast of the country. It is known for its religious significance, beaches, and cultural heritage.

Explore the Stories here: go.esri.in/StoryMapWinners

GIS – Driving Impact Across Sectors

Geographic Information System (GIS) is a crucial technology that has proven its capabilities across multiple domains such as environment conservation, natural resources management, urban planning, disaster and emergency management, agriculture, healthcare, utility management, retail, telecommunications, manufacturing, banking, insurance, etc. It is driving progress in these sectors by offering unique advantages like enhanced information sharing among multi-location teams, improved progress monitoring, superior asset management, increased productivity, and significant time and cost savings.
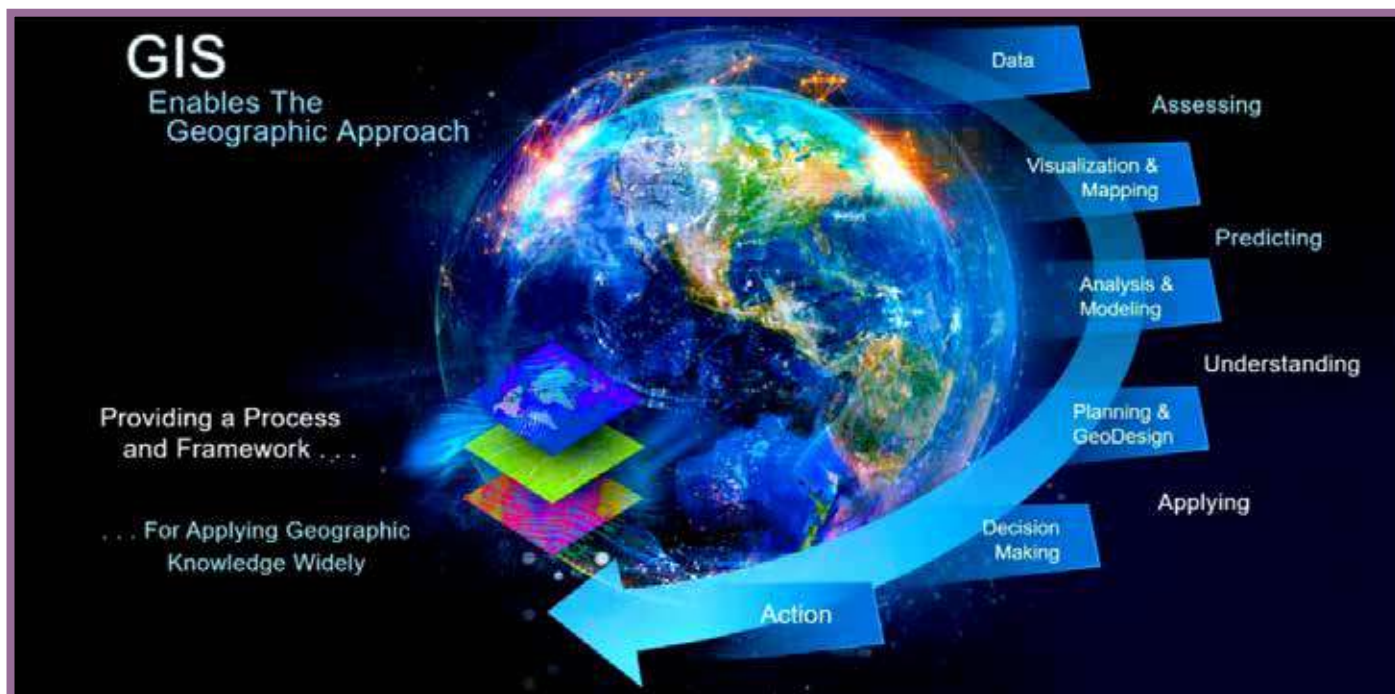
Urban Planning

While the population of the world is growing exponentially, the land available to accommodate the same remains limited. It is shrinking in size with every passing day. The need of the hour is not just urbanization but smart urbanization; to plan urban development smartly to accommodate more in less, and that too nicely and efficiently. By using GIS in urban planning, planners can take urbanization to new scales.

The most frequently involved sectors of urban planning include land use, transport, housing, land development, and environment. Each scale of planning involves different stages: the determination of planning objectives; the analysis of existing situations modeling and projection; development of planning options; selection of planning options; plan implementation; and plan evaluation, monitoring, and feedback. The different functions, scales, sectors, and stages of urban planning make different uses of GIS.

GMDA Achieves Higher Citizen Engagement using ArcGIS

Gurugram Metropolitan Development Authority (GMDA) embarked on an ambitious e-government initiative, aimed at enhancing responsiveness to citizens' needs; increasing operating efficiency and effectiveness; improving financial health, and ensuring greater transparency within various departments. It launched an innovative GIS-integrated Decision Support System named "OneMap Gurugram" in 2019. The data-driven system includes various GIS applications for e-Governance including a mobile app. OneMap went live with a huge amount of data available at a single click. The data is distributed under various heads, including wet and dry infra health, homeland security, planning, land governance, power, citizen-centric services, etc. Initially, there were 12 live applications on OneMap, which soon became available on the mobile app. Currently, more than 25 live applications on the OneMap Portal are helping the government to enhance collaboration and citizen engagement. Projects like 'Crop Survey' and 'Ease of Doing Business', which are part of OneMap Gurugram are enabling the authorities to extend the benefits to the State level.

The robust GIS-integrated Decision Support System (DSS) developed using Esri's ArcGIS technology has taken collaboration between different departments and citizen engagement to new levels. The System provides updated data about the various aspects of the city on a unified platform leading to better governance, higher vigilance, improved citizen-centric services, and higher citizen engagement.

GIS provides planners, surveyors, and engineers with the tools they need to design and map their neighborhoods and cities. Using **ArcGIS Urban**, administrators can analyze, visualize, and evaluate the demographic needs of the community, and planners can design and measure the impact of multiple housing scenarios. The technology enables planners and design professionals to collaborate across teams with a web-based 3D application that supports scenario planning and impact assessment. By incorporating ArcGIS Urban into a comprehensive planning process, planners can more easily assess land-use changes to meet future demand.

GIS helps to store, manipulate, and analyze the physical, social, and economic data of a city. It aids in monitoring an area or conducting the feasibility study of a location for a specific purpose, for instance ascertaining the suitability of a location for the construction of a bridge or dam. It also helps in identifying changes in geographical features or behavior of a land over a specified time. Such information enables professionals to make informed decisions about the development condition of an area and plan accordingly.

Planners make use of GIS also to smooth the progress of citizen participation and community input as they develop a vision for the community that enhances the quality of life for all citizens. Citizens are the life and blood of any city and first-hand input from them as to what can be done to make their city smarter can aid in crafting amazingly productive methods/means for urban planning. Smart community planning prioritizes the human element in designing the communities. Esri provides the technology to make it happen. Esri's smart city technology helps planning professionals determine how, where, and when their designs can have the greatest impact on improving the quality of life.

Esri India has worked with more than 45 Smart Cities, enabling the stakeholders to accomplish the objective of 'providing exceptional citizen experiences.' These cities have established GIS platforms or Geo-Hubs with Esri's ArcGIS technology, which has helped them to achieve excellence in urban planning and administration.

Infrastructure Development

Today's smart infrastructure projects necessarily warrant the usage of advanced technologies such as GIS, BIM, Digital Twins, etc. In large infrastructure projects, the cost overruns are usually in the 20% to 60% range. By using GIS and associated BIM technology, an average of 13% in terms of cost savings can be realized. GIS plays a crucial role in assisting project teams in site selection and evaluation based on geographical, resource, and environmental factors. It enables building professionals to visualize the landscape, strategically plan structure placements, and harmonize the built environment with nature. This location-based approach proves valuable in planning roadways, railways, and airports, allowing planners to assess terrain and environmental variables along proposed routes for optimal and environmentally conscious decisions. Esri's ArcGIS portfolio supports the end-to-end Architecture, Engineering, and Construction (AEC) value chain.

Esri solutions are conceptualized and developed embracing Findable, Accessible, Interoperable, and Reusable (FAIR) principles. Supported by intelligent mapping and data capture tools for Geodesign, intuitive visualization for enhanced situational awareness, advanced geospatial analytics for operational intelligence that is actionable, and multi-mode dissemination for sharing and collaboration among stakeholders, **ArcGIS AEC solutions** foster transparency, efficiency, and cost optimization across the value chain.

Esri's **ArcGIS GeoBIM** enables organizations to provide rich geospatial context to architecture, engineering, construction, and facility management projects. By bringing GIS and BIM data together, ArcGIS GeoBIM allows users to incorporate and use data from multiple systems, access project data from a common experience, explore GIS and BIM data side by side, collaborate and share information with stakeholders, and minimize costly data conversions. Using AEC Project Delivery, users can extend internal GIS content and context to resources outside of the organization. This allows them to collaborate and share information directly with stakeholders.

AEC firms are also increasingly leveraging the idea of integrating GIS and digital twins for abstracting and modeling everything to enhance business processes, mitigate risk, optimize operational efficiencies, and boost decision-making. ArcGIS Reality helps in building geo-referenced Digital Twins of Urban areas to address issues like better utility management, urban flooding, safety and security, etc.

Varanasi Smart City Excels in City Management with ArcGIS

Varanasi Smart City Limited (VSCL) used Esri's ArcGIS to create an **enterprise-wide integrated City GIS** to address the four major problems of the city: solid waste management, environmental monitoring, traffic management, and integration with smart streetlights. In the process, multiple data sources and data levels became available for analysis, including information on administrative boundaries, public services, religious places, education and health, tourism and recreation, transportation, water bodies, and locations of infrastructure related to water, sewerage and drainage systems in the city.

The team at VSCL created the **Kashi Integrated Command and Control Centre (ICCC)** to visualize and address the problems in real-time. The ICCC uses location-based technology to manage traffic safety and city security. The ICCC has also proved to be a versatile mechanism for rapid emergency response.

Varanasi 3D

Esri India has also created a 3D GIS for Varanasi City. The portal shows the entire Varanasi City land use in 3D, which helps in understanding the building scape of the city, and how it has grown over the years through density aspects. There is a set of analytical themes, and each one represents a 3D thematic map of a particular aspect or problem of the city. The 3D themes, when incorporated in dashboards, help in understanding the data in a better way. The portal also enables the planning of buildings, street lights, or cameras in the city.

Utility Management

Utilities are an integral part of any city. GIS has proved to be an irreplaceable tool for demystifying utility data and providing location-rich "contextualized" insights. For addressing the complex challenges utilities are faced with, the "Geo-Enabled Smart Utility Management" approach provides a bird's eye view of the utility infrastructure with the ability to narrow it down to individual assets and consumers.

Along with tools for analysis, visualization, modeling, and collaboration - GIS amplifies the digital utility operations multifold by enhancing situational awareness along with actionable intelligence for informed decisions both at regional and local levels.

ArcGIS Utility solutions are making access to contextualized information easier than ever, helping utility CXOs address their priorities better than before. They are helping organizations to stay agile in the changing times and drive innovation. By augmenting existing frameworks with **ArcGIS Utility Network**, utility CXOs can enhance their business value delivery while optimizing operations for improved efficiencies and increased customer satisfaction, paramount for a sustainable future.

Power utility companies like Sterlite Power, BSES, and AEML, are leveraging ArcGIS to improve their operational efficiencies and provide enhanced services to their consumers. In the **oil and gas** sector, IOCL, Gujarat Gas Limited, Mahanagar Gas Limited, and many others have been leveraging ArcGIS to achieve excellence in their operations and asset management.

Built using ArcGIS, India WRIS is a one-of-its-kind comprehensive Water Resources Information System (WRIS) that provides authoritative, and consistent data and information on **India's water** resources and allied themes. This information enables the stakeholders to achieve highly effective outcomes in the planning, development, and management of water resources in the country.

Telecommunications

The two major telecom service providers (TSPs) in India, Reliance Jio and Airtel have harnessed the various capabilities of ArcGIS to achieve the most effective outcomes in network planning to management. ArcGIS enables them to map their network assets along with their coverage capacities.

The technology allows the teams to collaborate, share, and perform a variety of spatial analyses such as identifying coverage blind spots, hotspot analysis, and network route planning.

Managing Gas Assets Optimally using Esri's ArcGIS System

A comprehensive GIS solution built using ArcGIS allows Gujarat Gas Limited (GGL) to map and manage gas assets efficiently.

In terms of engineering, planning, and design, the GIS system facilitates route planning, project estimating, network simulation, design clearances, and reinforcement and replacement planning.

For construction and projects, it aids in construction planning, network identification, route analysis, and risk assessment. Maintenance activities benefit from the system through maintenance planning, patrolling, valve chamber maintenance, shutdown planning, and providing data for root cause analysis.

