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ArcIndia News

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IN FOCUS

GIS: Innovate. Integrate. Inspire.

CASE STUDY

ArcGIS Empowering Bengal Gas Company Limited's City Gas Distribution Network in Kolkata

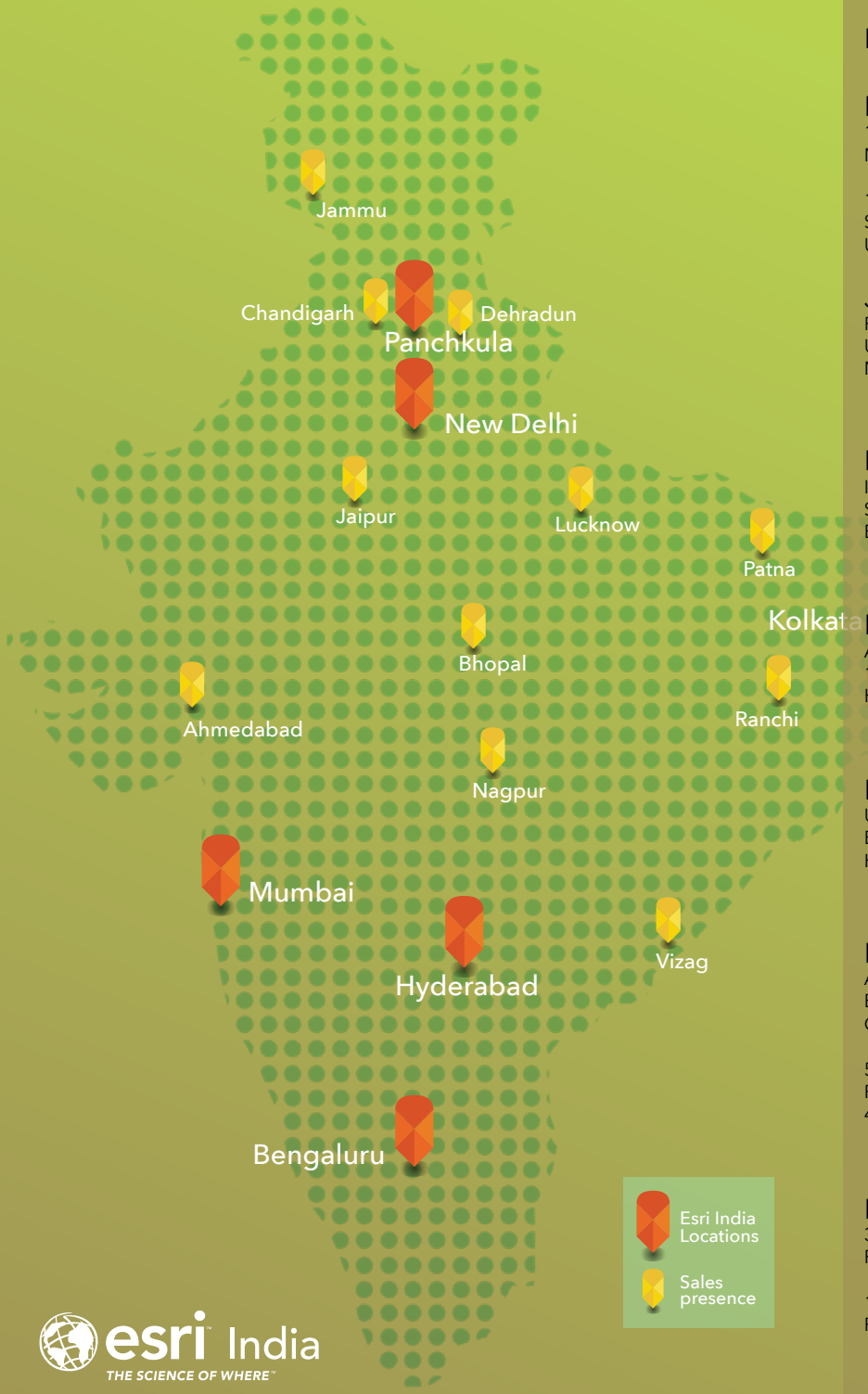
PRODUCT REVIEW

ArcGIS Business Analyst

GIS INSIGHTS

The Rise of GeoAI: Transforming India's Spatial Data into a Predictive Powerhouse

ESRI INDIA LOCATIONS



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CONTENTS

MD's Desk

Agendra Kumar

Managing Director, Esri India

Continuous innovation is making GIS more accessible, intelligent, and impactful than ever before. The fusion of GIS and AI is powering this innovation, reinforcing the growing recognition that 'AI needs GIS, and GIS needs AI.'

Authoritative geospatial data and the context provided by GIS help ground AI in the real world, enabling more reliable, contextual, and actionable insights. At the same time, GIS needs AI to accelerate complex spatial analysis, automate workflows, and make advanced capabilities accessible to a much broader set of users.

Esri's ArcGIS is evolving rapidly to power the new era of innovation. AI assistants are making ArcGIS more intuitive by enabling users to interact with maps, analyze data, automate workflows, and build applications using natural language. Advanced Geospatial AI models such as ArcGIS's Geospatial Vision Language Model (GoVLM) are enabling users to analyze imagery through simple prompts, while agentic mapping applications are bringing conversational interaction to maps and spatial data. Together, these capabilities are transforming how organizations interact with spatial information and make decisions.

We at Esri India, are continuously working towards strengthening these capabilities. Our GIS & AI Competency Centre in Noida is committed to accelerating the adoption of AI-driven GIS. It is helping user organizations integrate AI-based analytics into their spatial workflows. Through knowledge sharing and capacity-building initiatives, it is enabling users to harness the full potential of Geospatial AI in solving real-world problems.

Innovation, however, achieves its full potential only when it is integrated. Across industries, valuable information often resides in disconnected systems and organizational silos. GIS serves as the integrating platform that brings together spatial and business data, enterprise applications, field operations, and decision-makers into a single operational picture.

By bringing disparate datasets together, GIS facilitates innovation at an organizational scale. It connects information across systems, teams, and processes, creating a shared understanding of complex challenges. Powered by this integration, GIS enables users to create inspiring success stories. These inspiring stories have a ripple effect, fostering further innovation and integration.

As the GIS community continues to **Innovate, Integrate and Inspire with GIS**, together with our partners, we aspire to build a future where location intelligence empowers every decision, strengthens every community, and accelerates India's journey towards a smarter, more sustainable tomorrow. As we move forward on this journey, our customers remain at the heart of everything we do.

DTU and Esri India Join Hands to Advance GeoAI Education and Research

Esri India has signed a Memorandum of Understanding (MoU) with Delhi Technological University (DTU) to establish a Centre of Excellence ('CoE') in Geospatial Technologies with a focused thrust on GeoAI. The partnership marks a significant step in bridging the gap between industry's expectations for geospatial skills and academic programs, equipping the next generation of engineers, researchers and data scientists with cutting-edge GIS and GeoAI capabilities through world leading Esri technology.

DTU, one of India's premier technological universities, has a strong foundation in Geospatial Sciences and Technologies, Computer Science, Electronics and Communication Engineering, Civil Engineering and Space Applications etc. With the collaboration with Esri India, DTU aims to develop new curricula, particularly for its new upcoming UG, PG and Executive programs and enhancement of existing courses using the Indo ArcGIS platform.

Agendra Kumar, Managing Director, Esri India, said, *"Geospatial intelligence and AI are converging rapidly, and India needs a skilled workforce that can harness this power for real-world impact. Our partnership with DTU through this Centre of Excellence reflects Esri India's commitment to embedding GeoAI thinking into the mainstream academia. We look forward to working alongside DTU's faculty and students to build capabilities that will shape how India plans its cities, manages its resources, and prepares for the future."*

Prof. Prateek Sharma, Vice Chancellor, DTU expressed his happiness on the signing of an MoU between DTU and Esri India. He expressed hope that this MoU will turn out to be a milestone in the saga of industry-academia collaboration and will get emulated by many others in the coming years. He laid the vision for the Department of Geospatial Science and Technology (DGST) at DTU. He mentioned that DGST, DTU aspires to be a global leader in Geospatial Education, Research and Consultancy. DGST intends to launch not only Executive Master's Programs in Geoinformatics but also UG programs in Geospatial Science and Geoinformatics. DTU believes that the Geospatial segment not only needs to develop a technology vertical but also focus on Geospatial and Space Sciences. DTU aims to be a leader in the country in establishing Geospatial Science and Technology as an independent discipline.

With Esri's ArcGIS at the heart of the 'CoE', DTU students and researchers will gain hands-on exposure to technologies that are new and upcoming, but also to the technologies which are actively being used by government agencies, urban planners, defence establishments and environmental organizations across the country.

Bharat Electronics Limited and Esri India Ink Pact to Strengthen India's Defence Capabilities

Esri India has signed a Memorandum of Understanding (MoU) with **Bharat Electronics Limited (BEL)**, a Navratna Central Public Sector Enterprise under the Ministry of Defence, to collaborate on defence projects and programs involving GIS, Location Intelligence and GeoAI.

BEL and Esri India have already delivered projects for the Indian defence services. This MoU will further strengthen the collaboration.

Under the MoU, Esri India and BEL will jointly pursue opportunities in the defence sector by combining BEL's deep domain expertise in defence electronics and systems integration with Esri India's GIS, location intelligence and GeoAI capabilities. The two organisations will also work together to ensure the timely availability and deployment of GIS solutions to meet urgent, surge-driven operational requirements across India's defence initiatives. Esri India will also extend training support to BEL to help them build in-house capability in GIS and GeoAI on its 'Indo ArcGIS' platform.

Agendra Kumar, Managing Director, Esri India, said, *"Geospatial intelligence has evolved from being a support capability to becoming a strategic decision advantage in defence, enabling commanders to see, analyse and respond with greater speed and precision. As AI becomes deeply integrated into defence ecosystems, the convergence of GIS and GeoAI will play an increasingly critical role in building resilient, mission-ready capabilities. Our collaboration with Bharat Electronics Limited is an important step towards advancing indigenous geospatial innovation, strengthening national capability and equipping India's defence services with trusted, future-ready location intelligence and operational support aligned with the vision of Atmanirbhar Bharat."*

The MoU is aligned with the Government of India's 'Make in India' initiative, with both organizations committing to leverage indigenous capability and technology-sharing to serve the requirements of India's defence establishment.

Rajnish Sharma, Director (BC) & Addl. Charge Director (Mktg), Bharat Electronics Limited, said, "Bharat Electronics Limited has always focused on delivering advanced indigenous technologies for national security. Our partnership with Esri India brings together BEL's expertise in defence systems and Esri India's leadership in GIS, enabling us to develop next-generation geospatial solutions that empower defence forces with actionable intelligence, improved operational coordination, and superior situational awareness."

GIS: Innovate. Integrate. Inspire.

Geographic Information System (GIS) has evolved far beyond its traditional role as a mapping technology. Modern GIS has become the digital intelligence layer connecting data, people, and processes across the enterprise. Enhanced by Geospatial AI, cloud computing, IoT, and real-time analytics, **GIS empowers organizations to innovate with confidence, integrate operations seamlessly, and inspire meaningful change through informed decision-making.**

Innovation Begins with Understanding

Innovation is often associated with breakthrough technologies. However, meaningful innovation begins with deeper understanding. Organizations innovate when they uncover opportunities hidden within data, identify operational inefficiencies, anticipate future challenges, and make faster, more informed decisions.

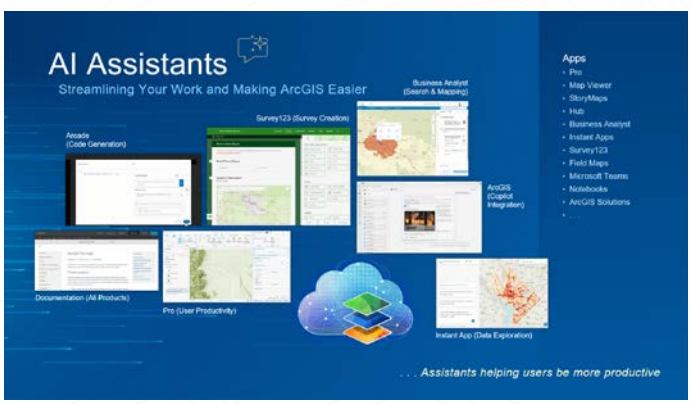
GIS is at the heart of this transformation. No longer just a system for mapping and spatial analysis, it has evolved into the foundation for next-generation technologies such as Artificial Intelligence (AI), Digital Twins, and the Internet of Things (IoT).

Geospatial AI (GeoAI)

AI needs GIS. While conventional AI excels at identifying patterns and making predictions, GeoAI enriches these insights with the critical dimension of location. It enables AI to understand not just **what** is happening, but **where** it is happening, **why** it matters, and **what** is likely to happen next. By embedding spatial context into AI workflows, GIS transforms AI from a predictive engine into an intelligent decision-making system capable of delivering more accurate, contextual, and actionable insights.

Esri's ArcGIS platform is evolving rapidly to power this new era of innovation.

AI assistants embedded within ArcGIS are bringing the power of generative AI directly into the user experience. Instead of navigating complex menus or writing scripts, users can interact with ArcGIS using natural language. They can simply ask questions or describe what they want to accomplish, and the AI assistant helps execute the task.



This democratizes GIS by enabling planners, engineers, analysts, executives, and field personnel to derive insights without requiring deep technical expertise. The result is faster adoption, greater collaboration, and more informed decision-making across the enterprise.
One of the most significant innovations in ArcGIS is

Esri's Geospatial Vision Language Model (GoVLM), a foundation model purpose-built for geospatial applications.

Unlike traditional deep learning models that are designed to perform a single task, GoVLM combines an understanding of both geospatial imagery and natural language. This enables users to interact with imagery using simple prompts rather than creating and training separate models for each analytical requirement.
Its "one model, multiple tasks" approach offers organizations a far more flexible and scalable way to analyze geospatial imagery. Instead of maintaining multiple task-specific models, organizations can rely on a single intelligent model capable of supporting diverse workflows across sectors such as agriculture, forestry, utilities, urban planning, defence, mining, and disaster management.

As geospatial datasets continue to grow in size and complexity, foundation models such as GoVLM represent a major leap forward in making advanced imagery analysis faster, simpler, and more accessible.

The next frontier of innovation is **AI-powered action**. While agentic AI is advancing rapidly, most general-purpose AI frameworks still lack one critical capability: **spatial intelligence**. Without geographic context, AI agents cannot fully understand the physical world in which organizations operate.

Within ArcGIS, agentic mapping applications are introducing a conversational experience directly on top of maps. Instead of navigating layers or complex interfaces, users can simply ask questions such as:

- Which villages are most vulnerable to flooding?
- Show me infrastructure projects currently under construction.
- Identify areas suitable for new EV charging stations.
- Where are the highest-risk utility assets?

The system interprets natural language, queries spatial data, performs analysis, and returns meaningful answers in context. This dramatically expands access to GIS by enabling non-technical users, including executives, planners, policymakers, and field teams, to interact with spatial information conversationally.

Esri is extending the power of GIS into the era of Agentic AI through support for the Model Context Protocol (MCP), an open standard that enables AI assistants and agents to securely discover and use external tools and data. By exposing ArcGIS capabilities through MCP, Esri allows AI agents to access authoritative geospatial services such as geocoding, routing, spatial analysis, feature queries, map generation, and location intelligence using natural language. This innovation ensures that AI-powered applications are no longer limited to generic responses but can reason with real-world geographic context, resulting in more accurate, location-aware insights and decisions. As Esri expands MCP support across the ArcGIS ecosystem, it is making geospatial intelligence seamlessly accessible within enterprise AI workflows, helping organizations build smarter, more context-aware AI solutions.

Living Digital Twins

One of the most transformative innovations enabled by GIS is the emergence of Living Digital Twins. While often perceived as another technology platform, a Living Digital Twin is not a new system—it is a smarter way of bringing together the systems organizations already have. It integrates operational, engineering, business, IoT, and geospatial data into a connected environment that supports better, faster, and more informed decisions.

More than a visual representation, a Living Digital Twin creates a continuously evolving digital replica of the real world. It helps organizations understand what has happened, what is happening now, and what could happen next. By bringing together authoritative data and real-world context, it enables operators, planners,

engineers, executives, and emergency responders to work from a shared understanding of reality, fostering coordinated action across the enterprise.

The foundation of every Living Digital Twin is geography. Every asset, sensor, customer, building, utility network, and business process has one thing in common, location. Geography provides the common reference framework that connects diverse systems and datasets, grounding the digital twin in the real world. It ensures that changes occurring in the physical environment are reflected in the digital representation, while insights generated in the digital environment can be translated into timely actions on the ground. In this way, geography becomes the bridge between the physical and digital worlds.

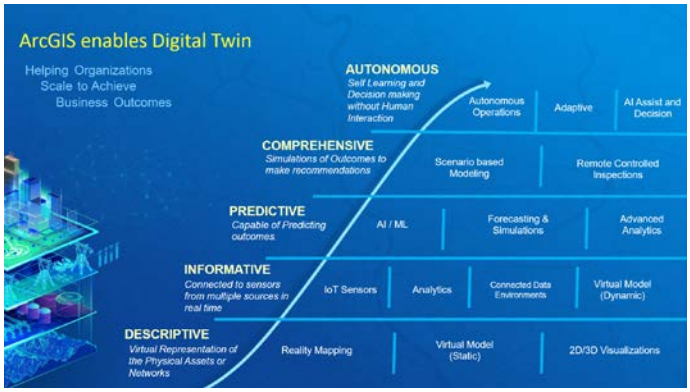
A Living Digital Twin is distinguished by three defining characteristics.

First, it is continuously connected. It integrates data from enterprise GIS, IoT sensors, engineering models, BIM, CAD, satellite imagery, drones, business systems, and operational databases into a living digital environment that remains current as conditions evolve. Rather than presenting isolated datasets, it creates a comprehensive view of interconnected assets, processes, and relationships.

Second, it is time-aware. Unlike static 3D models, a Living Digital Twin captures the past, reflects the present, and helps simulate future scenarios. Organizations can analyse historical trends, monitor real-time operations, and evaluate "what-if" scenarios before making critical decisions. This ability to move seamlessly across time transforms planning from reactive problem-solving to proactive decision-making.

Third, it is outcome-driven. Every Living Digital Twin is designed around a specific operational objective—whether improving urban mobility, strengthening utility resilience, optimizing industrial operations, enhancing disaster preparedness, or supporting sustainable urban development. The technology is valuable not because it creates a sophisticated 3D model, but because it enables better decisions and measurable business outcomes.

ArcGIS provides the geospatial foundation that powers this journey. Beginning with authoritative spatial data, organizations can progressively integrate route networks, real-time sensor feeds, enterprise systems, advanced spatial analytics, and GeoAI to build increasingly intelligent Living Digital Twins. Rather than replacing existing investments, ArcGIS connects systems of record into a unified decision-support environment, enabling collaboration across departments and throughout the organization.



Ultimately, the power of a Living Digital Twin lies not in its visualization capabilities, but in its ability to combine authoritative data with real-world context. It provides organizations with a living, continuously updated understanding of complex systems, enabling them to understand today's operations while exploring tomorrow's possibilities. As infrastructure, cities, and enterprises become increasingly connected, Living Digital Twins are emerging as a critical capability for building resilient organizations, intelligent infrastructure, and sustainable communities.

Reliance Jio: Connecting Millions Through Smarter Network Planning

India's rapidly expanding digital economy depends upon robust telecommunications infrastructure. As service providers extend high-speed connectivity across diverse geographies, efficient network planning has become increasingly complex.

Reliance Jio has leveraged advanced ArcGIS capabilities to support large-scale planning, asset management, and network deployment across the country. By integrating engineering information with geographic context, planners gain greater visibility into network infrastructure, optimize rollout strategies, and accelerate service delivery.

Location intelligence enables engineers to evaluate terrain,

existing assets, customer demand, and infrastructure constraints simultaneously, supporting informed investment decisions while reducing deployment timelines.

As India advances toward ubiquitous digital connectivity, GIS continues to play an important role in enabling smarter telecommunications infrastructure.

"Innovation accelerates when every network decision begins with geography."

Integration at the core of Innovation

GIS fosters innovation by bringing together disparate datasets, business applications, operational systems, and real-time information within a common geographic framework. By providing spatial context to enterprise data, GIS enables organizations to move beyond isolated insights and build a connected, data-driven enterprise capable of responding faster, planning better, and innovating continuously.

The Power of Integration

Every organization generates enormous amounts of data. Utilities collect information from smart meters and supervisory control and data acquisition (SCADA) systems. Telecom companies monitor network performance through millions of connected devices. Urban planners rely on satellite imagery, cadastral records, and demographic data. Manufacturers use IoT sensors to monitor production assets, while retailers analyse customer behavior across multiple channels. Individually, these datasets provide valuable insights. However, when they exist in silos, their potential remains largely untapped. GIS addresses this challenge by providing the common thread that connects information across departments and systems.

Connecting Enterprise Business Platforms

Today's enterprises rely on a wide range of digital business platforms to manage operations. ERP systems oversee financial and operational processes, CRM platforms capture customer interactions, asset management solutions monitor infrastructure, while business intelligence tools generate performance reports. Traditionally, these systems operate independently, requiring users to switch between applications to obtain a complete picture of operations.

GIS bridges these systems by integrating enterprise business applications with location intelligence. For example, an electricity distribution company can connect its GIS platform with ERP and asset management systems to visualize infrastructure investments geographically, monitor maintenance schedules, and analyse service performance in real time. A telecommunications provider can integrate customer databases, network assets, field workforce management, and service requests into a single operational dashboard, enabling faster fault resolution and improved customer satisfaction.

Similarly, municipal governments can integrate property tax databases, land records, utility networks, transportation infrastructure, and citizen grievance systems into a unified geospatial platform. This not only streamlines administration but also enables evidence-based planning and more responsive public services.

In infrastructure planning, engineers can integrate BIM models with GIS to visualize proposed assets within their surrounding environment, assess terrain constraints, analyse utility conflicts, and evaluate environmental impacts before construction begins. During operations, IoT sensors, inspection reports, and maintenance records can continuously update the same GIS environment, creating a living digital representation of the infrastructure throughout its lifecycle.

Rather than replacing existing enterprise applications, GIS enhances their value by providing the geographic context necessary for informed decision-making.

ArcGIS offers a wide range of integration capabilities to connect with enterprise IT systems, enabling seamless workflows and enhanced geospatial intelligence. These integrations are supported through strategic partnerships, APIs, and tools that cater to various use cases.

ArcGIS integrates with enterprise software such as Microsoft Azure, AWS, and SAP HANA, allowing organizations to leverage cloud computing, secure data storage, and spatially enabled business applications.

FROM DATA SILOS TO ENTERPRISE INTELLIGENCE

BEFORE GIS

Operating in Silos. Limited Visibility. Slower Results

1 **Separate Databases**
Data is stored in disconnected systems across departments.

2 **Duplicate Data**
Redundant data leads to inconsistencies and higher costs.

3 **Delayed Decisions**
Lack of real-time information leads to delays and missed opportunities.

AFTER GIS

Connected. Collaborative. Intelligent

1 **Shared Operational Picture**
A single, trusted view of information for all departments.

2 **Connected Systems**
GIS integrates enterprise systems, data and workflows seamlessly.

3 **Faster Responses**
Real-time insights enable quick actions and proactive decisions.

Developers can use ArcGIS APIs and SDKs to build custom integrations with in-house or third-party systems. These tools enable the creation of tailored solutions for data management, spatial analysis, and automation. For example, the "Integrate" tool in ArcGIS Pro allows users to analyze and align feature vertices within specified tolerances, ensuring data consistency.

ArcGIS also supports open standards and specifications, ensuring interoperability with other systems and fostering collaboration across platforms.

From Insight to Impact

Innovation introduces new possibilities. Integration connects those possibilities into a cohesive system. But the true measure of technology lies in its ability to inspire meaningful action and create lasting impact. GIS transcends technology to become an enabler of transformation. Every map tells a story. Every dashboard reveals an opportunity. Every spatial analysis supports a decision that can improve lives, protect natural resources, strengthen communities, or build resilient infrastructure.

OneMap Gurugram: A Single Source of Truth

As one of India's fastest-growing urban centers, Gurugram faces increasing demands on infrastructure, mobility, utilities, and citizen services.

The Gurugram Metropolitan Development Authority (GMDA) developed OneMap Gurugram, an integrated GIS platform that brings together data from multiple departments onto a single digital platform.

Urban planners, engineers, utility agencies, and administrators now access shared geospatial information for planning and decision-making.

Instead of maintaining separate maps and datasets, stakeholders collaborate using a common geographic framework, improving coordination while reducing duplication and delays.

OneMap demonstrates how ArcGIS enables cities to move from departmental operations to integrated urban governance.

Jawaharlal Nehru Port Authority (JNPA): Building a Smart Port

Ports are among the most complex operational environments, involving shipping movements, cargo logistics, road connectivity, security, utilities, environmental monitoring, and infrastructure management.

The Jawaharlal Nehru Port Authority (JNPA) has adopted ArcGIS to create an integrated view of port operations.

By combining infrastructure data, utility networks, logistics information, and operational assets within a single geospatial platform, port authorities gain improved situational awareness and more effective coordination across departments.

GIS also supports future expansion planning by helping planners visualize land availability, infrastructure capacity, and operational constraints before investments are made.

Tata Steel UISL: Integrating Urban Infrastructure

Managing urban utilities requires continuous coordination between water supply, wastewater systems, roads, public facilities, and citizen services.

Tata Steel UISL has leveraged ArcGIS to integrate utility operations, enabling engineers and administrators to monitor assets, streamline maintenance activities, and improve service delivery.

By connecting infrastructure information through a common geographic framework, the organization has enhanced operational efficiency while supporting smarter urban management.

Organizations that integrate spatial intelligence into enterprise workflows can reduce duplication, improve coordination, and accelerate decision-making by ensuring every stakeholder works from the same geographic context.

Across India, organizations are using GIS not merely to manage assets or analyse data, but to solve complex societal challenges, from ensuring clean drinking water and protecting forests to modernising governance, responding to disasters, and creating more sustainable cities. The most compelling GIS stories are no longer about technology. They are about people.

Governance

Good governance begins with understanding people, places, and the complex relationships between them. GIS provides governments with a comprehensive, location-based view of assets, infrastructure, resources, and communities, enabling more informed, transparent, and timely decision-making. By integrating data across departments, GIS helps improve urban planning, land administration, public safety, infrastructure management, disaster response, and citizen services. When combined with AI, IoT, and real-time data, GIS empowers governments to predict challenges, optimize resource allocation, and deliver more responsive, citizen-centric services. In an increasingly digital world, GIS has become the foundation of smart governance—transforming data into actionable intelligence and enabling governments to plan smarter, respond faster, and build more resilient and sustainable communities.

Agriculture

Agriculture has always been deeply connected to geography, with factors such as soil, water availability, terrain, and climate influencing productivity. Today, precision agriculture is redefining this relationship by combining GIS with satellite imagery, drones, remote sensing, IoT sensors, and artificial intelligence. These technologies provide farmers and policymakers with timely, location-specific insights that enable better planning and decision-making throughout the agricultural cycle.

Rather than applying the same practices uniformly across an entire farm, GIS enables interventions tailored to local conditions. Farmers can monitor crop health, analyse soil variability, optimize irrigation, identify pest and disease outbreaks, forecast yields, and apply fertilizers and pesticides only where they are needed. This data-driven approach not only improves productivity and profitability but also reduces water consumption, minimizes input costs, and lowers the environmental impact of agricultural operations, making farming more sustainable and resilient.

Forests, Biodiversity, and Conservation

India's forests are vital for preserving biodiversity, supporting millions of livelihoods, regulating climate,

and maintaining ecological balance. Managing these vast and diverse ecosystems requires continuous monitoring and informed decision-making across large geographic areas, something that traditional field-based methods alone cannot achieve.

GIS has become an indispensable tool for forest departments and conservation agencies by providing a comprehensive spatial view of forest resources. It enables authorities to monitor changes in forest cover, detect encroachments, identify illegal logging and mining activities, assess wildlife habitats and migration corridors, plan conservation initiatives, and monitor biodiversity over time. By integrating satellite imagery with AI-powered change detection and geospatial analytics, environmental monitoring becomes faster, more accurate, and more proactive, allowing authorities to respond quickly to emerging threats while supporting long-term conservation goals.

Defence

GIS has transformed the way defence organizations plan, operate, and make decisions. The technology, coupled with AI, has brought in highly credible outcomes in a wide range of applications, including intelligence gathering, battlefield management, terrain analysis, surveillance, infrastructure management, and monitoring activities. By providing accurate geospatial information and real-time situational awareness, GIS enhances operational efficiency, improves strategic planning, and strengthens national security.

Additionally, the integration of GIS with AI enables defence systems to evolve from reactive decision-making to proactive and predictive capabilities. This convergence supports intelligent threat detection, improves resource allocation, and enables faster, data-driven strategic and tactical decisions.

Land Administration

GIS is transforming land management by creating a single, authoritative view of land records, cadastral maps, ownership details, zoning regulations, and development plans. By integrating spatial and administrative data, GIS enables government agencies to efficiently manage land assets, verify land-use information, monitor development activities, and streamline approvals. It enhances transparency, reduces disputes, supports evidence-based planning, and improves coordination across departments. With real-time visualization, mobile data collection, and analytics, GIS empowers authorities to make faster, more informed decisions while ensuring sustainable land use, efficient resource management, and better citizen services.

GIS Enabling Evidence-based Decision-making: LDA

Lucknow Development Authority (LDA) transformed urban planning and governance through Urban Vista Lucknow, a comprehensive GIS portal built on ArcGIS. The platform integrates land records, cadastral maps, master plans, property allotments, Nazool land, utilities, road networks, satellite imagery, and engineering projects into a single geospatial system, enabling planners, government officials, and citizens to access accurate, authoritative spatial information for evidence-based decision-making.

Before implementing the GIS platform, LDA struggled with fragmented data spread across multiple departments, limited transparency, manual workflows, lengthy approval processes, and the absence of a centralized system for verifying land-use information. These challenges resulted in administrative inefficiencies, delayed approvals, and reduced public trust.

Esri India addressed these challenges by developing a single-window GIS portal with integrated web applications, mobile apps, interactive dashboards, ERP integration, and tools for land management, cadastral mapping, property management, project monitoring, park and monument information, and change detection using satellite imagery. The solution also included data standardization, user training, and real-time geotagging of projects to improve operational efficiency and data accuracy.

The implementation has significantly improved governance by providing a unified view of planning and infrastructure data, enhancing transparency, simplifying information management, streamlining workflows, strengthening collaboration, and enabling faster, data-driven decisions. The platform has also expanded public access to verified planning information, reduced manual processes, improved resource management, and supported sustainable urban development through better planning and monitoring.

Disaster Management

Climate change is redefining how societies plan, build, and protect infrastructure, manage natural resources,

and prepare for disasters. Increasingly frequent and severe events—extreme rainfall, heat waves, cyclones, droughts, forest fires, and sea-level rise—are creating complex challenges that require a deeper understanding of location and geography. Since every climate risk has a spatial dimension, decision-makers need technologies that can reveal where vulnerabilities exist, how risks are evolving, and which communities and assets are most exposed.

GIS provides the spatial intelligence needed to move from reactive disaster response to proactive climate resilience. By integrating satellite imagery, elevation models, weather forecasts, historical records, and real-time sensor data, GIS creates a comprehensive view of both current conditions and future risks. This enables governments, utilities, and emergency agencies to identify high-risk zones, simulate the impact of different climate scenarios, optimize evacuation routes, prioritize resilient infrastructure investments, and strengthen emergency preparedness and response strategies.

By making future risks visible today, GIS empowers organizations to make informed, evidence-based decisions that reduce vulnerability and enhance resilience. Whether protecting critical infrastructure, safeguarding natural ecosystems, or improving community preparedness, spatial intelligence is helping societies adapt to a changing climate and build a safer, more sustainable future.

AGiSAC: Driving Smarter Governance with GIS

Aryabhatta Geo-informatics and Space Application Centre (AGiSAC) is leveraging ArcGIS to strengthen governance in Himachal Pradesh through a centralized Decision Support System (DSS). AGiSAC has developed web, desktop, and mobile GIS applications for multiple government departments, including rural development, public works, irrigation, forests, town planning, and environment, enabling efficient, transparent, and data-driven governance.

The GIS-based applications integrate cadastral maps, satellite imagery, demographic and departmental data to support infrastructure planning, human resource management, gap analysis, route optimization, monitoring of government schemes, and identification of suitable locations for new facilities such as schools, healthcare centres, and fair-price shops. GPS-enabled mobile devices ensure real-time data updates, while a common geospatial platform enables seamless collaboration across departments.

By using ArcGIS, AGiSAC has enabled government officials to visualize complex datasets, perform spatial analysis, and make faster, evidence-based decisions. The platform has improved planning, resource allocation, infrastructure monitoring, and developmental gap analysis while supporting initiatives such as the Green Corridor, Panchayat Development Plans, PMGSY progress monitoring, water conservation under the Jal Shakti Abhiyan, and industrial planning. Overall, the project demonstrates how GIS serves as a powerful foundation for integrated, transparent, and citizen-centric governance.