In emergency response, the GIS system ensures quick response, isolation and squeeze-off analysis, efficient complaint handling, and crew monitoring.

The GIS solution has yielded several quantifiable benefits for GGL. These include significant cost savings through optimized route planning, efficient project estimating, and streamlined maintenance activities.

Manpower utilization has improved as a result of enhanced crew monitoring and efficient emergency response. Productivity gains are notable in terms of reduced hours spent on planning and increased operational efficiency. The GIS system has substantially improved data accuracy, contributing to better decision-making across various operational domains.

As the telcos transition from 4G to 5G, they rely on 3D geodata to accurately predict their 5G network coverage and deliver the quality of service the customers expect. 5G networks demand a more sophisticated approach to network planning due to their reliance on millimeter-wave frequencies, which are highly sensitive to environmental factors such as building structures, vegetation, and terrain variations. As traditional 2D maps fail to capture the intricate details necessary to accurately assess signal strength and quality, 3D mapping techniques have become a necessity in 5G network planning.

Esri's geospatial capabilities leverage 3D maps, LiDAR, drone-based surveys, and GIS coverage analysis to help telcos in site identification network planning and designing. ArcGIS Pro enables the creation of detailed 3D models at any scale – from individual sites to entire cities and regional geographies – which serve as the foundation for digital twins. Along with asserting its leadership in 5G, India aspires to connect over 20 crore rural and urban households with broadband services by 2030. To increase broadband penetration from the existing 13% to 80%, we are looking at a huge deployment of digital connectivity infrastructure-fibre, mobile towers, data centers, satellite broadband, wi-fi, etc. GIS will be a crucial enabler here as well, enabling stakeholders to achieve unmatched precision and cost and time efficiency in the projects. GIS-powered digital twins will enable the stakeholders to achieve excellence in network planning, coverage, maintenance, and management.

GIS-based digital twins extend beyond 3D models by incorporating temporal dimensions, showcasing historical, present, and projected future states. This temporal aspect enables users to track changes over time, facilitating better decision-making and planning. By integrating real-time data and predictive analytics, GIS-based digital twins provide a comprehensive understanding of dynamic environments, allowing stakeholders to anticipate trends, mitigate risks, and optimize strategies.

Recognizing the immense capabilities of digital twins in solving challenges across industries, the Government of India is also investing in unique digital twin initiatives. The initiatives aim to carve out a position of leadership for India in digital infrastructure and innovation by combining the prowess of 5G, IoT, AI, AR/VR, 6G, Digital Twin, and next-gen computational technologies. Esri's ArcGIS technology aims to become a crucial enabler here by facilitating enhanced data capture and integration, better real-time visualization, advanced analysis and automation of future predictions, and information sharing and collaboration. Using ArcGIS, the stakeholders can achieve unparalleled context and high-resolution data integration for better business decisions.

Disaster and Emergency Management

Disaster Management is an ongoing process along with the development plans of a region, including cities. Be it modeling through early warning systems or using decision support systems to understand which disaster is going to affect or is affecting which region the most, GIS can help mitigate the risks of a disaster to a great extent. Using GIS, preparations can be better, efforts can be more directed, and responses can be faster. GIS enables the response teams to gain situational awareness, engage with the public, and understand the impact of the event. As GIS leads to better identification of the affected areas and people, recovery becomes easier and faster.

ArcGIS provides powerful capabilities that aid in identifying, assessing, and understanding risks that cause disasters and emergencies. With its advanced capabilities for mapping,

imagery, and remote sensing, ArcGIS enables users to visualize, analyze, and manage data in 2D, 3D, and 4D to gain new insights for prevention, mitigation, and informed decisions.

Prevention: Using multidisciplinary factors and historical data, ArcGIS tools aid in improving predictions regarding subjects that will be impacted. Such localized evaluation helps in proactive measures to deal with the impact of the disruptions. By integrating real-time data from sensors/IoT devices and social media on maps and big data capabilities, agencies can identify temporal patterns and extract actionable location intelligence. By analyzing dependent factors, agencies can have a bird's eye view as well as the ability to drill down to details to assess accurate situations on the ground and plan remedial actions.

Response: Situational awareness along with actionable intelligence being the key factor, it is important that all responders are armed with updated information as situations dynamically evolve and data-driven decisions are taken. Be it evacuation routes, rehabilitation shelters, or other services that are key to successful response operations, it is updated information presented in a spatial context that makes the difference and helps stay ahead. The GIS-enabled mobile apps support field operations, community and citizen engagement by bridging the gap between teams on the ground and command-control reducing response times and maximizing resource utilization.

Rehabilitation and Recovery: The aftermath of disasters warrants a methodical recovery. While Post Disaster Needs Assessment (PDNA) is the first step toward a holistic recovery, it is important to recognize that the disaster recovery process goes beyond the PDNA and aids in identifying a criteria-based prioritization, planning, and implementation of the recovery agenda. GIS plays a critical role in ensuring that disaster recovery processes are prioritized and embrace inclusiveness, resilience, and sustainability. Situation analysis using dashboards, impact analysis tools, and workforce management tools helps in providing prioritized relief to affected citizens and their needs in the shortest time. This enables the affected communities to build back in a more adaptive way. The information and knowledge shared during the process supports in building actionable agendas for strategic planning, disaster risk reduction, and policy decisions to strengthen resilience.

Esri India's Indo ArcGIS offers specially curated solution products for disaster management. This Indo ArcGIS Solution provides automated alerts and live feeds for active hazards and possible disasters. It helps in locating available resources for efficient disaster response and mitigation and assessing

population and area under disaster impact. It also provides simple-to-use apps for effective decision support in the middle of a crisis.

The Volunteer Registration Solution provides an interface to the public for registering as a volunteer in case of disasters with location details. It enables disaster managers to check location-wise volunteers' status, helping them to plan actions as per the availability of the resources.

Healthcare

"Good health and well-being" are essential for achieving sustainable living conditions for the citizens of any region. GIS is the core foundation of all the key public health functions - assessment, policy development, assurance, and operational awareness. To devise effective healthcare strategies for communities, agencies need to be able to respond to questions such as:

• What are the key health challenges our communities are facing?

• Which are the immediate interventions needed?

• Where are these interventions needed?

GIS provides answers to these, enabling public health agencies to take larger steps in addressing national healthcare needs. It stands out as a game-changing technology for health systems focused on delivering personalized care. By providing a nuanced approach to understanding and communicating with various patients and communities, GIS opens doors to modernized outreach, tailored messaging, and informed decision-making.

GIS enables health systems to capture, analyze, and present data in impactful ways such as calculating access to care for patients, examining the health impacts of a community context through the social determinants of health model, and implementing service reconfigurations that align with local needs. GIS not only makes a healthcare agency's data more valuable, whether it comes from an electronic health record system, claims, and billing systems, or other data warehouses, but also makes it easy to source and use additional reliable platforms such as the Indian edition of ArcGIS Living Atlas.

Every day the technology ecosystem is evolving rapidly. Health agencies are collecting more and more data for analysis to build further efficiencies and effectiveness in their decision-making, operations, and processes. Integration of AI, ML, big data, and data science methods and tools with spatial analysis enables more accurate, efficient, and productive insights with potential applications across several disciplines within public health, precision medicine, and

the Internet of Things-powered smart healthy cities. These can help in predictive modeling to identify populations at high risk for disease, in healthcare delivery of telemedicine/mobile health to the masses or even integrating social media feeds for syndromic surveillance. GIS will continue to be the core foundation to support the health tech revolution we are witnessing.

Business Growth

Businesses are core to the development of cities, livelihood, and services to urban populations. GIS empowers businesses to make better-informed decisions by providing actionable insights derived from spatial data analysis. By leveraging GIS technology, businesses can gain a competitive edge, optimize their operations, and achieve their strategic objectives more effectively.

GIS can help them get answers to key questions including, where are markets shifting? Where are the best customers? Where are operations at risk? Where are products and services delivered? In a constantly changing world, GIS technology provides greater business intelligence for more successful, resilient organizations that can withstand the most severe disruptions and thrive to better serve their stakeholders.

Retail

As retailers strive to engage customers more effectively and build market share, unlocking the insights hidden in location data is key to understanding customers. GIS enables retailers to garner holistic customer insights that support engagement across the customer's journey: before, during, and after engagement. Before engagement, GIS helps firms decide where to open new stores and generate new leads. During the critical moments of engagement, the technology drives sales through contextual marketing and location-based experiences, and after engagement GIS allows firms to identify and deliver the next best experience and segment customers to derive even more insight.

ArcGIS Business Analyst is a Location Intelligence solution suite designed to aid organizations in making data-driven decisions. ArcGIS Business Analyst is a unique solution comprising data, maps, workflows, and infographics that will enable businesses to make smarter decisions. Using ArcGIS Business Analyst, businesses can gain invaluable insight into changing populations, housing, demographics, consumer spending, competition, etc., and thus make more informed decisions for market planning, site selection, territory management, and customer analysis. Such in-depth analysis will help them gain a competitive edge and improve operational efficiency.

Logistics is the lifeblood of every retail business. GIS enables retailers to visualize all parts of their supply chain—inventory, transportation assets, warehouses, and stores. It empowers supply chain professionals to make data-driven decisions regarding optimal site selection for warehouses, distribution centers, and manufacturing plants. By integrating various datasets such as demographic information, transportation networks, and customer locations, GIS helps identify strategic locations that minimize transportation costs, reduce delivery lead times, and maximize customer reach. This proactive approach enables businesses to stay ahead of the competition and gain a competitive edge. Leveraging location intelligence can also significantly enhance fleet management efficiency. Using GIS, retailers can optimize routes, minimize backtracking, and increase the probability of timely deliveries, thereby ensuring customer satisfaction. Additionally, it enables managers to proactively identify issues and provide drivers with instructions to circumvent them, further streamlining operations.

Advertising success also depends on precise, accurate information about target audiences. Location intelligence provided by GIS makes it possible to target a specific audience based on the places they visit in the real world. For example, by using precision or proximity audiences, retailers can increase the relevance of their ads to consumers based on the commercial places of interest they visit. With precise demographic, consumer spending, and behavioral data, they can confidently reach specific customer types where they live, work, and play. GIS helps gain a deeper understanding of the target audience and improve the return on investment (ROI).

Manufacturing

GIS plays a vital role in manufacturing as well. Manufacturers need agility and new insights to deliver good customer experiences. Data-driven insights, automation, and coordinated planning across the value chain enable more informed decision-making and thereby more effective outcomes. Esri's location intelligence solutions help in reducing operational costs, minimizing disruptions, and mitigating risks in the supply network. Esri offers a comprehensive suite of products and services tailored to meet the diverse needs of the manufacturing industry with an extensive portfolio that includes cutting-edge products such

as ArcGIS Business Analyst and ArcGIS Knowledge. These advanced tools empower manufacturing professionals to drive innovation in market analysis, customer service, sales territory optimization, field service operations, supply chain visualization and analysis, asset management, and more.

Banking and Financial Services

We have seen increased adoption of GIS in the Banking and Financial Services sector as well. GIS is helping the sector in enhancing sales and marketing, regulatory compliance, business continuity planning, and service location evaluation. By leveraging geospatial visualization, banks can gather and interpret information more effectively than traditional tables and charts allow. Mapping market statistics helps evaluate and determine optimal locations for bank branches.

As financial services and banking navigate unique challenges and opportunities, especially with the expansion into emerging markets, there is a growing demand for sophisticated geospatial and data analytics. The shift towards decentralized business models further necessitates advanced analytical tools. To address these trends and globalization pressures, banks are elevating their banking analytics capabilities. GIS plays a crucial role in this evolution, transforming geographic data into actionable insights that finance professionals can use for targeted banking analytics projects.