Inspiration Creates a Ripple Effect

The true power of GIS extends beyond technology—it lies in its ability to inspire transformation. Every successful implementation becomes a model that others can learn from and adapt. When one city demonstrates how GIS can improve governance and citizen services, other municipalities are encouraged to follow. When a utility uses spatial intelligence to reduce outages and improve operational efficiency, similar organizations recognize the value of adopting geospatial solutions. Likewise, when a state builds a comprehensive geospatial platform to support planning and decision-making, neighboring states are often motivated to accelerate their own digital transformation initiatives.

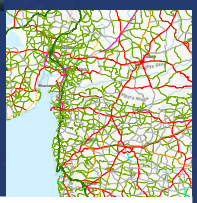
Innovation spreads through demonstrated success. As more organizations witness measurable improvements in efficiency, sustainability, resilience, and public service delivery, confidence in geospatial technologies continues to grow. This ripple effect is one of the defining characteristics of India's rapidly expanding geospatial ecosystem, where shared learning, collaboration, and innovation are collectively driving smarter governance, stronger industries, and more sustainable development.

Conclusion

Innovation reveals new opportunities. Integration connects systems, data, and stakeholders to enable seamless collaboration. Inspiration encourages organisations to learn from successful implementations and embrace new possibilities. Together, these three pillars define the next chapter of digital transformation.

Indo ArcGIS® Living Atlas

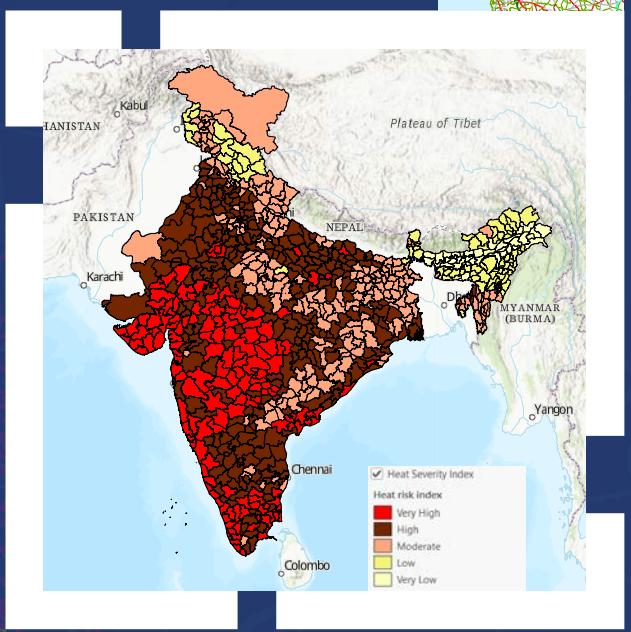
Foremost Collection of Geographic Data

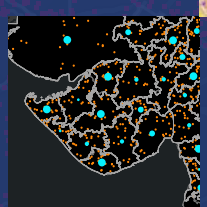


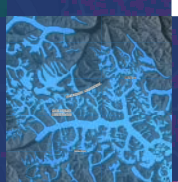
100+
Segments and Content categories

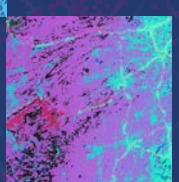
80M+
Annual data requests

- Get ready-to-use geographic content for India
- Access curated content from across 100+ categories
- Create maps, apps, and perform analysis









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GIS IN ACTION

ArcGIS Empowering Bengal Gas Company Limited's City Gas Distribution Network in Kolkata

Client

Bengal Gas Company Limited

Industry

Utilities – City Gas Distribution (CGD)

Organization Profile

Bengal Gas Company Limited is a leading natural gas distribution company serving industrial, commercial, and residential customers across Kolkata and surrounding regions. It is a joint venture of GAIL and Greater Calcutta Gas Supply Corporation Limited. The company develops and operates City Gas Distribution (CGD) networks, including steel and MDPE pipelines, pressure regulating stations, and CNG stations. BGCL is committed to providing safe, reliable, and clean energy solutions across the region.

Project

Integrated GIS Enterprise and Cloud-Based CGD Asset Management System

Website

www.bgcl.co.in

Project Summary

Bengal Gas Company Limited implemented an enterprise GIS solution using ArcGIS technology to modernize the management of its City Gas Distribution (CGD) assets. All assets are maintained digitally and securely stored in a cloud-based system. The solution migrated legacy GIS data and disconnected departmental workflows into a centralized cloud-based platform.

The new GIS system integrates spatial and non-spatial information related to pipelines, valve chambers, regulator stations, cathodic protection systems, PNG and CNG customers, and maintenance activities over the Kolkata GA Area.

The implementation provides a unified environment for planning, monitoring, analysing, and maintaining the entire gas network, enabling seamless collaboration across departments such as Engineering, Operations, Safety, and Customer Service.

Challenges

Before implementing its modern GIS platform, Bengal Gas Company Limited faced several key challenges, including fragmented asset data across multiple departments, limited scalability of its on-premises infrastructure, poor integration with enterprise systems, slow manual data updates, high maintenance costs, and a lack of real-time field access to critical asset information. These limitations affected data accuracy, operational efficiency, and decision-making across the organization.

Fragmented Asset Data – Infrastructure data was stored across multiple departments, leading to duplication and inconsistencies.

Limited Scalability – The on-premises GIS system struggled to support growing asset volumes and user demands.

Poor System Integration – Limited connectivity with other applications and internal systems, restricting seamless data exchange and reducing operational efficiency.

Manual Data Updates – Slow update processes reduced the accuracy and reliability of asset information.

High Maintenance Costs – Legacy infrastructure required significant investment in hardware and support.

Limited Field Access – Field teams lacked real-time access to critical asset data.

These challenges impacted data quality, operational efficiency, and decision-making across Bengal Gas Company Limited.

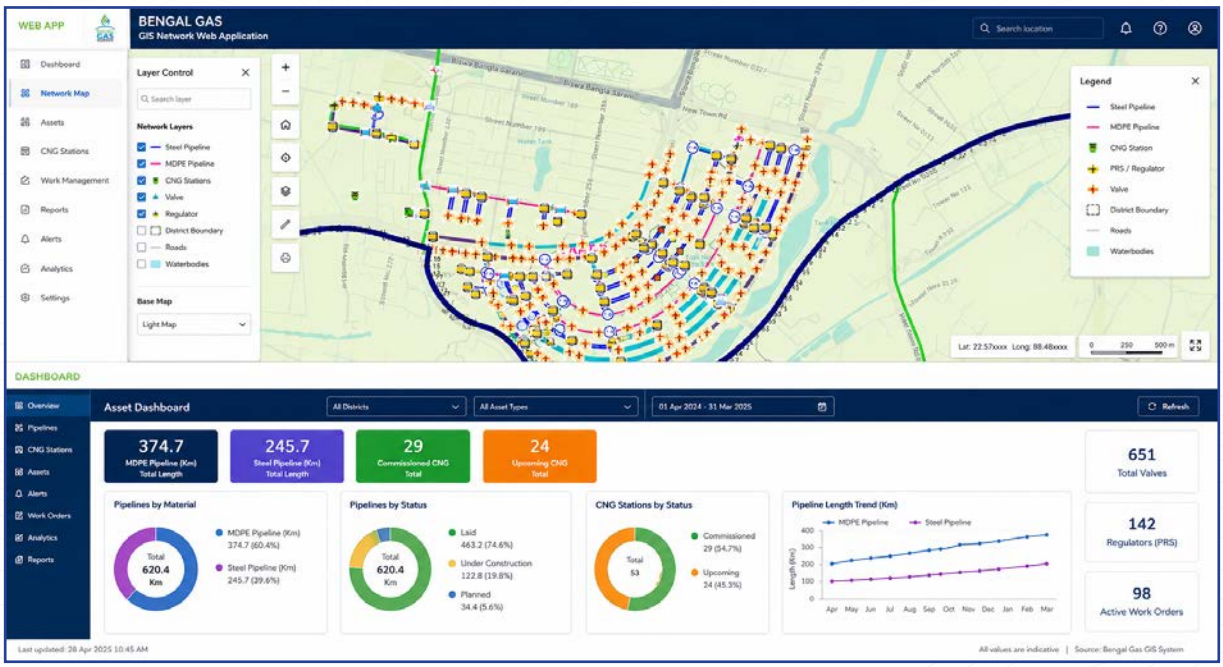
Solution

To modernize its asset management and operational workflows, Bengal Gas Company Limited implemented a comprehensive GIS solution powered by ArcGIS Enterprise. Designed to be secure, scalable, and fully integrated, the platform serves as a centralized digital foundation for managing the company's City Gas Distribution (CGD) network and associated business processes.

At the core of the solution is a centralized enterprise geodatabase that consolidates all CGD assets and related operational information into a single source of truth. Interactive Web GIS applications enable users to visualize, query, and analyse pipelines, customer connections, and critical network infrastructure through an intuitive browser-based interface. Field operations are streamlined through ArcGIS Field Maps, which allows engineers and technicians to collect and update asset information, inspections, and maintenance records directly from the field using mobile devices.

For operational oversight, ArcGIS Dashboards provides a real-time view of key performance indicators, including pipeline length by material and pressure category, CNG station count, active PNG and CNG customers, domestic PNG installation statistics, inspection status, leakage reports, and work order progress. These dashboards transform complex spatial and operational data into actionable insights for management and technical teams.

The platform is also designed to integrate seamlessly with BGCL's internal applications and business systems, enabling efficient data exchange and a unified view of operational information. This connected environment enhances cross-functional collaboration, improves data consistency, and supports faster, more informed decision-making across the organization.



Web Application

Benefits

The implementation of the ArcGIS Enterprise solution has delivered substantial operational and strategic benefits to Bengal Gas Company Limited, transforming the management of its City Gas Distribution (CGD) network.

Centralized Enterprise GIS Platform
A secure, centralized geodatabase serves as a single source of truth for all CGD assets and related operational information.

Interactive Web GIS Applications
Browser-based applications enable users to visualize, query, and analyse pipelines, customer connections, and other critical assets from anywhere within the organization.

Mobile GIS for Field Operations
ArcGIS Field Maps empowers field teams to collect and update asset information, inspections, and maintenance records directly from site locations.

Real-Time Operational Dashboards
ArcGIS Dashboards provides dynamic insights into key performance indicators such as pipeline length, CNG station count, customer connections, inspection status, and work order progress.

Enhanced Operational Efficiency
Automated workflows reduce manual effort and significantly improve data turnaround times.

Improved Data Accuracy
Standardized data capture and centralized asset management minimize duplication and ensure reliable information.

Faster Decision-Making
Real-time access to spatial and operational data supports timely and informed management decisions.

Increased Field Productivity
Mobile access to current asset information streamlines inspections, maintenance, and reporting activities.

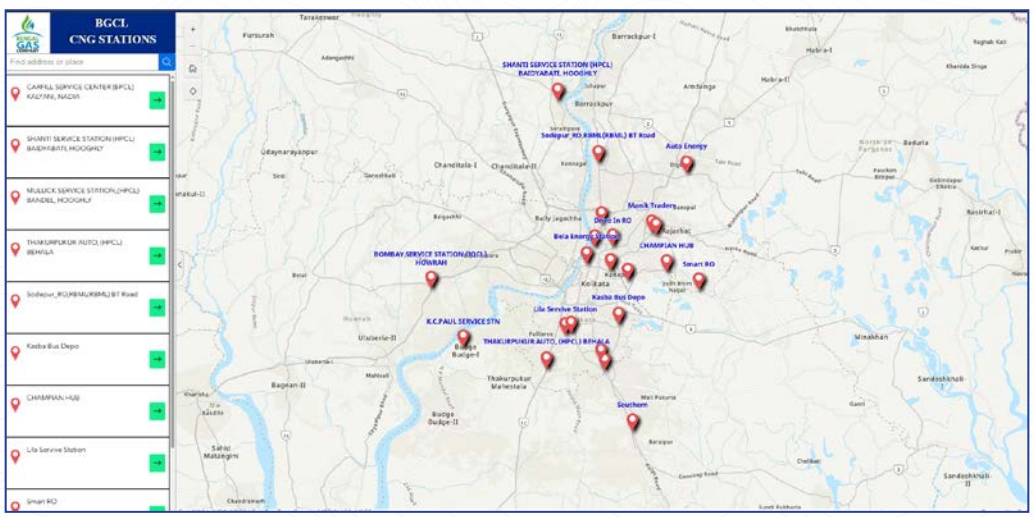
Scalable and Future-Ready Architecture
The platform is designed to support network expansion, additional users, and evolving business requirements.

Cost Optimization
Reduced infrastructure and maintenance costs through the adoption of a modern enterprise GIS platform.

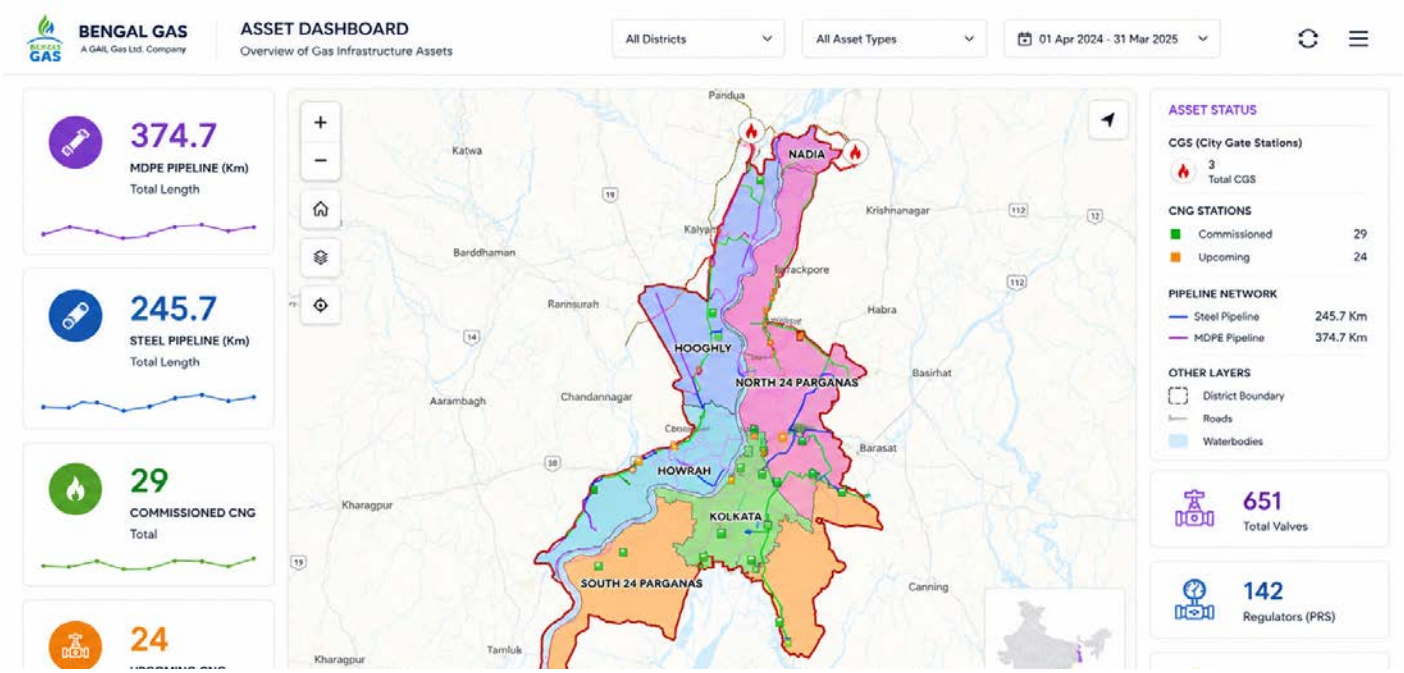
Improved Collaboration
A unified system strengthens coordination by ensuring all departments work from the same authoritative data source.

Regulatory Compliance
Accurate asset records and inspection histories support compliance with Petroleum and Natural Gas Regulatory Board (PNGRB) regulations.

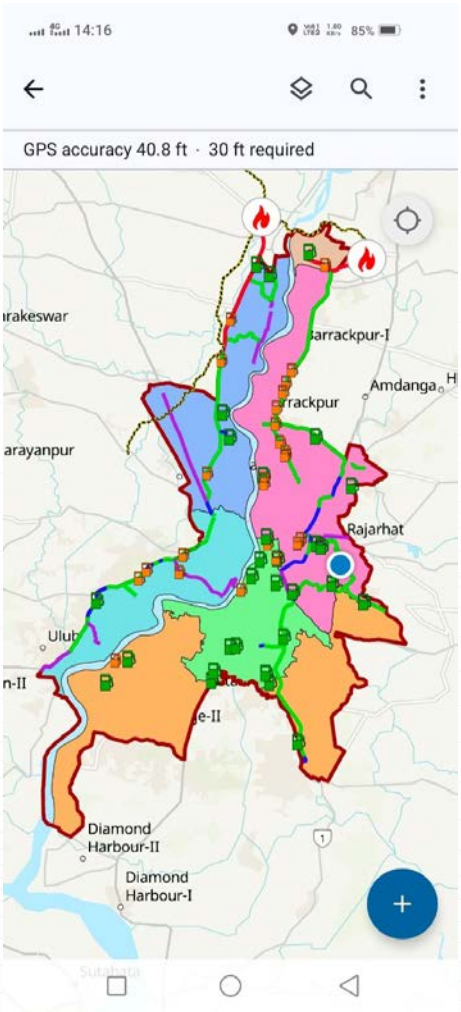
Collectively, these benefits have enhanced operational visibility, strengthened governance, and positioned BGCL to deliver safe, reliable, and sustainable energy services across Kolkata GA.



CNG Stations

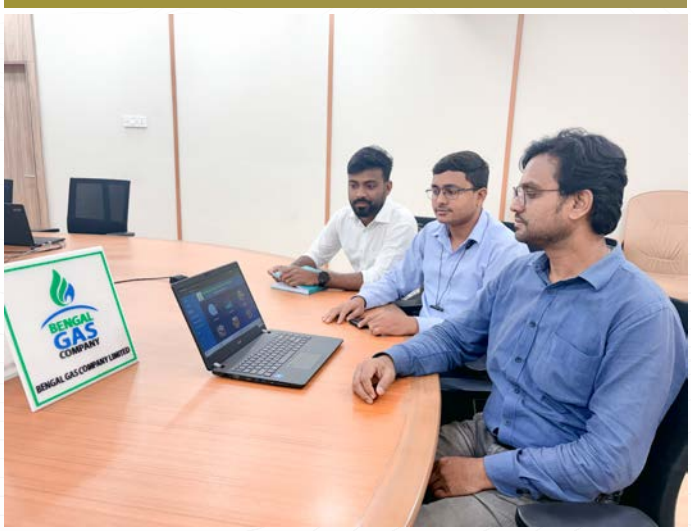


Asset Dashboard



Field Map

"The implementation of the ArcGIS Enterprise solution has enabled the management of Bengal Gas Company Limited's City Gas Distribution (CGD) network in Kolkata, delivering substantial operational efficiencies, enhanced decision-making capabilities, and long-term strategic value." - **Shri Anupam Mukhopadhyay, CEO, Bengal Gas Company Limited**



USAC: Enabling Smarter Governance Through GIS

Governance today requires timely information, informed decision-making, and seamless coordination across departments. Geographic Information System (GIS) has emerged as a powerful enabler, helping governments integrate diverse datasets, visualize complex challenges, and deliver citizen-centric services more effectively. At the **Uttarakhand Space Application Centre (USAC)**, GIS is playing a pivotal role in supporting planning, resource management, disaster preparedness, and digital governance across the state. In this interaction, **Prof. Durgesh Pant, Director, USAC,** shares how geospatial technology is transforming governance in Uttarakhand, the impact it has created over traditional systems, and the value of collaborating with Esri India to build innovative, location-driven solutions.

What are the core functions of USAC?

USAC was established to address the state's growing need for space technology and geospatial applications. Our primary objective is to provide technology-driven solutions to various government departments using satellite imagery, GIS, and other space-based technologies.

How are you using GIS in your work?

GIS has become the foundation of many of our initiatives. Geospatial information is relevant across virtually every sector, from agriculture and land use to urban planning, water resources, disaster management, and forestry. GIS has become an integral part of the decision-making processes of the government departments. Today, USAC works closely with these departments to develop innovative applications that solve real-world challenges and support better governance.

One of our significant projects focuses on managing government assets and addressing encroachment issues. We have also created an integrated GIS dashboard for one of Uttarakhand's border districts, bringing together nearly 200 data layers on a single platform. We are now developing a similar dashboard for Rudraprayag district, home to the Kedarnath Temple.

We look forward to building GIS-based dashboards for every district in Uttarakhand, enabling administrators, policymakers, and citizens to access reliable, location-based information for informed decision-making and improved public service delivery.

What benefits have you observed in using GIS over traditional systems?

Earlier, most government departments relied on manual processes or basic spreadsheet-based systems. GIS has completely transformed how information is managed and analyzed.

Today, we can accurately locate settlements, link them with multiple attributes, visualize relationships between datasets, and perform complex spatial queries that were previously impossible. This has significantly improved planning, monitoring, and decision-making across departments.

Instead of working with isolated datasets, GIS provides an integrated view of information, helping stakeholders understand patterns, identify issues quickly, and implement more effective solutions.

We appreciate Esri India's commitment to bringing advanced GIS capabilities to users and enabling organizations like ours to build impactful applications. We look forward to strengthening our collaboration and exploring new opportunities to leverage geospatial technology for better governance and public service.

Suez International: Building Smarter Water Utilities with GIS and AI

As cities around the world strive to build more resilient and sustainable water infrastructure, digital technologies such as Geographic Information Systems (GIS) and Artificial Intelligence (AI) are transforming the way utilities manage their assets and deliver essential services. In this conversation, **Dr. Sandeep Mahajan, Asset Manager at Suez International,** shares how GIS has become the backbone of large-scale water and wastewater projects, enabling smarter planning, efficient asset management, and data-driven decision-making. He also discusses the growing role of AI in predictive maintenance and how its integration with GIS can help utilities improve operational efficiency and proactively manage critical infrastructure.

How important is the use of GIS in the utilities industry?

GIS is an invaluable tool for creating, collecting, managing, and analyzing geographically referenced data. It brings together infrastructure, terrain, population, and environmental information on a single platform, enabling utilities to make informed decisions based on location intelligence.

How does GIS support wastewater and stormwater management?

In wastewater and stormwater management, GIS provides a comprehensive understanding of infrastructure, its condition, terrain, and population. Since population directly influences wastewater generation, having all this information in one system allows utilities to plan future infrastructure, optimize operations, and improve service delivery.

How has Suez International leveraged GIS in its projects?

We have been using Esri's ArcGIS platform since I joined Suez International in 2012. For large city-wide water distribution projects involving more than 1,000 kilometers of pipeline networks and thousands of customer connections, GIS serves as the foundation for mapping and managing assets.

Beyond mapping, how does GIS add value to your operations?

GIS is much more than a mapping tool. We use it for spatial analysis, asset management, planning, and operational decision-making. Any environmental or utility service that depends on accurate, location-based information can benefit significantly from GIS.

How do you see AI enhancing asset management?

AI has tremendous potential to improve asset management. For example, if AI can analyze photographs or visual inspection data to assess the condition of infrastructure, it could quickly identify deterioration or potential failures without relying solely on manual inspections or physical sampling.

What excites you most about combining AI with GIS?

The combination of AI and GIS can make asset management far more proactive. By integrating image analysis with historical asset data and GIS, utilities can implement predictive maintenance, prioritize investments, reduce downtime, and improve the reliability and longevity of water and wastewater infrastructure.

Ashoka University: Empowering the Next Generation of Spatial Thinkers

As the world becomes increasingly data-driven, the ability to understand, analyze, and interpret spatial information has emerged as a critical skill across disciplines. Geographic Information Systems (GIS) is no longer confined to geography or urban planning; it is now shaping research and decision-making in environmental science, economics, public policy, archaeology, public health, business, and the humanities. Universities across the globe are responding by embedding GIS into their academic curricula, ensuring that students graduate with the analytical capabilities needed to solve complex, real-world challenges.

GIS education goes beyond teaching students how to create maps. It equips them with the ability to integrate diverse datasets, visualize patterns, uncover relationships, and generate actionable insights. In an era where Artificial Intelligence, remote sensing, satellite imagery, and big data are transforming every sector, GIS provides the essential spatial context that helps students connect information with place, people, and processes.

Among the institutions leading this interdisciplinary approach in India is **Ashoka University**, where GIS has evolved into a powerful academic and research tool that transcends traditional disciplinary boundaries.

Fostering GIS Education Across Disciplines

By making GIS accessible to students from diverse academic backgrounds, Ashoka University is preparing graduates who can leverage spatial intelligence to address some of society's most pressing challenges. GIS is integrated into teaching, research, and social impact initiatives rather than being limited to a standalone technical subject.

As mentioned by **Meghna Agarwala, Ph.D., Associate Professor, Department of Environmental Studies, Ashoka University**, courses on GIS and remote sensing are open to students from all majors, reflecting the university's philosophy of interdisciplinary education. Beyond dedicated GIS courses, spatial technologies are embedded into subjects such as earth systems, air pollution, and environmental modelling, enabling students to apply geospatial thinking within broader scientific investigations.

Students from humanities disciplines, including English, Archaeology, History, and Philosophy, are increasingly applying GIS for digital humanities projects. **Spatial analysis enables them to study historical landscapes, map archaeological sites, examine cultural heritage, and visualize historical narratives in entirely new**

ways. Many of these projects go on to become integral components of doctoral research.

Economics students incorporate geospatial datasets into econometric analyses, allowing them to better understand regional development, demographic trends, environmental influences, and socio-economic disparities. **By combining spatial data with statistical models, they gain deeper insights into policy and economic questions.**

For students in the **natural sciences, GIS often forms the foundation of research, capstone projects, and thesis work.** Spatial analysis supports investigations in environmental science, ecology, climate studies, biodiversity, and earth systems, helping students model complex natural processes and interpret environmental change.

In addition to courses for undergraduates, the university also offers GIS to students of the Young India Fellowship and to social practitioners through the Professional Education and Development Programme.

This interdisciplinary approach demonstrates how GIS can enrich learning across the sciences, social sciences, economics, and the humanities while fostering innovation, research excellence, and societal impact.

As governments, businesses, and research institutions increasingly adopt GIS, GeoAI, digital twins, and location intelligence, the demand for graduates with spatial thinking skills continues to grow rapidly. Universities have a crucial role to play in preparing this workforce by integrating GIS into mainstream and fostering a culture of using **GIS to Innovate. Integrate and Inspire.**

The Rise of GeoAI: Transforming India's Spatial Data into a Predictive Powerhouse

When Esri India was established in 1996, Geographic Information Systems were confined largely to government survey departments and a handful of academic institutions. The country's spatial data landscape consisted primarily of paper maps, topographic sheets, and the occasional digitized layer running on workstations. Early adoption came from natural resource and infrastructure sectors, where each deployment proved the value of GIS in decision-making. The early 2000s marked a turning point with the rise of internet-based GIS and greater access to satellite imagery through platforms like Bhuvan. The mobile revolution further accelerated adoption, enabling field workers to capture real-time geotagged data, making GIS more dynamic and accessible.

A major shift came in 2021 with the liberalization of India's geospatial policy, unlocking high-resolution data for wider use. GIS evolved into an enterprise platform, powering initiatives like Smart Cities, Digital India, SVAMITVA, and PM Gati Shakti by connecting infrastructure, data, and decision-making.

Today, GIS has entered a new phase with AI and digital twins. Advanced analytics can now derive insights from imagery in minutes, while digital twins create real-time, dynamic models of cities and infrastructure. Together, these innovations are transforming GIS into a powerful tool for predictive planning and smarter governance.

We are moving beyond the era of looking at what is on the ground to a phase where we can simulate, predict, and model the future.

Predictive Intelligence with GIS

At the heart of this transformation is **GeoAI** (GIS powered by AI). We are no longer just identifying patterns; we are building predictive models. In sectors like agriculture, GeoAI is helping us analyze soil moisture and weather patterns to advise farmers on crop management. In cities, it is increasingly shaping utilities and infrastructure planning by predicting demand, identifying risk-prone zones, and enabling smarter, data-driven development of critical infrastructure.

Furthermore, the integration of **Generative AI with GIS** is opening doors to advanced scenario simulation. Decision-makers can now ask "what if" questions: What happens to city traffic if we add a new flyover here? How will a sudden flood impact the local power grid? By combining large language models with spatial analytics, we are making complex data accessible and conversational, allowing for faster and more inclusive decision-making.

The Shift to 'Living' Digital Infrastructure

The shift from static mapping to dynamic modelling is perhaps most visible in the rapid transformation of India's urban landscape. Urban planning is evolving from traditional 2D master plans to multidimensional, data-driven simulations. One of the most exciting developments in this journey is the rise of GIS-enabled Living Digital Twins.

By integrating real-time data from multiple sources such as traffic systems, utility networks, surveillance feeds, environmental sensors, weather monitoring systems, and GPS-enabled public transport, Living Digital Twins are creating dynamic virtual models of cities. By continuously reflecting real-world conditions in a digital environment, these technological marvels are allowing city planners and administrators to analyse patterns, anticipate potential issues, and evaluate alternative planning scenarios.

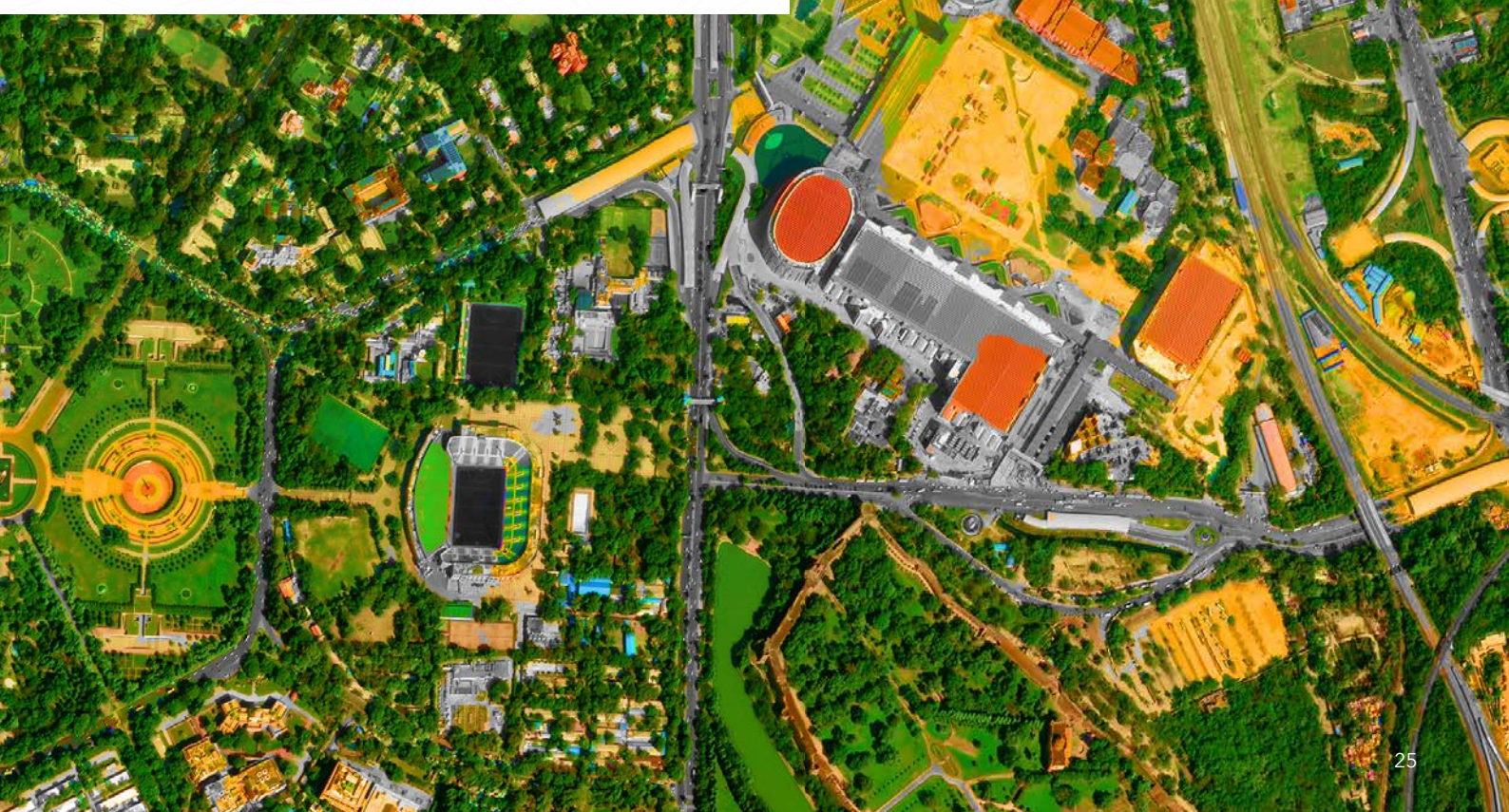
These dynamic models are also enabling more informed

and proactive decision-making in sustainable resource management, a critical area of concern today. For instance, researchers at the Indian Institute of Technology, Delhi are developing a digital twin of the Ganga River Basin that integrates satellite data, hydrological models, AI, and real-time sensors to simulate water flows and climate interactions. Such a model allows policymakers to test various scenarios related to floods, droughts, groundwater management, and long-term ecological sustainability, supporting more resilient and sustainable planning.