Sustainable Development

GIS has become integral to sustainability efforts worldwide. The unified platforms, powered by GIS, aid in integrating and visualizing a wide range of environmental data, enabling stakeholders to make informed decisions. With GIS, information on land use, biodiversity, water resources, and energy consumption can be overlaid on infrastructure assets and analyzed to identify patterns and areas for improvement.
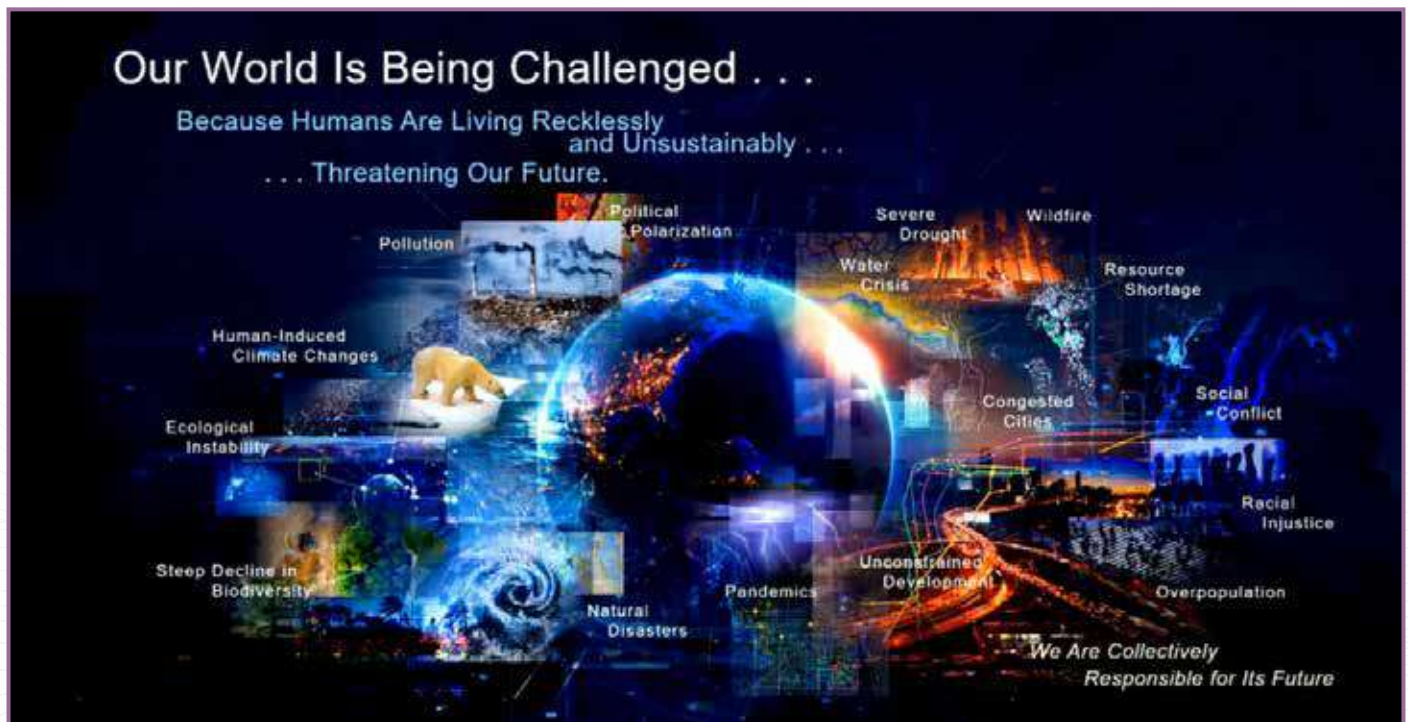
A primary application of GIS in sustainability lies in analyzing land cover data. By leveraging GIS, organizations can pinpoint areas suitable for conservation or restoration efforts. This facilitates the preservation and restoration of ecosystems, promotes biodiversity, and safeguards natural resources while planning and managing networks. Additionally, GIS aids in

monitoring and managing protected areas, ensuring their long-term sustainability. By integrating data on protected areas, land use, and ecological factors, GIS enables effective planning and decision-making to uphold the integrity of these vital areas.

In essence, GIS serves as a powerful tool for comprehending and managing sustainability factors. By harnessing its capabilities, stakeholders can glean valuable insights, identify improvement opportunities, and make informed decisions to foster a more sustainable future.

GIS and UN SDGs

Leave no one behind (LNOB) is the central, transformative promise of the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs). The ability to disaggregate SDG indicators where relevant, into thematic areas related to age, gender, economic status, and income is a key tenet of the "leave no one behind" philosophy. "Disaggregation of subjects by geographic location" is critical to ensure that no one is left behind. With economic development being highly contextual and spatially explicit, the context of geography (place) attains higher significance with people and the environment.

Each of the 17 UN SDGs is dependent on the understanding of geographic location, inter-relationships, and inter-linkages. Use of geospatial information, earth observations and other forms of location-based data becomes critical for situational awareness and decision support. Geospatial technologies play a central role in disaggregation contextualized to national, sub-national and local levels.

The SDGs Geospatial Roadmap is a living resource that helps communicate, guide and enhance the awareness of geospatial information, Earth observations, and related data sources, products, and enabling tools and methods, to inform and support the implementation of the SDGs, according to national circumstances.

Agriculture

Using GIS farmers can achieve increased production and reduced costs by enabling better management of land resources. The risk of marginalization and vulnerability of small and marginal farmers, who constitute about 85% of farmers globally, also gets reduced using GIS. Agricultural Geographic Information Systems enable farmers to map and project current and future fluctuations in precipitation, temperature, crop output, etc.

Agricultural mapping is day by day becoming crucial for monitoring and management of soil and irrigation of farmlands. It is facilitating agricultural development and rural development. Accurate mapping of geographic and geologic features of farmlands is enabling scientists and farmers to create more effective and efficient farming techniques. As farmers are able to take more corrective actions in the form of better utilization of fertilizers, treating pests and weed infestations, protecting natural resources,

etc., we are bestowed with more and higher quality food production.

GIS holds the key to viable solutions for agriculture. ArcGIS facilitates stakeholders to collect, maintain, analyze, and share the agriculture data and make better in-season decisions. ArcGIS allows integration of earth observation, imagery, field data, and real-time data streams to improve efficiency, profitability, and sustainability.

Environment Conservation & Climate Change

Perhaps the most important concern for all of us today is protecting the environment we live and breathe in. Climate change issues are creating havoc with erratic weather patterns affecting everything from crop production to the untimely melting of ice glaciers. There is a lot to worry about and immediate action is required. It's not that the world has not geared up to take corrective actions, but we need to do more, and GIS can help us achieve that.

GIS can be used most effectively for environmental data analysis and planning. It allows better viewing and understanding of physical features and the relationships that influence a given critical environmental condition. Factors, such as the steepness of slopes, aspects, and vegetation, can be viewed and overlaid to determine various environmental parameters and impact analysis.

GIS can also display and analyze aerial photographs. Digital information can be overlaid on photographs to provide environmental data analysts with more familiar views of landscapes and associated data. GIS can provide a quick, comparative view of hazards (highly prone areas), risks (areas of high risk that may occur) and areas to be safeguarded.

On completion of data analysis, GIS can help in effective planning and managing environmental hazards and risks. In order to plan and monitor environmental problems, the assessment of hazards and risks becomes the foundation for planning decisions and mitigation activities. GIS supports activities in environmental assessment, monitoring, and mitigation and can also be used for generating environmental models.

Esri's ArcGIS technology serves as a powerful integrative tool, consolidating data on global phenomena, their locations, and their impacts into a unified platform. This technology is pivotal in compiling and disseminating data related to Sustainable Development Goals (SDGs), informing policy decisions, and facilitating sustainable development initiatives. Through collaborations with governmental bodies, non-profit organizations, and authoritative data providers, Esri India is actively creating solution products, interactive dashboards, and other informational resources to help advance sustainable development efforts.
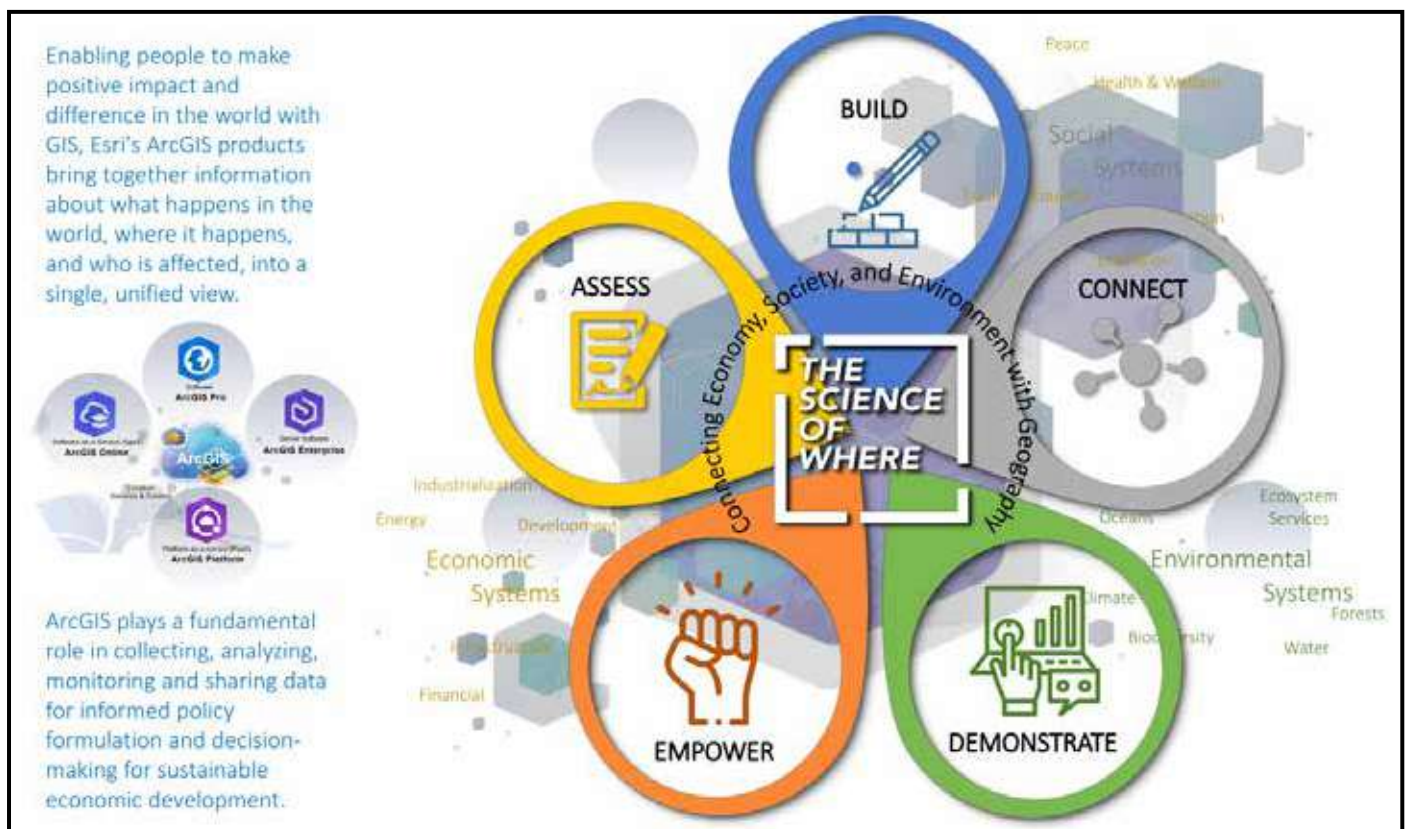
Natural Resource Management

Being a ubiquitous technology, GIS integrates seamlessly with disparate data sources such as satellite imagery, LiDAR (Light Detection and Ranging), aerial photography, and GPS. This helps in providing valuable information for natural resource management. GIS-based modeling techniques enable the simulation of various scenarios related to natural resource management, such as the impact of climate change, urban expansion, or deforestation on ecosystems. These predictive models assist in identifying potential future challenges and devising proactive measures to mitigate them.

Esri's ArcGIS System empowers decision-makers to manage natural resources more effectively. For instance, through our forest management solutions, we have made it easier for stakeholders to monitor forest health, create inventories of forestry data, and also analyze ecological parameters. Forest departments are now looking at scaling up their existing technology infrastructure to set up GeoHubs for a more coordinated approach to sustainable forest management as well as driving inclusive participation with larger stakeholder communities including citizens.

Esri India's Indo ArcGIS offers specially curated solutions for solving some of the most pressing challenges of natural resource management in India. These unique solutions for burnt area assessment, forest fire management, water resource management, forest plantation management, disaster management, land management, etc. are paving the way for sustainable natural resource management in India. These solutions are supported by 900+ layers of data through the Indian edition of ArcGIS Living Atlas.

Many state government departments have already been using GIS technology for forest management practices such as wildlife management, joint forest management, plantation/afforestation activities, forest fire management, protected area management, commercial forestry, and more. MP Forest is using ArcGIS for a central dashboard for forest monitoring, mapping entire forest boundaries and correcting them vis-a-vis revenue boundaries, utilizing mobile-based GIS for data collection, incident management, and tracking beat guard movement. This is largely helping in sustainable forest management.

Esri's ArcGIS is also playing a crucial role in the conservation efforts of the Ganga River. The GIS-based 'Web Centric Water Quality Dashboard', used by the National Mission for Clean Ganga (NMCG) authority aids in effectively assessing the current state of the Ganga River, identifying pollution sources, and planning conservation strategies.

Esri India's solution is also helping the National Water Informatics Centre (NWIC) to foster both environmental conservation and economic development. Powered by ArcGIS, the India-Water Resource Information System ensures the provision of reliable, timely data and insights for comprehensive future water projections. The System supports informatics-based sustainable development in water resource management, delivering value-added products and services to all stakeholders.