The possibilities are thus endless!

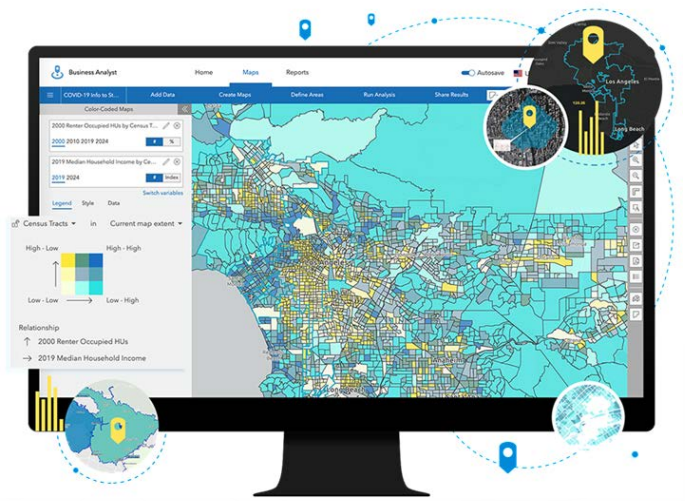
In Closing

Undoubtedly, we are now at the most consequential inflection point in India's GIS journey, where emerging technologies are redefining its scale, impact, and possibilities. We began with contour lines, simple representations of elevation on paper, and are now moving toward dynamic digital twins of river basins that respond to monsoon data in real time. The distance between those two points is not merely technological. It is the story of a country discovering, with growing confidence, that to understand India you must first understand its geography, and that to shape India's future, you must make that geography intelligent.



ArcGIS Business Analyst

Transforming Data into Smarter Business Decisions



ArcGIS Business Analyst is Esri's location-based market and community intelligence software that combines demographic, business, lifestyle, spending, and census data with map-based analytics for smart decision-making.

Available across desktop, web, and mobile platforms, ArcGIS Business Analyst leverages demographic mapping to help organizations detect underperforming markets, select optimal expansion sites, and visualize customer distribution.

Its powerful reporting tools allow you to transform complex data into professional infographics and interactive presentations for seamless organization-wide sharing.

Available on any device, anywhere, anytime, ArcGIS Business Analyst can be implemented into your current workflow as a web browser software as a service (SaaS) solution, on a desktop, or as part of your on-premises ArcGIS environment.

How ArcGIS Business Analyst works?

Step 1–Identify
Identify areas for analysis that are critical to your industry–from site selection for real estate to shelter locations for emergency response.

Step 2–Analyse
Analyse areas using Esri Demographics alongside your own data. Interpret the results in a spatial context, run analysis, and generate stunning maps.

Step 3–Share
Present your findings with informative maps, stunning infographics, and map-based stories that showcase your analysis.

Key Features and Benefits of Business Analyst

Site Selection and Market Planning: Evaluate market dynamics to inform expansion or consolidation strategies. The comprehensive toolkit offers consumer profiling, market potential modelling, and sales forecasting to guide your decisions. With advanced drive-time and trade-area analysis, it is convenient to conduct in-depth demographic research, optimize site selection for retail or facilities, and precisely define the ideal market.

Territory Design and Area Planning: Balance your network to help each location and territory manager succeed. Use automated workflows for territory design, location-allocation, and market penetration analyses. Locate your underperforming sites, predict how proposed locations will perform, and use multiple data sources to determine the best locations.

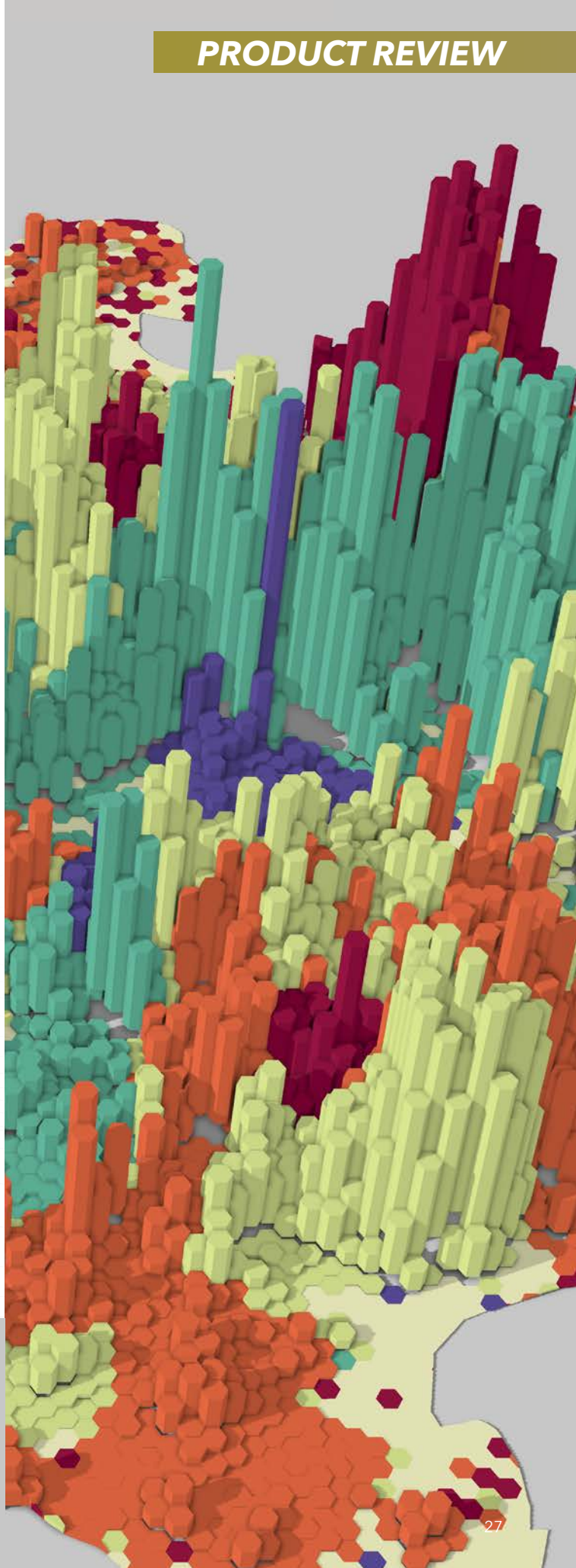
Customer Profiling: Understand new and potential customer preferences and needs so you know whom to target and how to attract them. Divide customers into targeted groups. Browse and use both demographic and census data including age, income, gender, family

size, and health history. Use lifestyle and behavioural data to learn what people prefer.

Data, Report, Infographics to Drive Decisions: Take a data-driven approach to validate your assumptions about location. Access global data for more than 170 countries with over 15,000 variables on market data. Combine proprietary data on locations and property costs with data about prospective customers, clients, or patients. Then, share your analysis as customizable infographics, reports, and presentations.

Collection of Location Analytic tool: Drive organizational strategy using a collection of desktop, web, and mobile apps and Esri's hosted data. From visualizing demographic data for an area of interest to performing advanced analysis like designing and optimizing trade areas, ArcGIS Business Analyst delivers a collection of tools for analysts, researchers, and GIS managers alike.

ArcGIS Business Analyst can be used by organizations of all sizes across a wide range of industries to drive location-based decision-making and business growth. It delivers significant value across **Retail, Banking and Financial Services, Healthcare Services, Real Estate, Government, and Architecture, Engineering,** and **Construction (AEC),** helping organizations gain deeper market understanding, optimize operations, improve planning, and make more informed strategic decisions. By integrating business, demographic, consumer, and geographic data into a single analytical environment, ArcGIS Business Analyst enables organizations to **innovate** strategies, **integrate** data-driven insights, and **inspire** better business decisions for sustainable growth.



GeoAI Updates in ArcGIS Pro 3.7

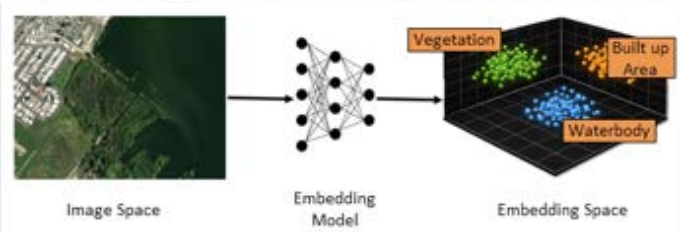
GeoAI integrates artificial intelligence (AI) with location intelligence to increase understanding and solve spatial problems. Within the ArcGIS ecosystem, ArcGIS Pro serves as Esri's desktop GIS platform for creating training data, training and deploying deep learning models, and operationalizing GeoAI workflows. The ArcGIS Pro 3.7 release introduced several new tools and enhancements to the GeoAI capabilities within the Image Analyst extension.

Embeddings-based analysis

ArcGIS Pro 3.7 expands the GeoAI toolbox with new embeddings workflows, enabling semantic analysis across text, imagery, and feature data. New tools include:

- Generate Embeddings Using AI Models
- Merge Embeddings
- Find Similar Features Using Embeddings
- Extract Embedding to Fields
- Predict Missing Values Using AI Models

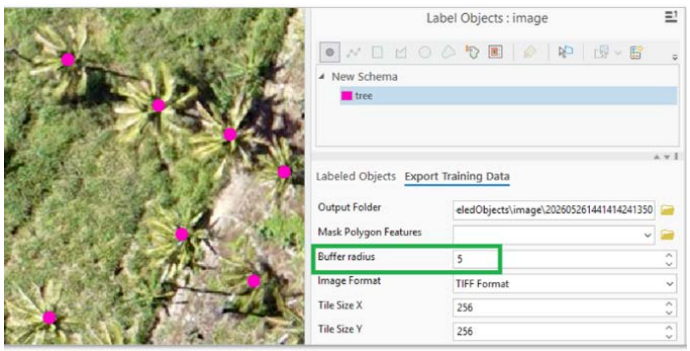
Analysis is performed in an embedding space where similar features are closer together and dissimilar ones are farther apart. Because the processes run on precomputed vectors, they are scalable, efficient, and run on standard CPUs.



Enhanced AI-Assisted Labeling

Improvements have been introduced to accelerate training data creation:

- The Label Objects for Deep Learning pane now includes new point and line drawing tools. The line tool simplifies the collection of linear features like road centerlines. By using the buffer setting during export, training masks can be automatically generated from these simplified geometries. This workflow significantly increases efficiency for features defined by a fixed-width buffer.



Tree locations captured with the point tool, using a buffer to export training chips

- The Text Prompt tool in the Label Objects for Deep Learning pane now supports multiclass labelling.

Multiclass text prompt tool simultaneously labeling trees and houses in a single pass within the Label Objects pane.

- Another enhancement is the Auto-detect Using Feature Class capability, which automatically generates segmentation boundaries from existing point datasets such as tree locations or building centroids.

Automatically converting a point feature class into accurate instance segmentation boundaries around vehicles.

These enhancements significantly reduce the effort required to create high-quality training datasets.

Native Video Labeling

ArcGIS Pro 3.7 now supports native video labeling, enabling users to collect training samples directly from video files. The software handles frame extraction internally, allowing you to label objects in individual frames, such as vehicles or infrastructure. This integration simplifies the workflow from raw video to model training.

Expanded Foundation Model Support

ArcGIS Pro 3.7 introduces support for the Dynamic One-For-All (DOFA) and TerraMind foundation-model backbones for remote sensing workflows. To improve compatibility with multispectral and hyperspectral imagery, a new wavelength model argument has been added. Although wavelength information is typically obtained from the model's Esri Model Definition (EMD) file, users can now supply wavelength values manually when needed to ensure accurate interpretation of spectral bands.

Translate Pixels Using Deep Learning

A new geoprocessing tool called Translate Pixels Using Deep Learning has been introduced. This tool supports image-to-image translation workflows for tasks such as super-resolution, colorizing grayscale imagery, and transforming RGB images into topographic maps.

Improved Inferencing Performance

ArcGIS Pro 3.7 includes performance enhancements for large-scale inferencing workflows, helping organizations process imagery more efficiently and operationalize GeoAI at scale. Specifically, the Detect Objects Using Deep Learning tool now delivers significant performance gains when processing image collections in a folder-based workflow.

Conclusion

ArcGIS Pro 3.7 advances GeoAI capabilities with new embeddings-based analysis tools, enhanced AI-assisted labeling workflows, native video labeling, expanded foundation model support, the new Translate Pixels Using Deep Learning capability, and optimized inferencing performance. Together, these enhancements make it easier for organizations to create training data, leverage modern AI models, analyze spatial information more efficiently, and scale GeoAI workflows across a broader range of geospatial applications.

How to Maximize Your ArcGIS Survey 123 Experience

ArcGIS Survey123 is much more than a digital form builder. By using its advanced capabilities, you can improve data quality, reduce user errors, and speed up field data collection.

Tip 1: Make your survey intelligent with skip logic

Including unnecessary questions in a form can make data collection slower, increase confusion, and lead to incorrect or incomplete responses. By using relevant expressions (skip logic), you can display questions only when they apply based on previous answers. This creates a more dynamic form where users see only the questions that are relevant to their responses.

Tip 2: Help save time using default values

Many surveys require the same information to be entered repeatedly. Examples include today's date, department, organization, project location. Instead of asking users to manually enter these details every time, Survey123 can automatically populate them using default values. So, this can immediately focus on recording inspection details rather than filling in repetitive information.

Tip 3: Use dynamic choice lists instead of static lists

Many organizations maintain changing lists of assets, employees, projects, villages, or equipment. If these lists are added directly into a survey, every update requires republishing the survey, which can become difficult to maintain. Survey123 supports dynamic choice lists, allowing dropdown values to be populated directly from a hosted feature layer or table. The form can intelligently display only the records that are relevant based on attributes, location, or distance.

Tip 4: Improve data quality with validation rules

Incorrect data entered in the field often leads to additional work and delays in analysis. Survey123 enables you to apply constraints (validation rules) that verify user input before the survey is submitted, which benefits to prevent invalid records, improves data accuracy, minimizes the post processing works and manual corrections.

Tip 5: Survey123 webhooks can trigger instant actions

Webhooks in ArcGIS Survey123 enable automatic communication between Survey123 and other applications or systems whenever a specific event occurs, such as the submission of a survey, using HTTP POST requests to pass callbacks between them. Instead of manually checking for new data, a webhook instantly sends a notification email, appending the survey content to a spreadsheet, and sending an alert. Webhooks reduce manual processes by automating actions based on survey submissions.

Tip 6: Build one survey for multiple languages

Configure your survey to display questions in different languages based on user preference. Including one or multiple sets of translations for surveys allows both data collectors and respondents to understand survey questions.

Tip 7: Collect multiple records in a single survey

An XLS Form can repeat a group of questions multiple times, which allows you to capture multiple related records within a single survey. For instance, instead of creating separate survey entries for each item such as the name, age, and gender of every person in a household, Repeat Groups enable users to add multiple instances of the same set of questions dynamically.

Tip 8: Barcode and QR code scanning

Manual entry of asset IDs, serial numbers, or equipment codes can be time-consuming and prone to typing errors. Survey123 supports barcode and QR code scanning, allowing users to capture information directly using the device's camera. This not only speeds up data collection but also improves the accuracy of asset identification.

Why ArcGIS in hydrometeorological services? For easy and quick solution

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Abstract

"Necessity is the mother of Invention". Here necessity is to incorporate the rain gauge stations with different administrative boundaries like State, Met-subdivision (36), District (738), Blocks (5961) and river basin and sub-basins (162) in the Hydro-meteorological services. India Meteorological Department (IMD) has 6372 rain gauge stations throughout India. IMD has to prepare the rainfall statistics, maps, charts etc. in different spatial mentioned above and temporal (Daily, Weekly, Monthly, Seasonal and annual) domains and disseminate to different Ministries, Prime Minister Office, Cabinet Secretariat, NITI Ayog and different insurance companies. Many Academic, Insurance and Banking institutions are also downloading these statistics and maps from the IMD website.

The purpose of this paper is to present how to overcome the problems of overshoots and undershoots of Districts and Blocks by using ArcGIS platform and get a good solution for the preparation of station level data by incorporating all the Block, Districts, Met-Sub-Divisions, States, Homogeneous Region, River Basins and sub-basins data. It will be very useful for GIS Analysts for preparing different spatial and temporal scale analysis.

Introduction

India Meteorological Department (IMD) is the nodal agency for preparing the rainfall statistics, maps, charts etc. in different spatial (District, Met-subdivision, State, Homogeneous Region and country) and temporal (Daily, Weekly, Monthly, Seasonal and Annual) domains and disseminate to the different ministries, Cabinet Secretariat, Neeti Ayog and different insurance companies. Many Academic, Insurance and Banking institutions are also using these data on a day to day basis. Different methods like Arithmetic Mean, Thiessen Polygon, Isohyetal and Isopercental are there for calculating the point rainfall to average areal rainfall. IMD is using the Arithmetic mean for calculating the rainfall statistics and maps by using ArcGIS. IMD is preparing the rainfall statistics for the 738 districts, 36 Met sub-divisions, 36 states & Union territories (UTs), four homogeneous regions and the country as whole by using these 6372 station level rainfall data.

For spatial analysis over river sub-basins and district level during heavy rainfall events over India, Isohyetal technique is used. For the Design Storm Analysis, over any catchment for construction of dams, reservoir, barrage, station level rainfall data is the main input. For getting better results, station level correct Latitude and Longitude is required. In the station level data, information for the Blocks, Districts, Sub-basins, States, Met-subdivisions are to be incorporated. To complete this job, Geographical Information System (ArcGIS) is used for easy and quick solution.

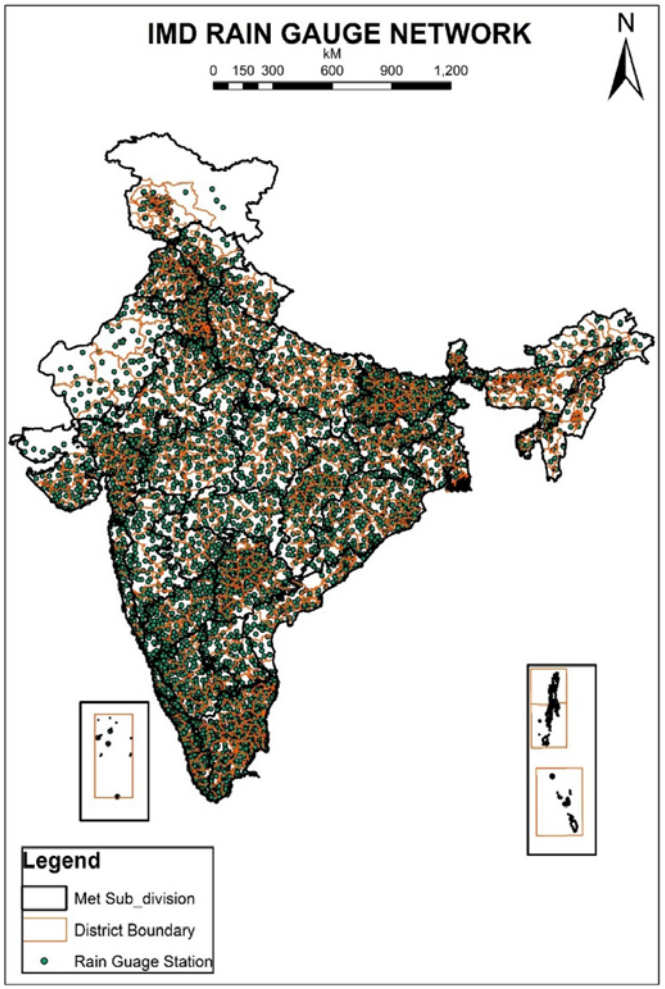

Fig 1: Rain Gauge Network of IMD

District level shape files have the information of the States, Met-subdivisions and Homogeneous Regions like East-North-East Region, North-West Region, Central Region and Southern Peninsular Region (Table-2). Only single information 'Name of the Blocks' (Table-1 Only for one district is shown) is available in the Block Shape files. There were undershoots and overshoots of block Shape files with the district Shape files file (Figure-1). There was no problem if there were no undershoots and overshoots of the block level Shape files with district Shape files. The aim of this work is to integrate information about the Block name, District name and sub-basin names with the station rain gauge data. It is the Necessity.

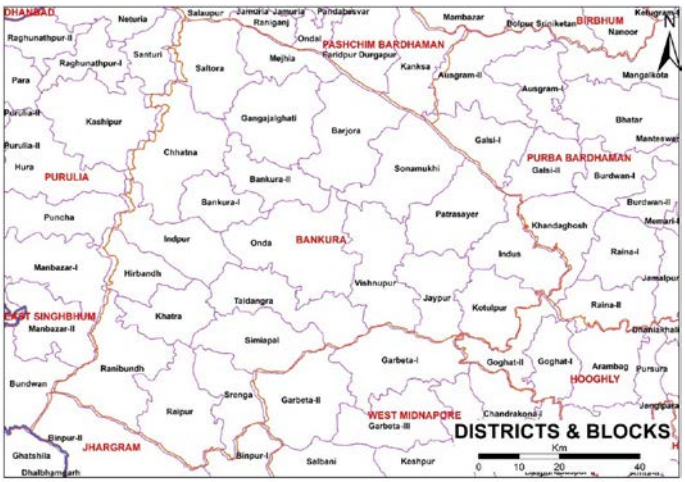

Fig 2: Undershoots & Overshoots of the Shape Files

Data and Methodology

Hydromet Division, IMD has 6372 rain gauge station network. Rainfall data of these stations are collected from different Meteorological Centers (MCs) through emails. IMD has 22 Met Centres (MC) under 6 Regional Meteorological Centers (RMCs) namely Delhi, Mumbai, Kolkata, Chennai, Guwahati, and Nagpur. For the preparation of district level rainfall statistics, Hydromet division is using Shape files of 738 districts. IMD has collected the State, District and Block level Shape files from Survey of India (SoI). River sub-basins Shape files have been collected from Central Water Commission which are used to give Quantitative Precipitation Forecast (QPF) and Hydromet bulletin for 162 River sub-basins with 7 days lead time. IMD has corrected the Latitude, Longitude of the rainfall stations by plotting the data using ArcGIS platform.

FID	Shape	Block
584	Polygon	Patrasayer
781	Polygon	Sonamukhi
782	Polygon	Indpur
783	Polygon	Hirbandh
784	Polygon	Raipur
785	Polygon	Ranibundh
786	Polygon	Srenga
787	Polygon	Khatra
3148	Polygon	Indus
3149	Polygon	Jaypur
3150	Polygon	Kotulpur

Table 1: Attribute in Block Shape Files

FID		Shape	Block
4354		Polygon	Saltora
4355		Polygon	Mejhia
4356		Polygon	Barjora
4357		Polygon	Chhatna
4358		Polygon	Bankura-I
4365		Polygon	Bankura-II
4377		Polygon	Gangajalghati
4378		Polygon	Simiapal
4379		Polygon	Taldangra
4380		Polygon	Onda
4381		Polygon	Vishnupur

Table 1: Attribute in Block Shape Files

Shape	Region	Met subdivision	States	District	District Code	RMC_MC
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	PURBA BARDHAMAN	20411003	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BIRBHUM	20411002	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	HOOGHLY	20411005	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	20411001	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	HOWRAH	20411006	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	EAST MIDNAPORE	20411004	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	WEST MIDNAPORE	20411013	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	PURULIA	20411011	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	MURSHIDABAD	20411008	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	NORTH 24 PARGANAS	20411010	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	NADIA	20411009	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	SOUTH 24 PARGANAS	20411012	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	KOLKATA	20411007	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	PASHCHIM BARDHAMAN	20411015	RMC KOLKATA
Polygon	EAST AND NORTHEAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	JHARGRAM	20411014	RMC KOLKATA

Table 2: Attribute in District Shape Files

Step 1: We have to insert all the attribute available in the district Shape files within the block level Shape files. If there are no undershoots and overshoots in the block and district Shape files, then it is very easy to collect the information available in District Shape files to the Block level Shape files.

In the block level data, there are only Block names, no common field is there. So, it is not possible to link the block level Shape file with district level information. Applying spatial join with block level Shape files to the district Shape files using **System Toolboxes → Analysis Tools → Overlay → Spatial Join** (Fig-3) (Match Option: completely within).

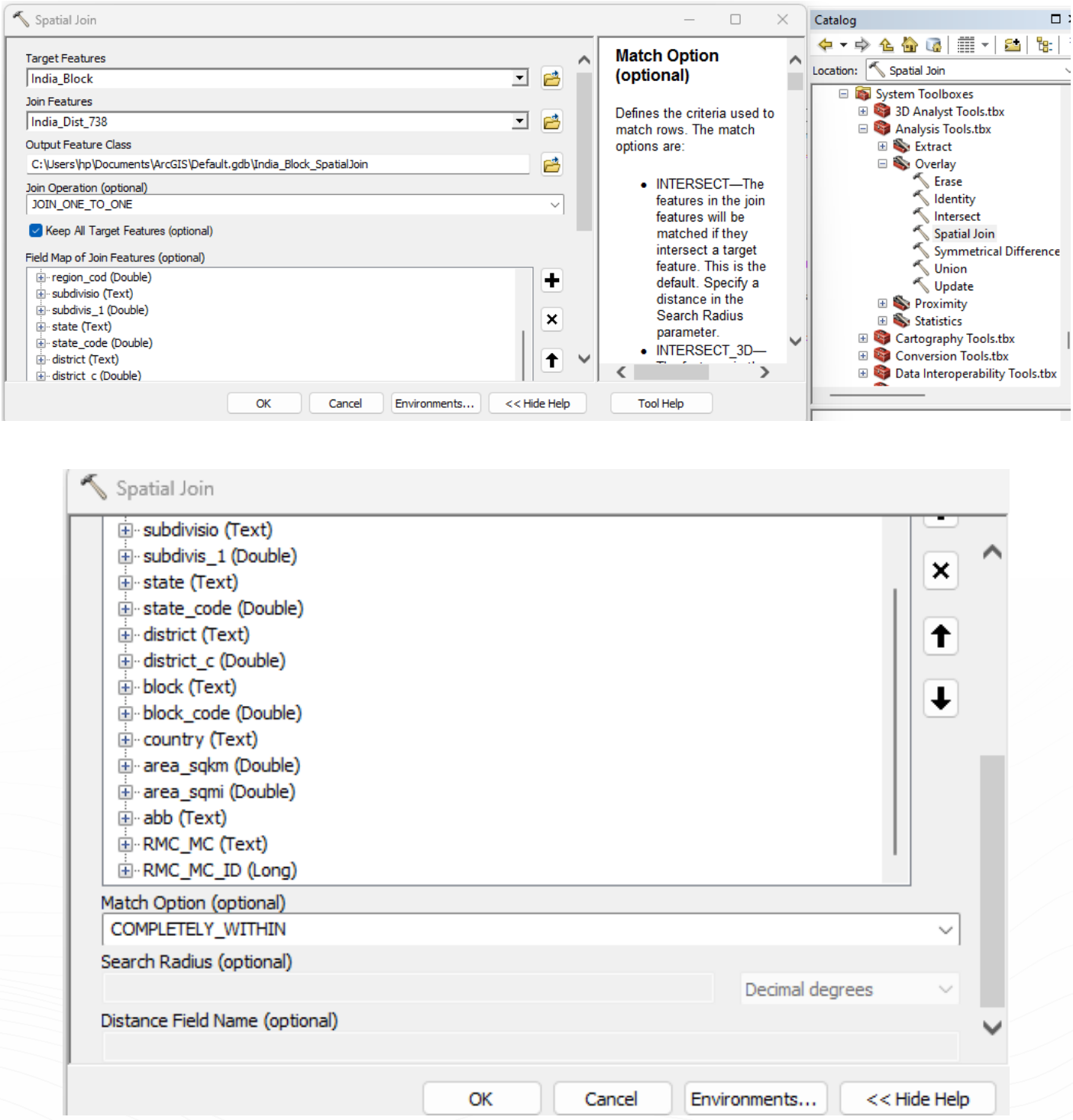

Fig 3: Spatial Join of Block Shape Files with District

After spatial join, many of the blocks are not joined with the correct district as they are not completely within the district polygon. Many of the blocks have taken null (Highlighted in green) or the district name adjacent to that district (Lying less percentage area) which is reflected in the logical column of the Table-3.

Block Name	Region	Subdivision	State	District	RMC_MC
Patrasayer	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Sonamukhi	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Indpur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Hirbandh					
Raipur					
Ranibundh	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	PURULIA	RMC KOLKATA
Srenga					
Khatra	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Indus	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	PURBA BARDHAMAN	RMC KOLKATA
Jaypur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Kotulpur					
Saltora	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Mejhia	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	PASHCHIM BARDHAMAN	RMC KOLKATA
Barjora					
Chhatna	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Bankura-I	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Bankura-II					
Gangajalghati	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Simiapal	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Taldangra	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Onda					
Vishnupur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA

Table 3: Attribute in Block Shape Wrongly Joined with District Shape Files

To rectify the district information in block shape file we have to place the **centroid** by using Feature to Point by using **System Tool boxes → Data Management tool → Features → Features to Point** in ArcGIS Tool box.

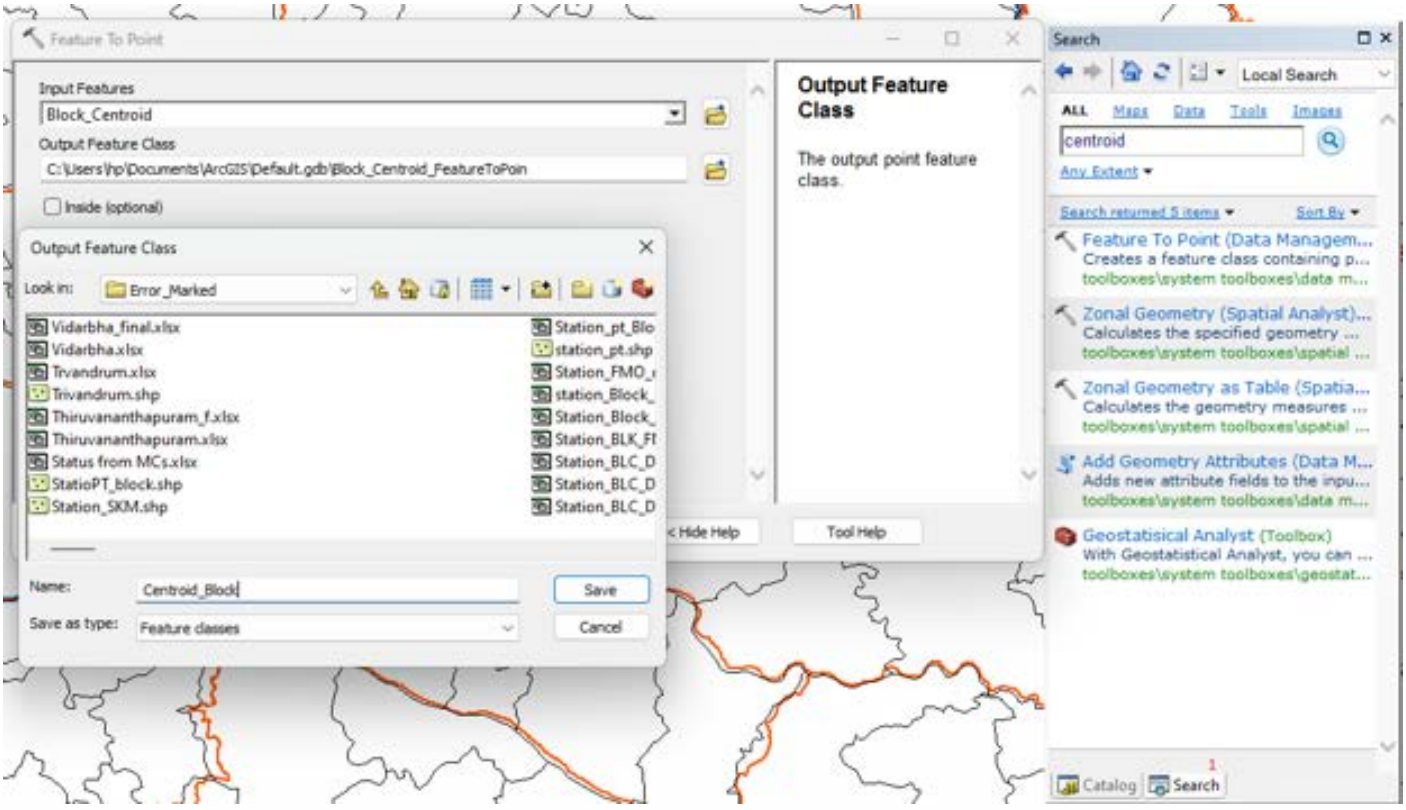

Fig 4: Placing Centroid of the Block Shape Files

After running this function, centroid point of the block Shape files placed inside the block area and a new feature class (Centroid Block) is created. The attribute data available with block Shape file has been transported to the centroid points (Shape files). Now, we applied the **spatial join** again with the Centroid point to the District Shape files (Fig 5).