ArcGIS Facilitates Comprehensive Decision-making in Mining

Adani Natural Resources is using Esri's ArcGIS to make informed decisions in mining.

The System is helping in:

- Contiguous acquisition and tracking of land in areas of interest demarcated by mine planners designated to certain activities like mining, dumping, or infrastructure areas.

- Infrastructure planning. GIS applications integrate geological model databases, surface features, and existing mining features to suggest suitable infrastructure areas.

- Monitoring large mining landscapes from drone data and tracking land reclamation details, vegetation planning, vegetation health growth, and mining operations.

- Exploration planning in undulated topography and tracking exploration progress through GIS dashboards and analytics.

- Monitoring of safety and environmental parameters in the mining area.

- Effective evacuation and logistics planning.

Conclusion

The applications of GIS go much beyond the scope of this story. GIS serves a diverse community ranging from citizens to administrators, business leaders, scientists, social workers, and many others. It caters to the requirements of individuals, governments, businesses, entire enterprises, and civil society. With geospatial data becoming increasingly ubiquitous, contextualized geo-intelligence has taken a center-stage. Its economic value and benefits across the spectrum, sector-agnostically, are well acknowledged. In the past, GIS was confined to desktop computers, offering only a handful of features, and requiring specialized expertise to operate within office settings. In the present day, with versatile functionalities that are tailored and customized, GIS has become easily accessible from any location at any time, empowering individuals from all walks of life to utilize its capabilities. The recognition of GIS as a valuable decision-making tool has led to its integration into various sectors, extending their reach and impact. By providing valuable insights, improving efficiency, facilitating collaboration, and supporting innovation in various sectors, GIS is reshaping the way governments, businesses, and communities collaborate and interact with spatial data. Harnessing the potential of GIS is critical for sustainable, inclusive, and equitable growth.

ArcGIS enables CRIDA to objectively review watershed projects and assess India's vulnerability to climate change

Central Research Institute for Dryland Agriculture used Esri's ArcGIS to deal with its vast geographic data for scores of applications in agriculture viz. land use planning, watershed management, agricultural sustainability and vulnerability studies, agrometeorology. Remote sensing, GIS, and GPS were used for precision agriculture to optimize the application of inputs for plot and crop identification, crop monitoring, etc. to estimate and maximize yield. The solutions were aimed at providing farmers with the best possible outcomes for themselves, their families, and investors and indirectly for their customers and the environment.

The ArcGIS solution enabled officials in different domains to make better and quicker decisions. It helped them in:

- Managing risks by assessing the nutrition retention capability of soil organic matter

- Bridging yield gaps by determining local natural resource availability and local model development for risk assessment

- Dealing with concerns related to nutritional security such as rise in demand, cereal production and growth in GDP

- Determining environmental footprints of changing demand profiles

- Managing water resources

- Maintaining soil health and productivity

- Evaluating climate change and climate variability

AGiSAC Facilitates Effective Governance in Himachal Pradesh using ArcGIS

Client
Aryabhatta Geo-informatics and Space Application Centre (AGiSAC)

Industry
Space

Organization Profile
Aryabhatta Geo-informatics and Space Application Centre (AGiSAC) has been set up under the aegis of the State Council for Science, Technology, and Environment, Himachal Pradesh.

The Centre envisages the development of low-cost software and web-based applications for the various government departments and stakeholders that facilitate administration in tracking, monitoring, and analyzing data.

Website
www.agisac.gov.in

Project
Decision Support System

Highlights
The geo-informatics applications developed by AGiSAC using ArcGIS aid the user departments in planning, monitoring capacity building measures, upkeeping existing infrastructure, and more. Further regional and sub-regional balance in all spheres get measured, monitored, and maintained effectively using these geo-informatics applications. The applications help the user departments to decide on establishing an asset/scheme/project based on geospatial analysis of various variables such as terrain and topography. A gap analysis of existing infrastructure coupled with inputs like user base, routes, etc. helps them to identify ideal locations for developing infrastructure.

Project Summary

AGiSAC works to identify decision-making applications with the help of user departments and provides tailor-made GIS solutions for better decision-making in government departments using ArcGIS. It has developed web, desktop, and mobile applications for various state user departments such as rural development, public works department, irrigation and public health, forest, town and country planning, and environment to ensure efficient, effective, transparent, and accountable governance.

Solution & Benefits

The geo-informatics applications developed aid user departments in human resource management, upkeep of existing infrastructure, visualizing gaps in the existing infrastructure, identifying ideal locations for establishing new facilities like educational and health institutions, fair-price shops, timber and non-timber plantations, finding nearest routes, action plan generation for MNREGA works, check duplicity of works, and measure and monitor distribution of beneficiaries and thereof regional and sub-regional imbalances.

The Decision Support System (DSS) is hosted on a web portal and efficient low-cost data gathering devices like GPS-enabled mobile phones are used for the automatic updating of the databases. The user departments provide validated databases to the Center. As all government departments are enjoined to subscribe to the Center, various databases are used seamlessly, and interdepartmental issues are tackled easily. The inputs used for the development of geospatial information include SOI (Survey of India) toposheets, cadastral maps, high-resolution satellite data, demographic data, departmental data, etc.

Esri's ArcGIS suite is helping AGiSAC achieve the desired outcomes through these applications. The technology facilitates viewing, editing, creation, and analysis of geospatial datasets. It allows users to explore data within a dataset, symbolize features accordingly, and create maps. By using the technology, AGiSAC could create and manipulate datasets to include a variety of information. The maps produced generally include features such as north arrows, scale bars, titles, legends, neat lines, etc. The ArcGIS suite also allows the users to use extensions such as 3D Analyst, Spatial Analyst, and Network Analyst.

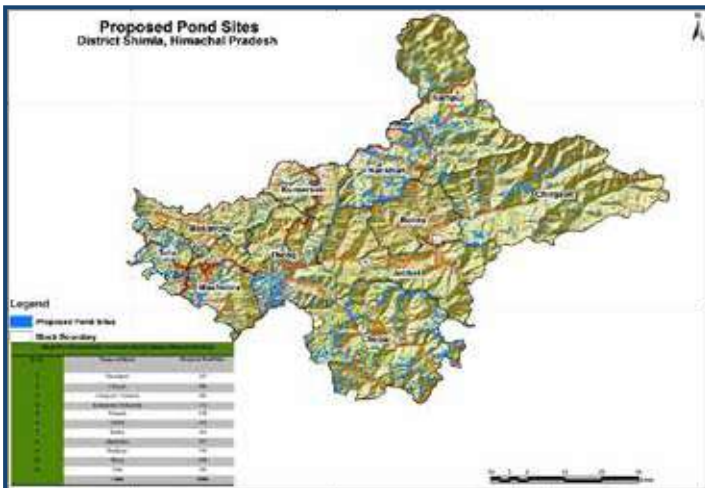GIS Portal Showcasing Green Corridor of Himachal Pradesh

GIS System Showcasing Panchayat Level Development Plan for Rural Development Department

Annual PMGSY Incentive Progress for Public Works Department

GIS Portal used by Jal Shakti Vibhag

GIS-based Water Conservation Plan and Inventory of Water Bodies for Shimla District under Jal Shakti Abhiyan: "CATCH THE RAIN CAMPAIGN"

> ArcGIS effectively meets AGiSAC's GIS-based analytical requirements. By facilitating easier management of complex datasets, the technology enables officials to make quick, informed decisions. The DSS enhances collaboration, allows effective analysis of the developmental gaps, and works as an effective tool in spatial planning and decision-making processes.
>
> **- Sh. D.C. Rana, IAS, Director cum Member Secretary, AGiSAC & Sh. Satpal Dhiman, HPFS, Joint Member Secretary, AGiSAC**

GIS Portal used by the Department of Industry

Esri India and Hexamap Solutions Collaboratively Enabling BMSK to Enhance Agricultural Resilience

Bihar, with 81% of its population engaged in agriculture, faces significant challenges due to its dependence on the Indian Summer Monsoon Rainfall (ISMR) between June and September. The increasing frequency of extreme weather events, including droughts, floods, hailstorms, heat stress, and erratic pest and disease outbreaks, heightens the vulnerability of agrarian communities, especially those reliant on rainfed agriculture.

From 2006 to 2019, the state experienced concurrent droughts and floods, with southern regions prone to droughts and northern regions susceptible to floods. Irregular rainy periods, dry spells, and delayed monsoon onset have induced drought-like conditions, even in northern districts, as seen in 2018. Marginal and small-scale farmers with limited coping capacities necessitate mechanisms to safeguard against adverse weather impacts.

Earlier, the weather advisory services in Bihar were confined to district-level data and there was a lack of spatial coverage and effective dissemination, often hindered by unreliable data from instrument malfunctions. To support informed decision-making, it was crucial to develop agro-advisory services based on high-resolution weather data and short-to-medium-range forecasting, aiding in monitoring agricultural hazards and enabling effective risk management at state and panchayat levels.

Project Summary

Using software and frameworks such as ArcGIS Desktop, ArcGIS Enterprise, ArcGIS JS API, and Oracle database, the Hexamap team developed a real-time weather monitoring web-based DSS for Bihar Mausam Sewa Kendra (BMSK). This application provides alerts to government executives, farmers, and the public about prevailing and impending weather conditions, enabling better planning and decision-making.

The project focuses on addressing the need for a GIS-enabled digital platform to capture and illustrate hydro-meteorological data in real-time, allowing for the integration, processing, and analysis of this data to generate customized advisories for mitigating adverse weather impacts.

The GIS-web application collects data from various sources, including Automatic Weather Stations (AWS) and Automatic Rain Gauges (ARG) sensors spread across a vast area, depicting variations in weather parameters, and providing forecasts for the next 3 to 5 days in 15-minute intervals. The team has implemented innovative methods to minimize false alarms and increase the reliability of weather alerts and advisories.

The project implementation involved data modelling, migration (with regular data sync intervals), geoprocessing using ArcGIS desktop, and the design and development of a responsive Web GIS Application with functionalities like measure tools, search, filter, popups, and map switch. The web-based DSS is supported in modern web browsers, and it provides end users with a comprehensive tool to visualize complex weather conditions and understand variability quickly and easily.

Challenges

The DSS has helped in overcoming the following challenges:

Unavailability of hydro-meteorological data on time: Insufficient availability of real-time data on rainfall, humidity, wind speed, etc., was leading to delays in decision-making. The potential consequences included significant loss of human lives and damage to public and private property, including agricultural land.

Absence of a digital framework for modelling: There was no established digital framework for modelling dynamic hydrometeorological datasets collected from various sources.

Delays in alerts: The lack of a robust platform for disseminating real-time alerts to vulnerable communities during disasters led to significant loss of human lives.

Solution

To address these challenges and strengthen Bihar's agricultural resilience against adverse weather impacts, Hexamap Solutions, using the capabilities of ArcGIS, implemented several comprehensive solutions:

- **A Real-Time Weather Monitoring Web-based GIS Decision Support System (DSS):**
  - **Forecast Module, Archive Module, and Report Generation:** The DSS includes specialized modules for forecasting, archiving historical data, and generating detailed reports, providing a comprehensive digital framework for simulation and modelling.
  - **Visualization and Analysis:** Using Esri ArcGIS Enterprise, the DSS visualizes and analyses real-time weather data, aiding farmers, officials, climate scientists, environmentalists, urban planners, and several other stakeholders in making informed decisions. It includes a digital framework for the simulation and modeling of hydro-meteorological datasets.
  - **Daily Rainfall Status Reports:** The DSS provides Daily Rainfall Status Reports at 05:30 AM and 05:30 PM, enabling proactive measures to protect crops and livelihoods.
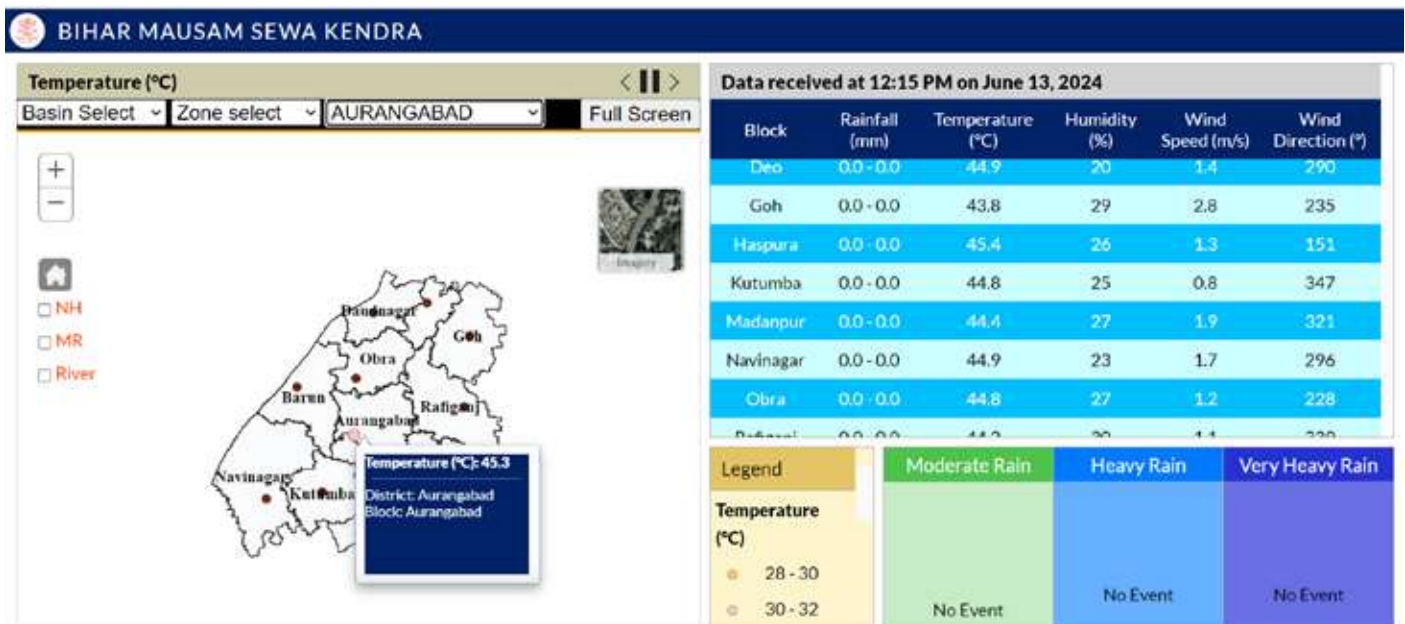
- **Integration of Automatic Rain Gauges and Weather Stations:**
  - o **Enhanced Data Availability:** By integrating automatic rain gauges and weather stations managed by BMSK, the system ensures the availability of real-time hydro-meteorological data, improving the reliability of weather monitoring and forecasting.
  - o **Real-Time Alerts and Notifications:** With continuous updates every 15 minutes, stakeholders can respond swiftly to changing weather conditions, potentially saving lives, and reducing damage to property and crops.
  - o **Proactive Measures:** The DSS delivers real-time weather alerts and notifications to citizens, farmers, and government officials, enabling proactive measures to protect crops and livelihoods.These solutions bridge the gap between data availability and actionable insights, empowering farming communities to build resilience, optimize agricultural practices, and secure livelihoods against the backdrop of increasingly unpredictable weather patterns.
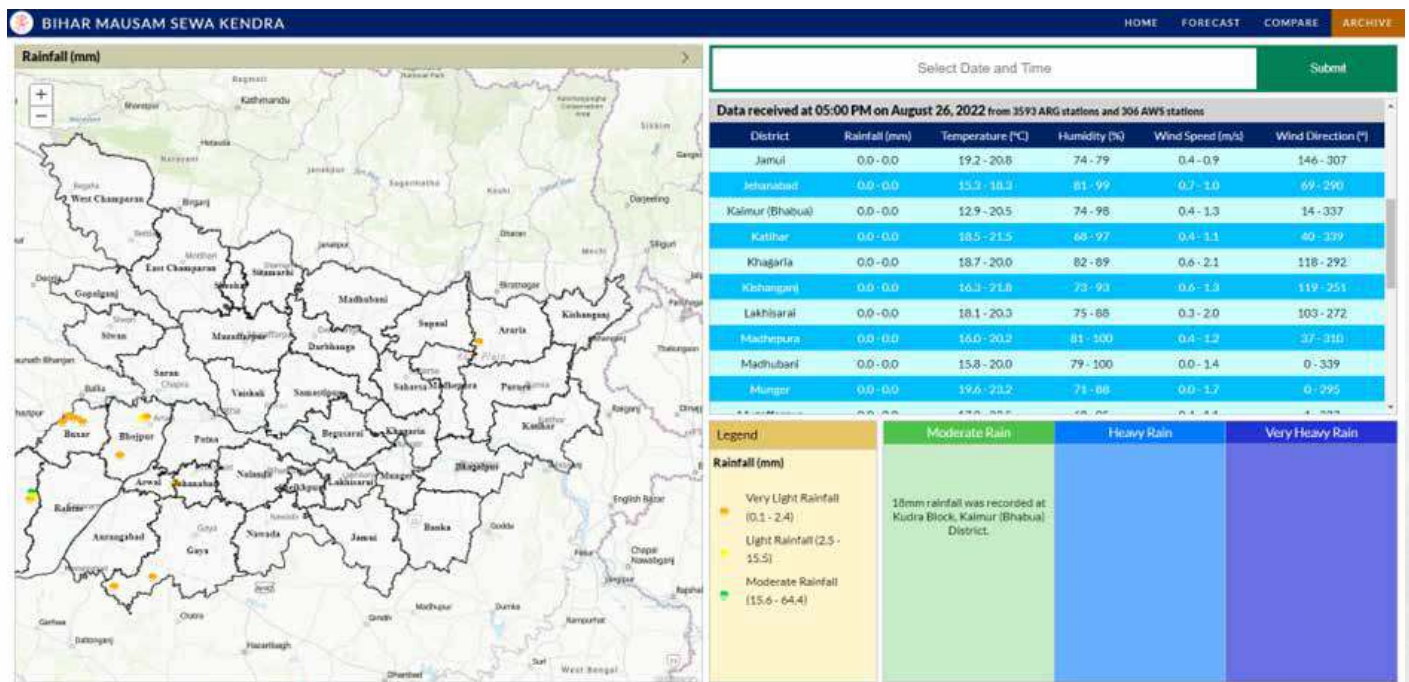

Benefits

Enhanced Agricultural Productivity: Providing accurate and timely weather advisories allows farmers to make decisions regarding planting, irrigation, pest management, and harvesting, thereby optimizing agricultural practices, and increasing overall productivity.

Risk Mitigation: By offering insights into impending weather extremes like droughts, floods, and hailstorms, farmers can proactively implement risk mitigation measures, such as adjusting crop selection, adopting conservation agriculture practices, or implementing water management strategies.

Resource Optimization: Access to high-resolution weather data

Workflow
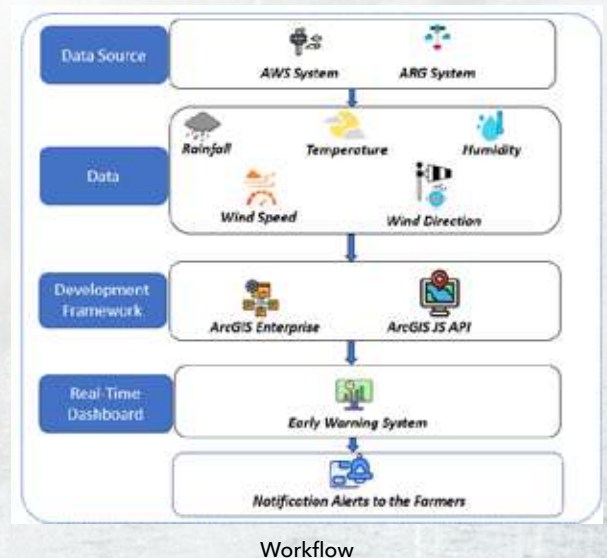
enables the agricultural department to efficiently utilize resources such as water, fertilizers, and pesticides, minimizing waste and reducing input costs for farmers. These data resources can also be utilized by several departments such as the health department, urban planning departments, disaster management, research and development to analyze the weather patterns and act accordingly in the favour of humanity.

Climate Adaptation: Accurate weather data and forecasts help communities adapt to changing climate conditions by informing infrastructure planning, public health initiatives, and resource management strategies, ensuring a resilient and sustainable future.

About Hexamap Solutions

Hexamap Solutions takes pride in being a technology-agnostic GIS company with core services in Application Development and Geospatial System maintenance. Our core focus is on Geo-Enabling businesses and organizations within budget and on time. As a Silver Partner of Esri, Hexamap harnesses cutting-edge Geospatial Technology for building robust Geospatial Platforms.

Hexamap business operations, over the past 20+ years, revolve around serving diverse customers across domains of Natural Resources Management, Disaster Management, Urban Planning, and Environmental Consulting. Having worked with more than 100 major customers worldwide providing tailor-made solutions, Hexamap takes pride in successful implementations and the satisfaction of happy customers, showcasing the effectiveness of its solutions.

In Conversation with Sanjay Kumar Jha, Executive Director & Head, City Gas Distribution, IOCL

Please share a bit about IOCL's city gas distribution business.

Indian Oil Corporation Limited (IOCL) entered into the city gas distribution business in 2018, with the intent of becoming a true energy company, wherein it is able to provide all kinds of energy solutions to a consumer. The company along with its 2 JVCs is now present in 49 Geographical Areas (GAs) in 105 Districts across 21 States and UTs. This makes it one of the most significant CGD players in the country. On a standalone basis, Indian Oil now has a presence in 26 GAs and 75 Districts spread across 11 states & UT. Indian Oil is now proactively expanding its natural gas infrastructure. This creation of a natural gas ecosystem is in sync with Govt of India's thrust on promoting a gas-based economy which will reduce environmental pollution. A cost-effective fuel will also act as a catalyst for overall economic development.

How is GIS helping IOCL in its CGD business?

City gas distribution networks require the laying of pipelines within the city. GIS aids in identifying the exact location of underground assets that need to be taken care of while laying the pipelines. It plays a vital role in pipeline management by providing a comprehensive view of the pipeline network, including its location, condition, and associated data. It helps in monitoring pipeline integrity, identifying potential hazards, planning maintenance activities, and ensuring compliance with safety regulations. GIS provides a solution for identifying the location of our assets because as a part of the city gas distribution network, we are creating many assets. At IOCL, we have been using GIS in the city gas distribution networks from the very beginning. GIS Systems are also helping us to get real-time progress updates on projects. GIS serves as a powerful tool for optimizing the planning, design, operation, and management of our CGD networks, enabling us to deliver safe, reliable, and efficient energy services to the communities.

How is GIS helping you to provide better customer service?

We aim to have as many customers as possible in our retail outlets. Our SAP system, when coupled with GIS, helps us to identify potential customers and deliver readymade solutions through GIS to them. In the cities where we are doing CGD business, we have identified retail outlets where we will have a CNG dispensing facility. Since all these things are mapped on our network, if anyone wants to know which Indian Oil petrol pump is catering to CNG, they can get this information through the GIS System, which is available on mobile also.

Why have you chosen Esri's technology for managing your CGD networks?

Esri's ArcGIS is a proven technology. It has been adopted by all reputed companies. So, this gives us the confidence that we are using the best technology. The integrity and safety of the software is high. With Esri's software in use, we are confident that our data is safe.

Indo ArcGIS®

GIS Solutions and Data Products engineered in India, powered by ArcGIS technology

Build Geospatial Infrastructure for your need

Indo ArcGIS offers out-of-the-box solutions and data products developed to solve some of the most challenging problems India is facing today.

Solution Products

Easily deployable solutions designed to solve some of the most complex challenges innovatively and efficiently

Data Products

An exhaustive collection of ready-to-use GIS data layers for India. A must for Indian GIS applications.

ArcGIS

Powered by ArcGIS Technology. World's leading GIS and Location Analytics system.

Indo ArcGIS on Cloud

Deployed and managed by Esri India experts, Indo ArcGIS on Cloud gives you higher utilization at a lower total cost of ownership

Location Intelligence:
A Game Changer for Enterprises

Competitive pressures and consumer preferences are driving massive shifts in enterprise business models. Enterprises are reinventing operations to create enhanced value for their shareholders and customers alike. With a compelling need to address complex geographical, economic, and climate challenges for sustainable growth, they are faced with numerous questions in a constantly changing world. For instance, while doing market research for a new business or an expansion, obvious questions like "Where are my customers", "Where are my warehouses and distributors", "What will influence sales", etc. come to the drawing board. Location intelligence demystifies these questions by placing them in the required context not only to find the target audience but also to decode their preferences, now and in the future.

Conventional approaches fail to provide answers in space and time resulting in a poor ability to contextualize geographically and predict scenarios. Location intelligence helps enterprises to make more informed decisions by providing accurate business insights in real-time. As the cornerstone of enterprise success, location intelligence enables organizations to unlock the true value of their data.

GIS-Driven Location Intelligence

Location intelligence is made possible by Geographic Information System (GIS) technology, which allows users to manage, visualize, and analyze location data. Cloud based platforms, smart maps, apps, and dashboards unify all relevant information by location and enable enterprises to approach challenges holistically and find impactful solutions. Powering enterprises with critical insights in real-time, GIS facilitates a transformative change by harnessing location intelligence for hyper-localized decision-support in various sectors including retail, BFSI, logistics, and manufacturing.