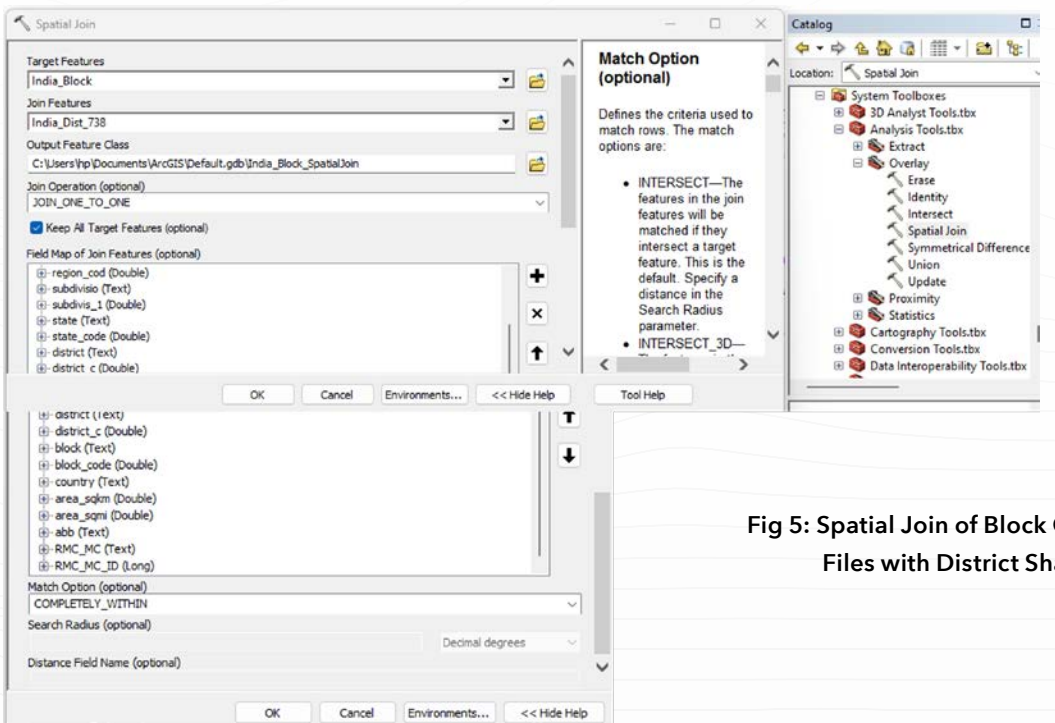

Fig 5: Spatial Join of Block Centroid Shape Files with District Shape Files

Block Name	Region	Subdivision	State	District	RMC_MC
Patrasayer	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Sonamukhi	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Indpur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Hirbandh	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Raipur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Ranibundh	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Srenga	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Khatra	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Indus	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Jaypur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Kotulpur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Saltora	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Mejhia	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Barjora	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Chhatna	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Bankura-I	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Bankura-II	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Gangajalghati	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Simiapal	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Taldangra	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Onda	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA
Vishnupur	EAST AND NORTH EAST INDIA	GANGETIC WEST BENGAL	WEST BENGAL	BANKURA	RMC KOLKATA

Table 4: Attribute of Block Shape Correctly Joined with District Shape Files Attribute

Now the attribute of the District Shape files is linked/ attached with all the Block centroid files (Here results of a district has been shown in Table 4). This attribute table is to be exported in the Excel file which is to be linked later with the original block Shape files by **<Selecting the shape file>→'Right click'→ Joins and Relates→ Join** with the common field 'Block Name'. Now District, Met sub-divisions, States information for all 5972 blocks are filled in the attribute table.

FID	BLOCK	SUB_ DISTRICT	Region	Sub divsion	Sub division Code	State	State code	District	District Code	RMC_ MC	Logical
584	Patrasayer	Patrasayer	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
781	Sonamukhi	Sonamukhi	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
782	Indpur	Indpur	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
783	Hirbandh	Hirbandh	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
784	Raipur	Raipur	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
785	Ranibundh	Ranibundh	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
786	Srenga	Srenga	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
787	Khatra	Khatra	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
3148	Indus	Indus	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
3149	Jaypur	Jaypur	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
3150	Kotulpur	Kotulpur	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4354	Saltora	Saltora	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4355	Mejhia	Mejhia	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4356	Barjora	Barjora	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4357	Chhatna	Chhatna	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4358	Bankura-I	Bankura-I	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4365	Bankura-II	Bankura-II	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4377	Gangajalghati	Gangajalghati	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4378	Simiapal	Simiapal	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4379	Taldangra	Taldangra	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4380	Onda	Onda	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True
4381	Vishnupur	Vishnupur	EAST AND NORTH EAST INDIA	GANGEIC WEST BENGAL	204	WEST BENGAL	20411	BANKURA	20411001	RMC KOLKATA	True

Table 5: Attribute of Block Centroids (Column 2 & 3) are Same as the Block Shape Files

Now, there are the 6745 point features for the rain gauge stations which contain the attribute of Lat/Long, District, Met-subdivisions, States, Homogeneous Regions except Block level information. We have to link the block level information to the station data. Now, we apply again the **spatial join** of the station data with the block Shape files (Fig-6). Here few stations lying in actual district may come to the other block which is not under that district. After applying the spatial join only **143 stations** out of **6745 stations** whose districts are not matching (Shown in Table 6) with the districts reflected in the Block Shape files. Manually we corrected the districts names of these stations.

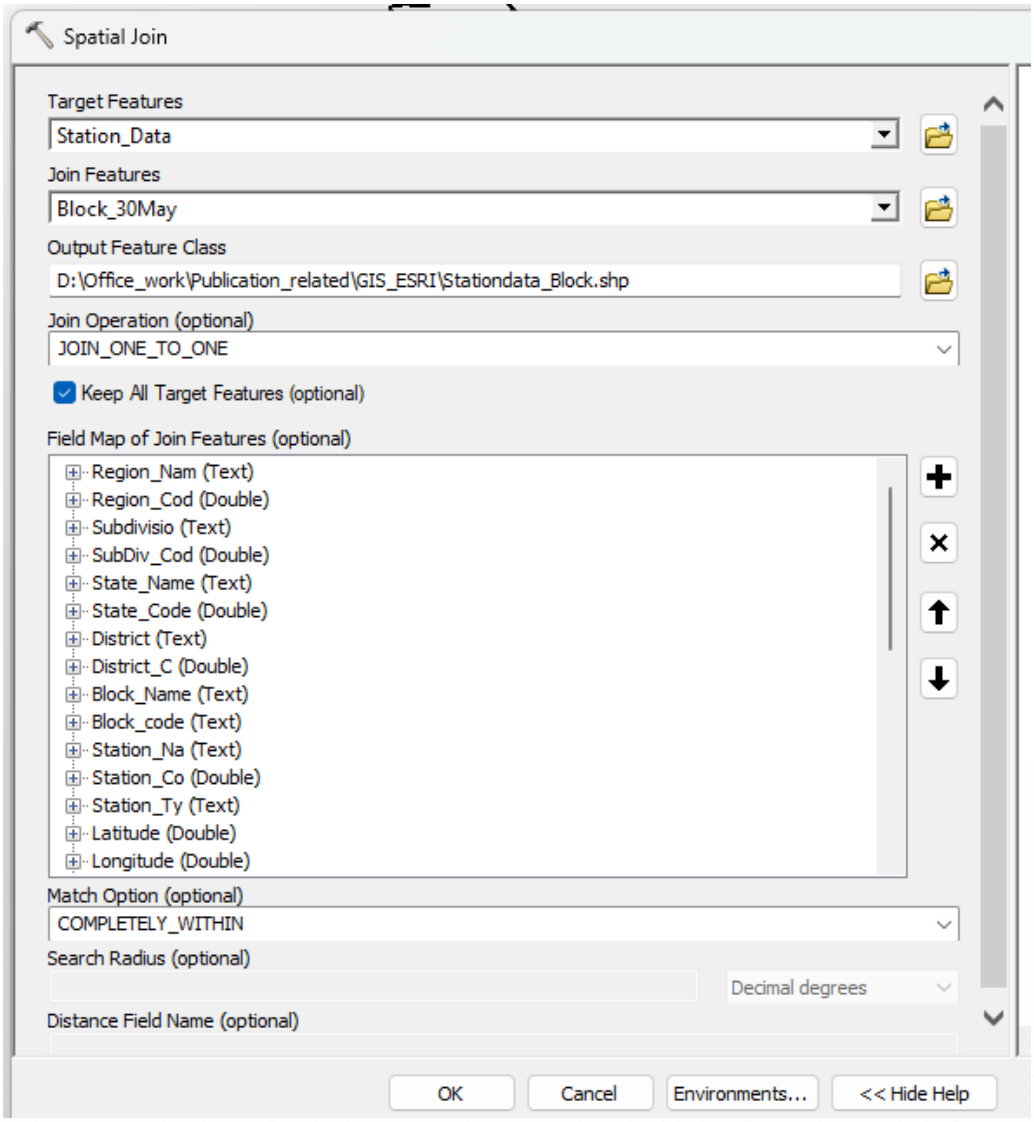

Fig 6: Spatial Join of Station Shape Files with Block Shape Files

Region_Nam	Subdivisio	State_Name	District	Station_Na	Station_Ty	Latitude	Longitude	district_1	block_Na_1	Dist_Logical
CENTRAL INDIA	CHHATTISGARH	CHHATTISGARH	KORIYA	PONDI BACHRA	ORG	23.04	82.49	MANENDRAGARH-BHARATPUR	Khadgawan	FALSE
CENTRAL INDIA	CHHATTISGARH	CHHATTISGARH	SUKMA	TONGPAAL	ORG	18.75	81.79	BASTAR	Darbha	FALSE
CENTRAL INDIA	GUJARAT REGION	GUJARAT	MAHISAGAR	WANAKBORI	ORG	22.9478	73.4193	KHEDA	Thasra	FALSE
CENTRAL INDIA	KONKAN & GOA	MAHARASHTRA	SINDHUDURG	DODAMARG	ORG	15.68306	73.96694	NORTH GOA	Dicholi	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	AKOLE	ORG	19.53833	74.00444	AHMEDNAGAR	Akola	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	JAMKHED	ORG	18.73694	75.31389	AHMEDNAGAR	Jamkhed	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	KOPARGAON	ORG	19.87861	74.47944	AHMEDNAGAR	Kopargaon	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	AHMEDNAGAR - IMD PT	ORG	19.08694	74.80583	AHMEDNAGAR	Nagar	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	CHAS_AGRI	ORG	19.03556	74.65056	AHMEDNAGAR	Nagar	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	KARJAT	ORG	19.55361	75.00889	AHMEDNAGAR	Nevasa	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	NEVASA	ORG	19.5525	74.92972	AHMEDNAGAR	Nevasa	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	PARNER	ORG	19.0025	74.43472	AHMEDNAGAR	Parner	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	PATHARDI	ORG	19.1775	75.17056	AHMEDNAGAR	Pathardi	FALSE

CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	RAHATA	ORG	19.70806	74.48167	AHMEDNAGAR	Rahta	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	SAVLIVIHIR_AGRI	ORG	19.8022	74.4711	AHMEDNAGAR	Rahta	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	SHIRDI AWS	ORG	19.76139	74.45444	AHMEDNAGAR	Rahta	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	RAHURI	ORG	19.39222	74.65056	AHMEDNAGAR	Rahuri	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	SANGAMNER	ORG	19.57028	74.20306	AHMEDNAGAR	Sangamner	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	SHEVGAON	ORG	19.35028	75.21917	AHMEDNAGAR	Shevgaon	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	SHRIGONDA	ORG	18.62111	74.71167	AHMEDNAGAR	Shrigonda	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	AHILYANAGAR	SHRIRAMPUR	ORG	19.62444	74.66167	AHMEDNAGAR	Thrirampur	FALSE
CENTRAL INDIA	MADHYA MAHARASHTRA	MAHARASHTRA	NANDURBAR	AKKALKUWA	ORG	21.55333	74.13333	TAPI	Nizar	FALSE
CENTRAL INDIA	ODISHA	ODISHA	BHADRAK	BONTH	ORG	21.12	86.31	KEONJHARGARH	Nandipada	FALSE
CENTRAL INDIA	ODISHA	ODISHA	BOUDH	HARABHANGA	ORG	20.63	84.62	ANGUL	Athmallik	FALSE
CENTRAL INDIA	ODISHA	ODISHA	DEOGARH	BARKOTE	ORG	21.33	85.01	ANGUL	Palalahada	FALSE
CENTRAL INDIA	ODISHA	ODISHA	JHARSUGUDA	KOLABIRA ARG	ARG	21.8	84.16667	SAMBALPUR	Kolabira	FALSE
CENTRAL INDIA	ODISHA	ODISHA	KEONJHARGARH	CHAMPUA	ORG	22.065	85.666	WEST SINGHBHUM	Jagannathpur	FALSE
CENTRAL INDIA	SAURASHTRA & KUTCH	GUJARAT	AMRELI	VADIA	ORG	21.6876	70.8132	RAJKOT	Jetpur	FALSE
CENTRAL INDIA	SAURASHTRA & KUTCH	GUJARAT	BHAVNAGAR	JESAR	ORG	21.36667	71.66667	AMRELI	Savar kundla	FALSE
CENTRAL INDIA	SAURASHTRA & KUTCH	GUJARAT	BOTAD	GADHDA	ORG	21.96667	71.4	AMRELI	Babra	FALSE
CENTRAL INDIA	SAURASHTRA & KUTCH	GUJARAT	SURENDRANAGAR	KHARAGHODA	ORG	23.16667	71.71667	KUTCH	Unknown	FALSE
CENTRAL INDIA	WEST MADHYA PRADESH	MADHYA PRADESH	DATIA	BHANDER	ORG	25.73333	78.75	JHANSI	Moth	FALSE

Table 6: District Name of the Stations that are Not Matching with the District of Block Shape File (32 out of 143 are shown)

Now we have to update the information of the River basin and sub-basins in the point i.e. station rain gauge data. Again, we have applied the spatial join to the station Shape files with the river sub-basin Shape files. In the output files all the stations are updated which are lying within the river sub-basins.