Be it demand forecasting, business planning, operational support, risk management at the strategic level or understanding markets, consumer behaviors, supply chain, risk assessment, or optimizing routes and networks at the operational level, Location-based Analytics enables enterprise leaders with instant access to hyper-localized actionable insights. Social media integrations with geographic insights in real-time help enterprises to connect better with their customers and foster value-based engagement.

Demand-supply matching is at the heart and soul of every business, and GIS can help organizations to gauge the consumption patterns, factors that influence demand-supply, and the existing gaps in it. Furthermore, from keeping

enterprises situationally aware of the adequacy of their assets and resources, optimizing supply-chain routes and warehouse utilization to enhancing the efficiency of their operational and utility infrastructure, GIS aids in the optimization of every process with lesser input of time and effort. GIS acts as a force multiplier in making informed business decisions that are tailored to specifics.

Today, every business is also challenged by climate change. Natural disasters and erratic climatic conditions can not only interrupt business operations but also leave a long-lasting impact on sustainability. The need for operational resilience is higher than ever. Businesses are increasingly relying on GIS to understand the effects of climate change or extreme weather events on their operations, predict likely scenarios, and assess and strengthen their operational effectiveness and preparedness.

GIS helps enterprises to understand why things happen where and when they happen, and gain business advantage through better understanding. GIS-powered solutions like Esri India's ArcGIS Business Analyst aid organizations in making data-driven smart decisions in almost every area of business, be it identification of new markets and new sites for stores or outlets, understanding customers' preferences, gaining visibility about competitors, managing deliveries, or assessing risks of sudden disruptions.

In a nutshell, the context of location provides several advantages to enterprises. The choice of location not only impacts the visibility, accessibility, and potential customer base of a business, but also plays a significant role in supply chain, product/service pricing, operating costs, and overall competitiveness. Thus, it will not be an exaggeration to state that in today's hyperconnected world, location intelligence is a necessity for enterprises to stay relevant and thrive. To stay ahead, enterprises need to be spatially prepared at all times to - uncover, unlock, and unravel the value of enterprise data.
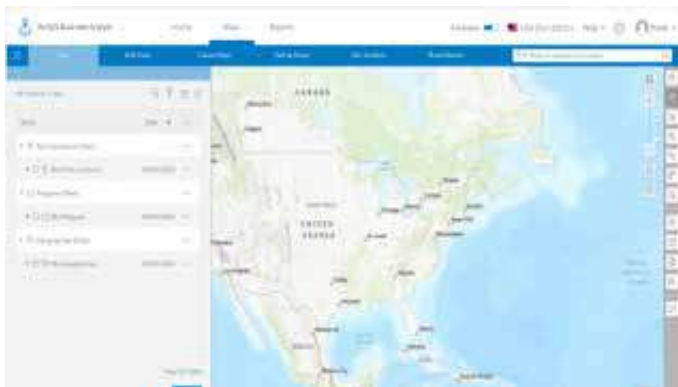
ArcGIS Business Analyst

ArcGIS Business Analyst helps you make smarter decisions for market planning, site selection, and customer segmentation by combining demographic, business, lifestyle, spending, and census data with map-based analytics. Through desktop, web, and mobile apps, Business Analyst demographic mapping software helps you identify under-performing markets, pinpoint the right growth sites, find where your target customers live, and share the analysis across your organization as accurate infographic reports and dynamic presentations.

Secure. Scalable. Flexible.

Use a secure system with controlled access. Stay in control of all deployment aspects in your own IT infrastructure. Control access to content and services and leverage existing authentication like single sign-on. Whether you have a team or an entire organization to support, ArcGIS Business Analyst Enterprise is ready to securely scale with you.

What is included with Business Analyst Enterprise?

- ArcGIS Enterprise, an industry leading Web GIS platform that puts collaboration and flexibility in your local infrastructure on physical hardware or virtualized environments.

- ArcGIS Business Analyst Web App, a ready-to-use web application that gets installed on-premises in your organization's portal. ArcGIS Business Analyst Web App allows you to access Business Analyst data and combine it with your organization's own data to deliver on-demand analysis and produce high-quality maps, reports, and infographics.

- Reports and analysis integrated into defined workflows within an enterprise environment. The ability to create and share demographic maps, analyses, models, and reports throughout your organization.

- A variety of location-based datasets, such as points of interest; road network; accurate boundaries at various levels like village, PIN codes, district, state, etc.; socio-economic and demographic data; and data available from Esri's Living Atlas. Live road traffic information is also available.

- ArcGIS Pro, via Business Analyst tools and Spatial Analyst tools, can consume the GeoEnrichment service, providing users with geoprocessing tools and scripting capabilities to create and share analysis throughout ArcGIS Enterprise and ArcGIS Online.

- A GeoEnrichment utility service provides an API for ready-to-use Business Analyst apps and for creating custom apps.

- Demographic feature services to power thematic mapping workflows (color coded and smart maps) in Business Analyst applications.

- Other ready-to-use apps that leverage GeoEnrichment such as the ArcGIS Enterprise Portal Map Viewer Classic's Enrich Layer analysis tool.

ArcGIS Business Analyst Enterprise 11.2 introduces enhancements to ArcGIS GeoEnrichment Server and ArcGIS Business Analyst Web App, including improved variables search.

Server-side Feature in GeoEnrichment

The Semantic Search feature has improved variables search. This works by ArcGIS REST API converting the search term into a meaning vector representation using a pretrained AI language model. The meaning vector of the search term is compared to the meaning vectors of variable descriptions to find the most semantically similar variable descriptions to the search string. This means that when you search for something that is phrased differently than how the variable is named in the data browser, it will still return results that are similar in meaning to the search string.

Business Analyst Web App

Business Analyst Web App has new features and capabilities, including the following:

- New color-coded maps workflow.
- Updated user interface.
- Improved custom data setup performance.
- Performance improvement using a large number of sites in suitability analysis.
- Improved data browser search
- Added data browser variable ID search

Business Analyst Widget in Experience Builder

The Business Analyst widget has been included with Experience Builder.

With Business Analyst Web and Mobile Apps, you can:
- Conduct demographic analysis faster and easier than ever.
- Access and use global data in minutes.
- Stay ahead with the latest data and reports.
- Present your findings with map-based stories.
- Run site selection on the go

Since it's cloud-based, you can get the most up-to-date data and technology anywhere, anytime. It also includes a mobile app that gives you a quick market snapshot from the field. Esri updates the data annually, ensuring that you have access to the most current and accurate data. Business Analyst is hosted by Esri, so you don't have to worry about managing data or technology updates.

ArcGIS Survey 123: Tips and Tricks

ArcGIS Survey 123 is a powerful tool for collecting field data with ease and efficiency. Whether you're a seasoned GIS professional or just getting started with data collection, mastering Survey 123 can significantly enhance your workflow. In this article, we'll explore some tips and tricks to help you make the most out of this versatile tool.

1. Plan Your Form Design Thoughtfully

Consider the type of data you need to collect and how you want to structure your survey questions. Keep the form concise and user-friendly to encourage accurate responses from field workers.

2. Leverage the Power of Smart Forms

Survey 123 offers the flexibility of creating smart forms that can adapt dynamically based on previous responses. Take advantage of this feature to streamline data collection and improve the user experience.

3. Utilize Default Values and Calculations

Save time and improve data accuracy by setting default values and incorporating calculations into your survey questions. Default values can prepopulate certain fields with consistent information, while calculations can automatically derive values based on predefined formulas.

4. Customize the Look and Feel of Your Survey

Customize the appearance of your survey by adding logos, changing colors, and adjusting fonts. A visually appealing survey can enhance respondent engagement and professionalism.

5. Test Your Survey Before Deployment

Test all question types, logic conditions, and data validation rules to identify any potential issues.
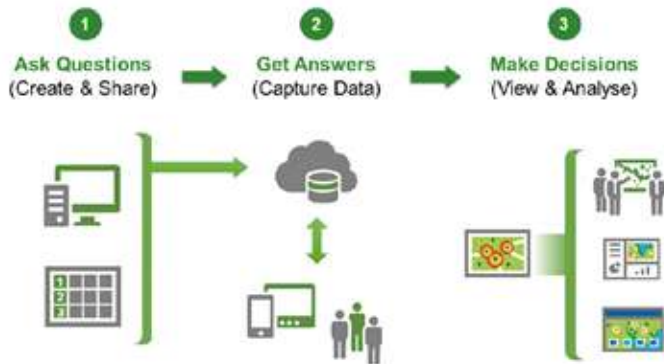
6. Take Advantage of Offline Data Collection

One of the key advantages of Survey 123 is its ability to collect data offline, even in remote or disconnected areas. Make sure to configure your survey for offline use and provide field workers with the necessary training and resources to utilize this feature effectively. Sync data regularly to ensure that collected data is backed up and up-to-date.

### 7. Explore Advanced Analytical Capabilities

Survey 123 integrates seamlessly with ArcGIS Online, allowing you to leverage advanced analytical capabilities for data visualization and analysis. Explore the various tools and functions available in ArcGIS Online to analyze survey data, create interactive maps, and generate insightful reports.

8. Stay Updated with Latest Features and Updates

ArcGIS Survey 123 is constantly evolving with new features, enhancements, and updates. Stay informed about the latest developments by regularly checking for updates and exploring documentation and resources provided by Esri.

In conclusion, mastering ArcGIS Survey 123 requires a combination of thoughtful planning, strategic design, and ongoing optimization. By implementing these tips and tricks, you can streamline your data collection process, improve data quality, and unlock the full potential of Survey 123 for your organization's needs.

Happy surveying!
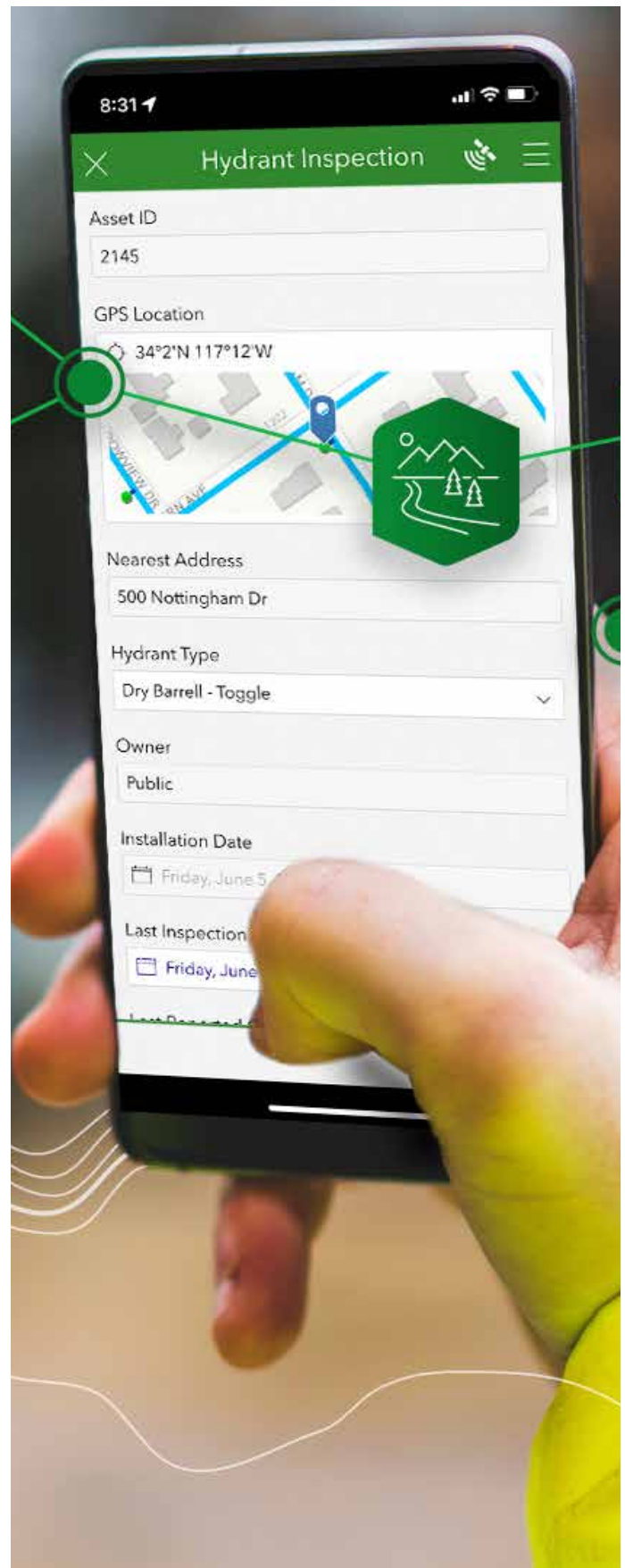
What's New in ArcGIS Online?

ArcGIS Online is a cloud-based mapping and analysis solution. Use it to make maps, to analyze data, and to share and collaborate. Get access to workflow-specific apps, maps, and data from around the globe, and tools for being mobile in the field. Your data and maps are stored in a secure and private infrastructure and can be configured to meet your mapping and IT requirements.

Use of ArcGIS Online:

Using ArcGIS Online, you can work with smart, data-driven styles to explore and visualize 2D and 3D data. Share your maps with anyone, anywhere or keep them private. Work collaboratively with your colleagues to build maps, scenes, apps, and notebooks. Access intuitive analysis tools that help you better understand your data. All this and more is possible with ArcGIS Online.

ArcGIS Online brings lots of exciting new features. Here are the key highlights:

1. Delete Multiple Members:

Administrators can now easily delete multiple members from their organization and transfer their contents to another user (or delete their content) in one workflow. The workflow includes managing groups as well.

In organization management, we have the option to delete multiple members from the organization and either transfer their content to another user or delete it, making managing members much easier. To do this, all you need to do is select all of the members that you wish to delete.

Go to the More dropdown and select Delete Members. Choose whether you would like to transfer or delete the content and note that any groups owned by these users will be permanently deleted.

If you choose to transfer the content, you'll be able to choose what members to transfer the content to, and you can choose to create a new folder or to use an existing folder. Once this choice has been made, you can click delete members, and that is it.

Esri Access will be disabled, any licenses will be revoked, existing groups from which the content was not transferred will be deleted, the content will be transferred or deleted, and once all that is done, the member will be deleted.
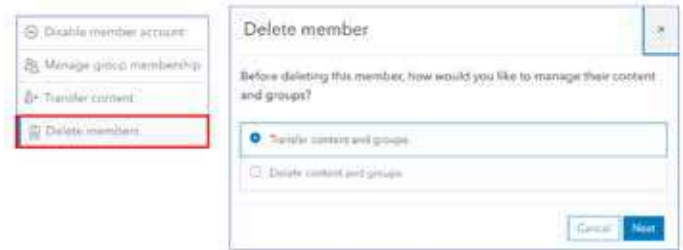
Note: Administrators must exercise caution when deleting members, as it is a task that cannot be reverted. Before performing these tasks, it is important to have data and named user governance standards in place, as well as backups if necessary.

2. Save Media Layers as items:

In Map Viewer, users can now save media layers to be reused in multiple maps without having to recreate them. A new feature is added to save Media Layers created in Map Viewer as items in the Content and reuse them in other web maps. Previously, they could only be saved on the web map. The placed media positioning will be saved in the Media Layer item and automatically adjust to other maps it is added to. After you have added and configured your media layer into your map, you can select the More Options button in the Layers list. Choose Save As and choose a name for the layer. Once the layer has been saved, it will be added to your My Content and can be added to other maps.

3. Introducing ArcGIS Data Pipelines:

One of the most exciting updates is that ArcGIS Data Pipelines is out of beta and available for general use. This native data integration capability within ArcGIS Online empowers you to ingest, prepare, and manage your data for mapping, analysis, and reporting without writing a single line of code. This new app offers a fast and efficient way to ingest, prepare, and maintain data, with an intuitive drag-and-drop interface. Users can connect to a variety of data sources including Amazon S3, Google BigQuery, Snowflake, feature layers, JSON files from Amazon S3, Microsoft Azure Blob storage, or Public URL. ArcGIS Data pipelines can be accessed from App Launcher. It can be run interactively or on a recurring schedule, helping you to ensure that data is kept up to date even when the source data is changing.

4. ArcGIS Instant Apps Manager Template:

This template allows users to locate, view, and filter records on a map or table and modify data in editable feature layers. Data collected using ArcGIS Survey123 or ArcGIS Field Maps can be easily reviewed in the Manager template with one or multiple maps.

For example, after data is collected using apps such as ArcGIS Survey123 or ArcGIS Field Maps, Manager can be used to simplify the data review process for one or multiple maps.
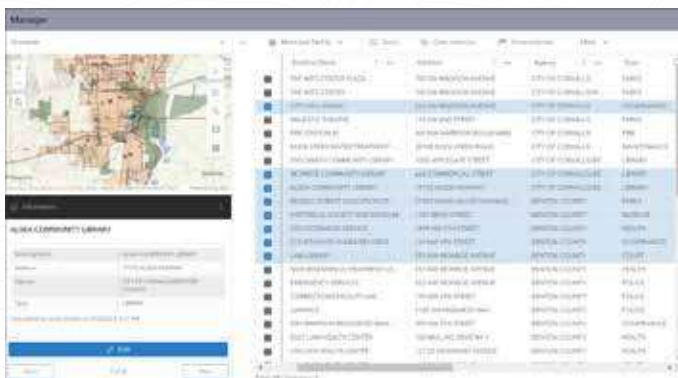

Language Switcher Enhancements: Using the language switcher, users can choose a language from a drop-down list and view app-authored text in that language in their web app. With this update, app authors can easily export text from the translation dialog out to Excel, update the translations, and then import the updated text. The language switcher is now supported in five additional templates: 3D Viewer, Atlas, Attachment Viewer, Basic, and Slider.

Additional Enhancements: New capabilities are supported in ArcGIS Instant Apps templates. Sidebar allows users to view oriented imagery such as imagery captured from ArcGIS QuickCapture. Also, users can visualize data from floor-aware maps in the 3D Viewer, Media Map, and Manager templates.

5. Manage ArcGIS Notebooks Files:

ArcGIS Notebooks now includes the ability to manage notebook files. Individual users can manage their own files, or administrators can manage their members' files. With this update, users can now organize and manage their files in a notebook workspace separate from the notebooks themselves. This feature provides administrators with the capability to oversee and manage the content within the notebook workspace for all notebook users. It offers a more efficient and organized way to handle notebook files. Look for Manage button in the ArcGIS Notebooks interface.
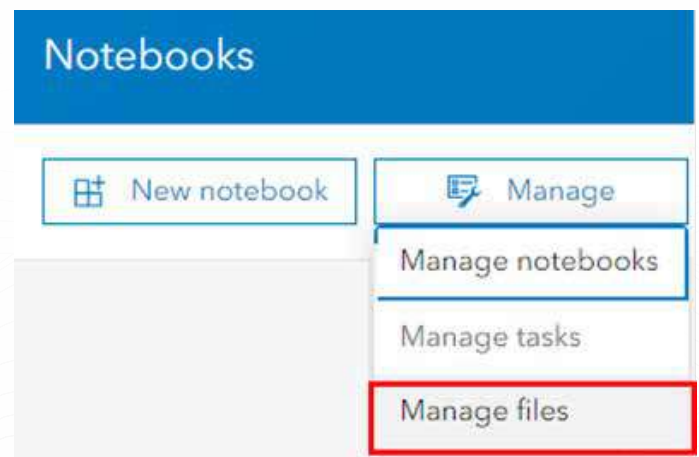
User Type Updates

User Types have been updated to expand access to ArcGIS capabilities, apps, and services. The updates will not affect your current workflows, but will simplify access to ArcGIS, enabling your teams to work from anywhere and easily scale as organizational needs grow. Members will not lose any existing access or functionality due to these updates.

Geographic Information Science in Higher Education: The Kumaun University's Interventions

The Department of Geography, Kumaun University, SSJ Campus Almora started the development of Geographic Information System infrastructure for its applications in governance, education, and research in the Uttarakhand State in 2002 by Setting up a Natural Resources Data Management System (NRDMS) Centre and Creation of Digital Data for District Almora with the technical and financial support of the NRDMS Division, Department of Science and Technology (DST), New Delhi. Through this Centre, the GIS infrastructure for district Almora has been developed in association with different line departments as per their own needs.

In 2008, Kumaun University was identified for setting up the Centre of Excellence for NRDMS in Uttarakhand (COE NRDMS). Hi-tech laboratories of GIS Technologies, viz., GIS, GPS, Remote Sensing, and Computer Cartography have been established in the COE NRDMS.

The objectives of this Centre are to:

1. To develop and demonstrate methods and techniques for managing geospatial datasets in Uttarakhand in a better way.
2. To build the capacity of concerned stakeholders to support the provision and use of up-to-date Geographic Information Science for decentralized planning in the State; and
3. To conduct regular education, training and research programs in Geographic Information Science.

GIS Capacity Building Initiatives of COE NRDMS

To fulfill the third objective of COE NRDMS and for producing skilled human resources in Uttarakhand, in particular, and India, in general, the COE NRDMS designed a M.Sc. Remote Sensing and GIS program which was started in 2008.

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Kumaun University
(Accredited Grade "A" by NAAC)

The M.Sc. Remote Sensing and GIS program is a four-semester course spread over two years, that aims to impart state-of-the-art knowledge of Geographic Information Science to meet the emerging demands of geospatial knowledge in different sectors of development. The Centre has produced more than 300 students and professionals skilled in Geographic Information Science Technologies, i.e., Remote Sensing, GIS, Web GIS, GPS, DGPS, and Digital Cartography to date.

In view of the rising need of skilled human resources in Geographic Information Science in our country, the COE NRDMS has also designed Ph.D., Diploma Courses, and Certificate Courses in Geographic Information Science. It also has a vision to induct Geographic Information Science at undergraduate and secondary school levels in the near future. COE NRDMS also organizes Capacity Building Training for district and state level planers/administrators, teachers, researchers and students on the development, updating, and applications of Geographic Information Science in governance.

" Teaching students GIS is not just about preparing them for future careers; it's about equipping them with the spatial thinking skills needed to address complex environmental and societal challenges in an interconnected world. India needs skilled human resources and advanced research in GI Science Technologies, i.e., Remote Sensing, Geographic Information Systems, Artificial Intelligence, GPS, and DGPS. With the support of the NRDMS Division of DST, Government of India, the COE NRDMS in Uttarakhand is playing a crucial role in fulfilling this need through its varied programs in GIS. "

- Prof. J.S. Rawat, COE NRDMS, Uttarakhand

Wildfire Safety Operations in Utilities

Mr. Prakriti Mohan Vashist[1], Dr. Prabir Mukherjee[2], Mr. Manish Sharma[3]

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Abstract

Wildfires are becoming the terrifying new normal in some parts of the world, endangering property, humans, and wildlife. Given the growing threat of extreme weather conditions and climate change, it is expected to have an increased wildfire risk to electrical transmission and distribution assets.

GIS (Geographical Information System) is used for providing location-based analytics. It helps utilities in preparedness, response, and the recovery process. Integration of heterogeneous skills of sensors and analytics with GIS helps in building a robust fire-fighting system. The most important element is the sharing of the information obtained using shared protocols, and terrestrial and satellite technologies. Another important element is the information processing in GIS for decision support: report maps and forecasting.

Introduction

The most important characteristic of major forest fire incidents, from a societal perspective, is their potentiality to seriously and irreversibly damage regions of significant natural beauty. In addition, the extent and severity of such incidents may significantly affect the population and the environment of the adjacent areas.

Power companies are especially vulnerable and exposed to this peril. Recent years have seen the causes of wildfires in California, Texas, and Australia and elsewhere. As wildfires are linked to power lines, utilities face significant liability exposures in some cases. The business of designing, operating, and maintaining the electric grid continues to increase in complexity as utilities address the challenges of wildfire risk mitigation. In this paper, we have discussed the GIS-based solution that we designed and implemented. The solution helped a major utility company to significantly lower its expenses and liability exposures.

Applying GIS Technology to Manage Wildland Fire Crisis

When it comes to wildfire protection, local, state, and federal agencies must be able to respond at a moment's notice.

Protecting life, property, and natural resources requires comprehensive planning, mitigation, coordination, response, and recovery.

Today, GIS technology has expanded and provides comprehensive capabilities that support all aspects of wildland fire management. GIS solution enables wildland fire professionals to manage complex operations by delivering critical capabilities that support the entire mission.

The following are the key levers of GIS solutions used by utility companies:

- Monitor near real-time fire incidents
- Determine areas vulnerable to intense fire behavior.
- Predetermine fire tactics and strategies.
- Establish situational awareness through a GIS-based common operating picture.
- Produce key maps and analysis to support fire suppression operations.
- Predicts how fire can spread in a given time
- Identify and analyze fire damage to develop rehabilitation plans.
- Inform the public of changing conditions such as road closures and threatened areas

IoT data when combined with As-IS business and operational data of utilities, external agencies data, and data from social media to do geospatial analytics based on various geospatial modeling and AI models, hidden patterns and relationships are revealed for more effective outcomes. These outcomes are used in spatial data processing, predictive analytics, and simulation capabilities to assess the risk of wildfires and other weather-related events. Analytics output can be visualized in applications, dashboards, Web APIs, and interfaces which help the organizational user community, customers, and public services to manage wildfire safety operations.
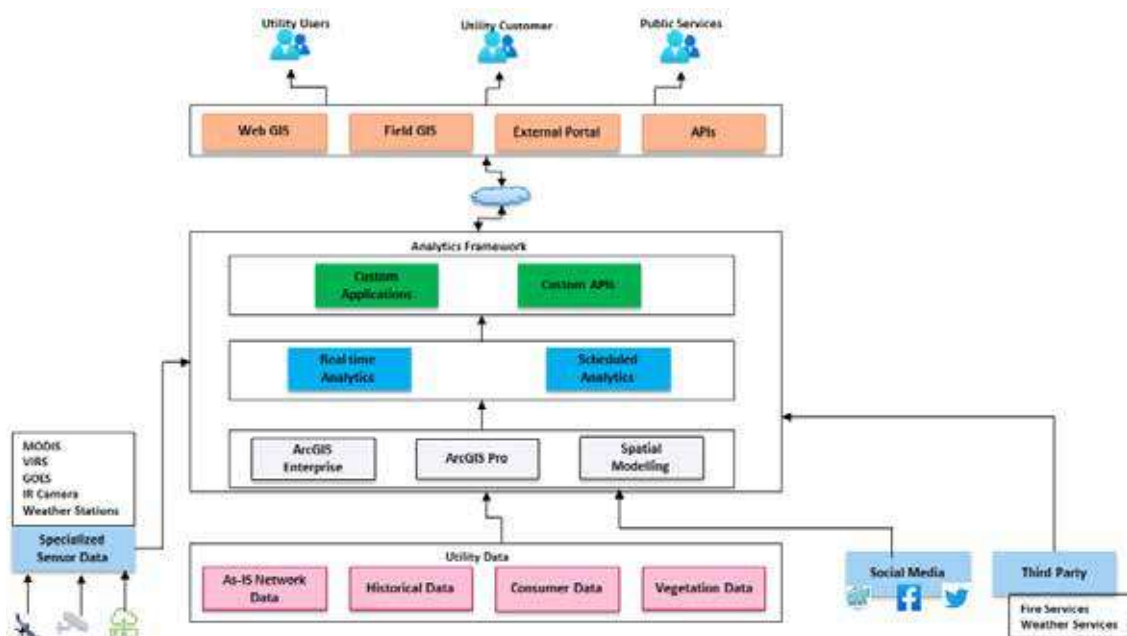
Following are the key tenants of the solution that helped utility company to optimize their fire safety operations by reducing the impact, enhancing emergency operations and response effectiveness, and improving customer experience:

1. Fire Detection Data

Following are the key data sources ingested in the solution to assess the situation and take prompt actions:

- Specialized sensor data
- Utility-owned data
- Social media data
- External agency data

Specialized sensor data: Various fire detection IoT sources provide real-time or near real-time fire data in static raster images. The solution uses GIS to convert these images of fires with time stamps and location coordinates into actionable intelligence. The IoT sensors send raw data that is stored in large data libraries. The GIS platform then imports this data and performs a series of steps to improve location accuracy, and visual performance, and to prepare the data for interactive map presentation. These steps also include combining the data with elevation content to create a more accurate location that considers the characteristics of the surface and projecting that onto a two-dimensional plane appropriate for use within an interactive map.

- **Satellite based Sensors**
    - MODIS (Moderate Resolution Imaging Spectroradiometer) is a spectroradiometer that measures both light amplitude and wavelength from sources such as fires. It can even distinguish flaming from smoldering burns.

    - VIIRS (Visible Infrared Imaging Radiometer Suite) I-Band Active Fire Data: It provides data from the VIIRS sensor aboard the joint NASA (National Aeronautics and Space Administration)/NOAA (National Oceanic and Atmospheric Administration) Suomi National Polar-orbiting Partnership (Suomi NPP) and NOAA-20 satellites. Attribute fields for NRT (Near Real-time) VIIRS 375 m active fire data include location coordinate, temperature, scan, confidence level, Fire Radiative Power, etc.

    - GOES (Geostationary Operational Environmental Satellite) 16 &17 Fire Detection: GOES 16 & 17 are NOAA satellites that provide weather and fire data with a rapid data refresh rate, low data latency, and continuous coverage.

- **Weather station:** The utility company had installed weather stations at different locations which capture real-time data related to temperature, wind speeds, and humidity levels to provide improved awareness of current fire danger conditions.

- **Remote Camera:** Vendor-owned high-definition camera with infrared (IR) capabilities detects infrared energy (heat) and converts it into an electronic signal which helps the emergency responder to monitor wildfires and take necessary action on time.

Utility-Owned Data: The following utility-owned data is ingested in the solution:

- **As-IS Network data:** This includes network asset data for the transmission and distribution network. Network data helps to detect which assets are impacted, will impact, and require maintenance/ replacement to avoid fire.
- **Consumer data:** helps the solution to find what all consumers have been impacted or will be impacted due to fire. This will help the utility to send timely communication to the customers.
- **Vegetation data:** helps to assess the as-is vegetation conditions and locate the assets where vegetation such as trees is more prone to fall due to its age, and angle of inclination which can become the reason for the fire.

Historical data: The utility maintains the data of fire incidents that occurred in the past which will be ingested in the system to predict the fire patterns and high incident regions

Social Media data: helps to access and locate the incident reported in social media. Utility keeps monitoring the local news channel, tweets, Facebook posts, and complaints register in the call center.

Third Party data: The solution consumes data from various third-party agencies that monitor fires, weather, and earthquakes at the state level. Wildfire forecast plays a crucial role in preparation for possible wildfire events. Wildfire forecast is done based on various weather inputs and algorithms. Major parameters are wind speed, wind gust, temperature, humidity dry fuel on the ground and live vegetation (moisture content) terrain, and local climate. Wildfire forecast data is added to the GIS system for analysis and modeling purposes. The data is mapped on a GIS map for better situational awareness.

2. GIS-based decision support system

Esri's GIS solution utilizes ArcGIS Enterprise, ArcGIS Pro, and Spatial modeling to ingest various data mentioned above to do real-time analytics and schedule/ batch analytics for creating various predictive scenarios which help the utility to manage ongoing incidents and plan the maintenance and mitigations to avoid the future incidents. With the help of an asset network and connected consumer data, the utility can reduce the impact on the network and consumers. The solution provides role-based access to the organization users and also provides real-time updates to the customer and public services through the external portal and service base APIs which they can consume in their systems and applications.

The following are the key components of the solution:

3D Map Implementation: 3D map implementation for wildfire applications provides real-time analytics based on the elevation models. It provides more accurate predictive analysis in a real-time manner which includes AI-based alerts to visualization of potential fire locations specifically in hilly areas.

Power Outage Alerts: The Utility Fire Potential Index and Outage Producing Winds Model are evaluated multiple times a day by meteorology and fire science teams. In extreme fire danger conditions, which may lead to possible power shutoff. It becomes important to notify customers about current weather conditions and possible power shut-offs. GIS has the capability of identifying all the impacted customers using network trace and customer data integration techniques. Automated Notifications can be sent to customers during various stages of power shut-off and restoration.

Integrated Decision Support System: During a forecasted wildfire, decision-making for power shutoff is very crucial. The decisions made at the time of a wildfire event may disrupt lives and affect critical customers with medical support. This component executes multiple steps for data collection and processing to identify the outage area that includes minimum fire conditions (humidity, wind speed, etc.), catastrophic fire probability and behavior, Vegetation, and Electric Asset Criteria Considerations. This data is mapped geographically with pre-identified high-fire risk areas, and outage area is determined through the integration of machine learning and cloud computing.

Damage assessment: The solution provides various spatial and non-spatial reports for damage assessment during a wildfire event or post-wildfire event. GIS can provide high-quality information on a range of factors influencing damage assessments that include electric, and gas asset damage, road closures, and infrastructure reports.

Conclusion

This paper presents an overview of the extensive use of GIS and IoT technologies collectively to contain and mitigate massive destructions due to a wildland fire crisis.

Wildfire response starts with a map that can answer these questions: Where is the incident? What is the best route to get there? What is the likelihood of rapid-fire spread (based on the wildfire analysis and current weather conditions)? In which direction will it be moving? All these issues and related decisions are supported through GIS analysis and the information received from several IoT techniques to create situational awareness that includes:

•   Automatic Vehicle Location (AVL) display of fire apparatus locations

•   Live weather data

•   Other dynamic sensor data

•   Cloud computing

When dynamic data feeds are integrated into existing base maps (fire hazard maps, value maps, imagery, etc.), fire personnel begin to get comprehensive situational awareness

The solution helps the utility to answer all the questions defined above and focus on all three stages of an incident which include:

•   **Pre-Event:** In pre-event time, the solution helps in predicting the impact zone, modeling different scenarios to analyze the impact, planning to minimize the impact, and managing communications to the field crew, customers, and public services.

•   **During Event:** During the event, the solution will help in monitoring the situation on a real-time basis by ingesting intelligence through various sources such as social media, Sensors, Weather Stations, third-party sources, and more. With the help of a modeling technique, the solution will inspect and assess the damage and initiate emergency response actions through communication to public services, customers, and internal field crew teams.

•   **Post Event:** In post-event time, the solution helps the utility to monitor and assess the damage of assets and losses and decide on the restoration plans, help in communication of restoration activities going on, and any supply outages planned for restoration. It will help the utility in planning the future strengthening of the network.

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Retail Bankruptcies Rise, But That's Not the Real Story

By Gary Sankary

In 2023, over 800 Bed Bath & Beyond stores permanently switched off their lights—the linen aisles emptied, the iconic signage gone. They were one of 26 retailers that went bankrupt last year, the most since 2020. This year is on pace to surpass that mark.

Call it a dynamic shift instead of a downturn.

US retailers are expected to open more stores than they close in 2024, according to The Wall Street Journal, but finding the right space could be challenging. Construction of retail buildings has been slowed by inflation and higher interest rates, and the retail vacancy rate is low.

Companies that have adapted to new consumer preferences—a community-focused, omnichannel, experiential way of

Snapshot: Despite some high-profile bankruptcies, the retail vacancy rate remains noticeably low, putting pressure on executives to find just the right location.

shopping—are looking to expand in locations where other retailers have failed.

Location, always a key factor in business success, is now even more important. With the retail vacancy rate low, retailers feel added pressure to analyze markets and meet customers where they are.

Expansion demands precision, and intuition is not enough; data is key to such high-stakes decisions. Retailers have prodigious amounts of customer data available to them, with

sales transactions, loyalty programs, and online interactions revealing who their customers are. Combining customer data with location data surfaces valuable insights about where customers are, and how to engage them. Top retailers rely on geographic information system (GIS) technology for this kind of analysis.

Mapping Psychographics When the Retail Vacancy Rate Is Low

With retail space in short supply, smart executives will look to analytics for an edge.

Psychographic research builds on demographic information to segment markets, helping retail planners better understand their target customers. Psychographic profiles comprise the attitudes, motivations, values, opinions, and other characteristics of consumer groups, and GIS technology brings psychographic research to life by grounding it in geography—a form of location intelligence.

One of the world's largest commercial retail firms analyzes psychographics when designing shopping centers to fit the communities they serve. In one location, GIS-based analysis revealed that a shopping center was a destination for families. With this information, the firm added spaces for family-centric events, concerts, yoga classes, and pet-friendly amenities, and drove the retail vacancy rate below 10 percent.

Omnichannel Sales Data Informs Smart Expansion

Location intelligence also informs the expansion strategy for a popular work apparel brand.

As the company's omnichannel strategy matured, leaders sought to understand the relationship between a growing e-commerce presence and the performance of physical stores—including company-branded stores and those of retail partners that carry their apparel.

GIS technology helped contextualize customer behavior and gave decision-makers a way to view performance by location. Now, it's even offering predictions. As WhereNext reported, the company relies on:

> . . . an advanced form of location analytics that crunches sales data from multiple channels along with information on consumer demographics to predict how a geographic market will perform. It represents the next stage of strategic planning for omnichannel retailers . . .

In a time where expansion opportunities are limited, the stakes are too high for a guessing game. With GIS-driven location analysis, apparel brands, restaurant chains, grocery stores, and other retailers are transforming data into guidance as they decide on their next expansion sites.

Gary Sankary

Gary Sankary joined Esri in 2014 as a subject matter expert in retail after spending 30 years in the industry. Gary's retail career started in his parent's family business more than 40 years ago. Along the way he had an opportunity to work with Cost Plus Imports, Mervyn's and Target Corp. where he led a number of cross-functional teams developing technology and business process strategies to support store and digital merchandising initiatives.

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(9:00 a.m. - 5:30 p.m. IST, Monday-Friday)

Online Support via My Esri*

esri.in/tech-support

*Online support on My Esri portal is enabled for Esri products only. Support for partner products e.g ENVI and ArcFM is available via email and telephone.

esri India

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