Region_Nam	Subdivision	Unique Stn Code	State Name	District Name	Block Name	Station Name	Station Type	Latitude	Longitude	RMC_MC	FMO	BASIN	SUB_BASIN
CENTRAL INDIA	CHHATTISGARH	101CHH0001	CHHATTISGARH	BALOD	Dohdiluhara	MARRI BANGLA DEORI	ORG	20.91	81.05	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0002	CHHATTISGARH	BALOD	Dondi	DOUNDI	ORG	20.61667	81.05	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0003	CHHATTISGARH	BALOD	Gunderdchi	ARJUNDA	ORG	20.95	81.2	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0004	CHHATTISGARH	BALOD	Gunderdchi	DONDILOHARA	ORG	21	81.33333	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0005	CHHATTISGARH	BALOD	Gunderdchi	GUNDARDEHI	ORG	20.95	81.28333	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0006	CHHATTISGARH	BALOD	Gurur	GURUR	ORG	20.68333	81.4	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0007	CHHATTISGARH	BALOD	Sanjaribad	BALOD	ORG	20.729	81.2044	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0008	CHHATTISGARH	BALODA BAZAR	Baloda_Bazar	BALODA BAZAR	ORG	21.66667	82.16667	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0009	CHHATTISGARH	BALODA BAZAR	Baloda_Bazar	LAWAN	ORG	21.64	82.34	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0010	CHHATTISGARH	BALODA BAZAR	Bhatapara	BHATAPARA	ORG	21.73333	81.95	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0011	CHHATTISGARH	BALODA BAZAR	Kasdol	GIDHORI TUNDRA	ORG	21.68	82.61	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0012	CHHATTISGARH	BALODA BAZAR	Kasdol	KASHDOL	ORG	21.61667	82.43333	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0013	CHHATTISGARH	BALODA BAZAR	Kasdol	SONAKHAN	ORG	21.51	82.55	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0014	CHHATTISGARH	BALODA BAZAR	Palari	PALLARI/PALARI	ORG	21.53333	82.16667	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0015	CHHATTISGARH	BALODA BAZAR	Simga	SIMGA	ORG	21.63333	81.7	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0016	CHHATTISGARH	BALODA BAZAR	Simga	SUHELA	ORG	21.61	81.97	MC RAIPUR	Bhubaneshwar	Mahanadi	Upper Mahanadi
CENTRAL INDIA	CHHATTISGARH	101CHH0017	CHHATTISGARH	BALRAMPUR	Balrampur	BALRAMPUR	ORG	23.6	83.61667	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0018	CHHATTISGARH	BALRAMPUR	Balrampur	DOURA KOCHALI	ORG	23.52	83.46	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0019	CHHATTISGARH	BALRAMPUR	Rajpur	RAJPUR	ORG	23.3	83.41667	MC RAIPUR	Patna	Ganga	Upper Sone
CENTRAL INDIA	CHHATTISGARH	101CHH0020	CHHATTISGARH	BALRAMPUR	Ramanujganji	RAMANUJGANJ	ORG	23.8	83.7	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0021	CHHATTISGARH	BALRAMPUR	Ramanujganji	RAMCHANDRAPUR	ORG	23.93	83.49	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0022	CHHATTISGARH	BALRAMPUR	Samari	CHANDO	ORG	23.54	83.83	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0023	CHHATTISGARH	BALRAMPUR	Samari	KUSMI	ORG	23.3	83.88333	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0024	CHHATTISGARH	BALRAMPUR	Samari	SAMARI	ORG	23.41	83.93	MC RAIPUR	Patna	Ganga	Kanhar
CENTRAL INDIA	CHHATTISGARH	101CHH0025	CHHATTISGARH	BALRAMPUR	Shankargarh	SHANKARGARH	ORG	23.3	83.6	MC RAIPUR	Patna	Ganga	Upper Sone
CENTRAL INDIA	CHHATTISGARH	101CHH0026	CHHATTISGARH	BALRAMPUR	Wadrafinagar	CHALGALI	ORG	23.6	83.36	MC RAIPUR	Patna	Ganga	Upper Sone
CENTRAL INDIA	CHHATTISGARH	101CHH0027	CHHATTISGARH	BALRAMPUR	Wadrafinagar	RAGHUNATH NAGAR	ORG	23.83	82.93	MC RAIPUR	Patna	Ganga	Upper Sone
CENTRAL INDIA	CHHATTISGARH	101CHH0028	CHHATTISGARH	BALRAMPUR	Wadrafinagar	WANDRAFNAGAR	ORG	23.75	83.2	MC RAIPUR	Patna	Ganga	Upper Sone
CENTRAL INDIA	CHHATTISGARH	101CHH0029	CHHATTISGARH	BASTAR	Bakaband	KARPAWAND	ORG	19.38	82.08	MC RAIPUR	Hyderabad	Godavari	Indravati
CENTRAL INDIA	CHHATTISGARH	101CHH0030	CHHATTISGARH	BASTAR	Bastanar	BASTANAR	ORG	18.96667	81.55	MC RAIPUR	Hyderabad	Godavari	Indravati

Table 7: Stations Data with Blocks, District, River Baisns/Sub-basins (30 out of 6372 are shown)

Conclusion

At the end of the process, we have added the attribute (District, Met sub-division, Homogeneous Region, RMC/MC etc.) to the block level Shape files. Secondly, in station level rain gauge data, we have added correct information of the Blocks in which it is lying. Finally, the information available in the river Basins/sub-basins Shape files is also incorporated in the station level data which is a big achievement.

By using ArcGIS, we can easily solve the problems of overshoots an undershoots of the block Shape files and district Shape files information in the station level data. Now, these stations data may be used for the preparation of rainfall statistics by using arithmetic mean method for the block level and river sub-basin level for the daily, weekly, monthly, seasonal and annual basis and specified period also.

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GLOBAL CUSTOMER SUCCESS STORY

Redrawn: How Baltimore Police Department Used Data to Rethink Territory and Officer Workloads

For roughly half a century, the boundaries defining Baltimore's nine police districts remained the same while the city around them shifted. Some districts fielded hundreds of calls for service every day while neighboring ones were quieter. The map hadn't kept up. And when a map is wrong, the consequences are operational. If a 911 call for a shooting drops on the wrong side of a boundary, the nearest officer may not be the one who responds. In 2023, a correction to those district lines set a digital transformation in motion that now reaches from the chief's office to the patrol car.

Data drove every level of it–from the analysts proposing new boundaries to the officer walking the block to confirm them.

Baltimore Police Department built an enterprise GIS that turned district boundaries, patrol beats, and crime patterns into a shared language.

Key Takeaways

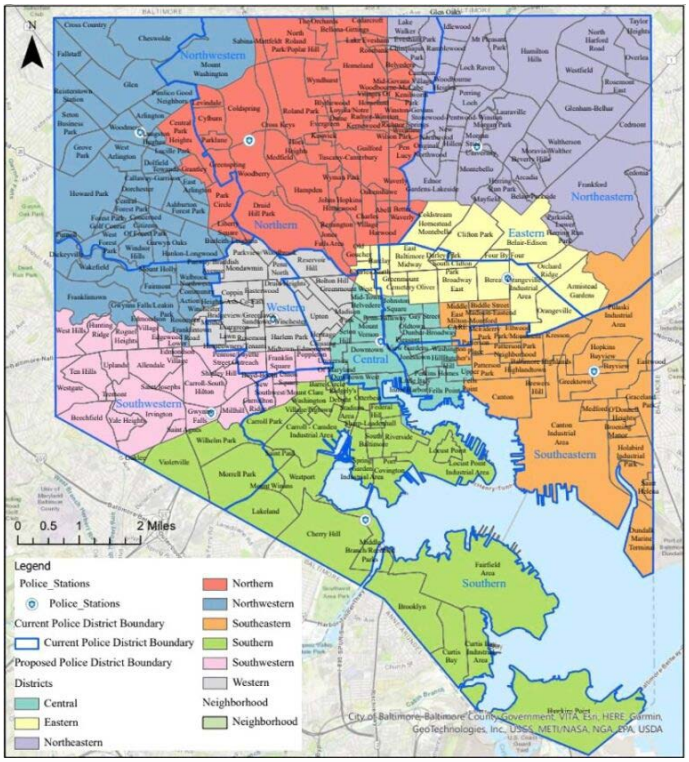
- Baltimore Police Department spent months analyzing call volume, drive times, and demographic data before redrawing district boundaries.
- GIS analysts went to all stakeholders to show proposed lines and the data behind them.
- Detectives, patrol officers, and commanders now work from the same operational map.

The Science Behind the Lines

Derek Canton, chief technology officer with the Baltimore Police Department (BPD), had a standard for deployment. "We used science to determine what would be best for our agency," he said, "not just cops on dots, but people who are able to respond in a reasonable time." The old district boundaries had no systematic measure of workload behind them. Some districts carried significantly more calls than others. Getting the balance right meant building a solution the data could defend.

The push came from multiple directions: active federal court oversight, the operational demands of a city where every patrol assignment carries real stakes, and the belief that better data should determine where officers go. "Redistricting kind of forced our hand," Canton said, "to make sure we had resources where resources needed to be."

The effort fell to Rajiv Sharma, geographic information system (GIS) manager for the information technology division. When Sharma joined the department nearly a decade earlier, he and Canton built an enterprise GIS from a standing start. The redistricting would be its most demanding test: data driving the new lines and everyone—from commissioners to council members, from patrol cops to residents—discussing the same maps.



Baltimore's nine redrawn police districts are color-coded by name. Blue lines mark the previous boundaries, showing where neighborhoods shifted from one district to another following the 2023 redistricting.

Drawing the New Lines

Baltimore police analyzed more than 200,000 crime records and five years of call data before a line was moved on the map. Working with Esri's territory design tools in ArcGIS Business Analyst, Sharma built the solution around fixed anchors: police stations and hospitals, seeds from which new boundaries grew outward. Into that framework the team fed call volume, unit counts, drive-time approximations, and 2020 census data tracking population shifts across Baltimore's 278 neighborhoods. From there Sharma's team ran scenarios, weighed tradeoffs—drive time against crime volume, workload against district size—and adjusted until the boundaries held up on every axis.

Sharma took the analysis to post officers and cops on the beat—people with years on specific blocks whose knowledge the data couldn't capture. Their input surfaced complications buried in the geography for decades.

ArcGIS Business Analyst displays projected workload by district as analysts ran redistricting scenarios. The bar chart reveals call volumes across all nine districts to balance workloads with the new boundaries.

Old boundaries had accumulated anomalies, some cutting directly through properties. "Mr. and Mrs. Smith's bed was cut in half," Sharma said. "If Mrs. Smith called the police, one post would respond. If Mr. Smith's side had a problem, he would get a different post." The same problem scaled to a major trucking facility whose front entrance fell within one district and loading docks in another.

Resolving each anomaly meant going segment by segment, with one governing rule: Every district boundary follows the same side of every road centerline. No street would divide two districts.

The department's geocoder also had to be aligned with the new district geometry, synchronized with computer-aided dispatch, and coordinated with fire and emergency medical services (EMS)—so that every first responder arrives at the same address. When the geocoder is wrong, a shooting at a busy intersection drops on the wrong side of the line. "If the point drops on the other side, you're calling for the wrong people to go to the wrong place," Sharma said. Getting the address right meant aligning the 911 call, the patrol response, and the incident record from the moment someone picked up the phone.

Refinements followed: gaps closed, community concerns were addressed, including a mall and a neighborhood on York Road bisected by the first version. In January 2025, Commissioner Richard Worley approved restructured sectors within each district, improving digital recordkeeping and sharpening supervisory coverage.

What the Map Changed

Workload balanced across all nine districts. The redistricting also created space for communication. Officers assigned to new territory learned it from colleagues who'd worked it for years. Commanders from adjacent districts sat down and shared what they knew.

"There was greater opportunity for communication," Canton said. "Commanders were able to have a discussion about who, what, when, where, and how things were happening." It started around maps and moved to the streets, commanders walking new territory together, pointing out features no dataset could convey.

The new geometry also went public. A find-your-district tool on the BPD website lets any resident enter an address and identify their district commander. Maps of each BPD post—individual patrol beats, with their specific intersections and alleys—went online for the first time.

A block of occupied row houses lines a Baltimore street in spring. The same geographic framework that redrew district boundaries now helps commanders understand where concentrated need ends and stable neighborhoods begin.

Violent crime in Baltimore has fallen in recent years. Canton attributes it to a broader set of reforms—resulting in smarter call prioritization, reduced response burden, better data at every level—redistricting among them. "I would like to think the city is safer," he said, "because we're able to provide the data that's necessary to effectively deploy where we need to."

A Foundation Still Being Built

Canton's goal was to create a department where any officer could work with spatial data, with GIS training pushed to detectives, patrol officers, and analysts. "We're pushing the tools down as far as we can get them so that everyone can do it," he said. "You don't have to rely on someone from my shop providing information." Training, he said, creates something else: an environment where officers start asking what's possible, and the requests come from the ground up.

Om Poudel, a senior application developer Sharma calls his wingman, produces be-on-the-lookout bulletins three times a day—warrant data, mug shots, area-specific

crime patterns—giving officers in every district the same picture before they go out.

The same geographic framework underlies Hot Streets, BPD's block-level analysis of where calls are most heavily concentrated. Each district gets a map showing its 20 highest-call blocks, rendered as red lines—thicker where calls are heaviest—so that a commander can see the weight of a place before deploying anyone to it. Hot Streets applies the redistricting logic at finer resolution: not nine districts to balance, but specific blocks, often just one or two, where proactive patrols will make the most difference.

Sharma's team also builds ArcGIS StoryMaps briefings for active investigations: shell casings from recent shootings linked forensically to incidents years earlier; ShotSpotter audio tied to precise locations; suspect galleries connected to gang turf and victim networks (see sidebar). Sharma said that when you start building an ArcGIS StoryMaps story, "You get that knowledge graph—from the shell casing to the gun to the criminal who used it, to the gang he belongs to, to the turf area where it happened."

That geographic awareness extends to the building level. Officers on mobile terminals can see which structures the housing department has condemned and whether a building is known to be occupied. Vacant housing was one of the strongest correlations in the original redistricting analysis—a signal of where workload concentrates, now visible on the screen during a foot pursuit. When a suspect disappears inside, the officer already knows the structure and whether anyone is likely to be in it.

The reach of what Sharma and Canton built extends beyond the city of Baltimore. Departments from Baltimore County to Cary, North Carolina to San Diego have come to study it.

Canton is deliberate about what drives the results. The department's GIS platform is central, but the transformation depends on integration across systems and partners—housing data from the Baltimore Department of Housing & Community Development, geocoder alignment with fire and EMS, call data from 911, coordination across every agency having the same operational picture. "I will not allow this organization to do something because it's cool," he said. "What we do must benefit our officers or the city." The redistricting qualified. So did the geocoder alignment, the ArcGIS StoryMaps briefings, and the training program that put spatial tools in the hands of officers who, a decade ago, were reading PDF maps pinned to a notice board.

Officers now pull up maps before they start their shifts, checking what happened while they were off duty. The data doesn't forget those places. Neither does the officer who works the beat.

John Beck is the Director of Law Enforcement Solutions at Esri where he is responsible for helping police agencies worldwide understand and implement GIS for every mission. Before joining Esri, Beck was a police officer and crime analyst in Nevada. In his role at Esri, he helps police agencies apply GIS to crime analysis, strategic planning, patrol operations, investigative support, and citizen engagement. John has also worked with agencies to implement GIS for open and transparent policing and to tackle hard problems like the opioid epidemic and homelessness. He is also helping police realize the value of new geospatial technologies including machine learning and big data analysis to gain a real-time understanding of crime patterns and make better informed decisions. John earned undergraduate degrees in geography and anthropology and a master's degree in criminal justice from the University of Nevada.

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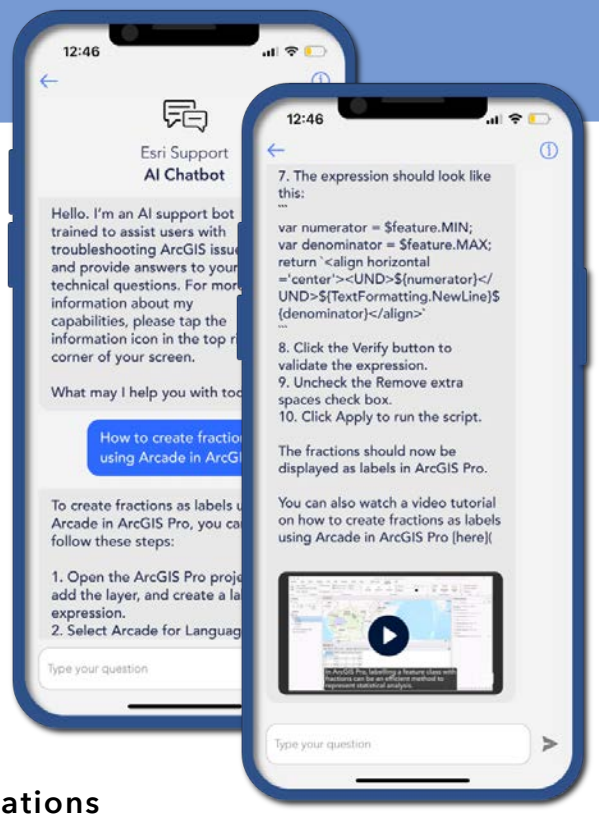

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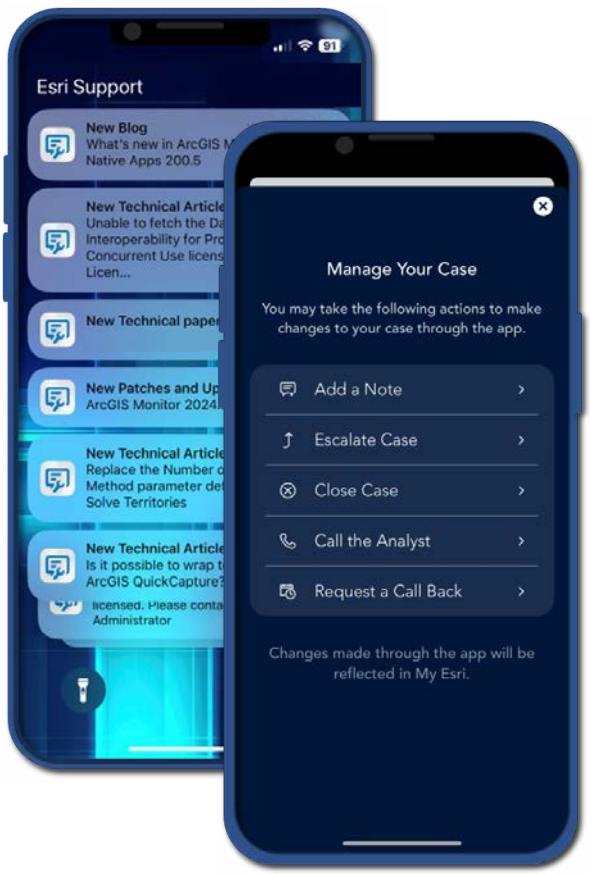

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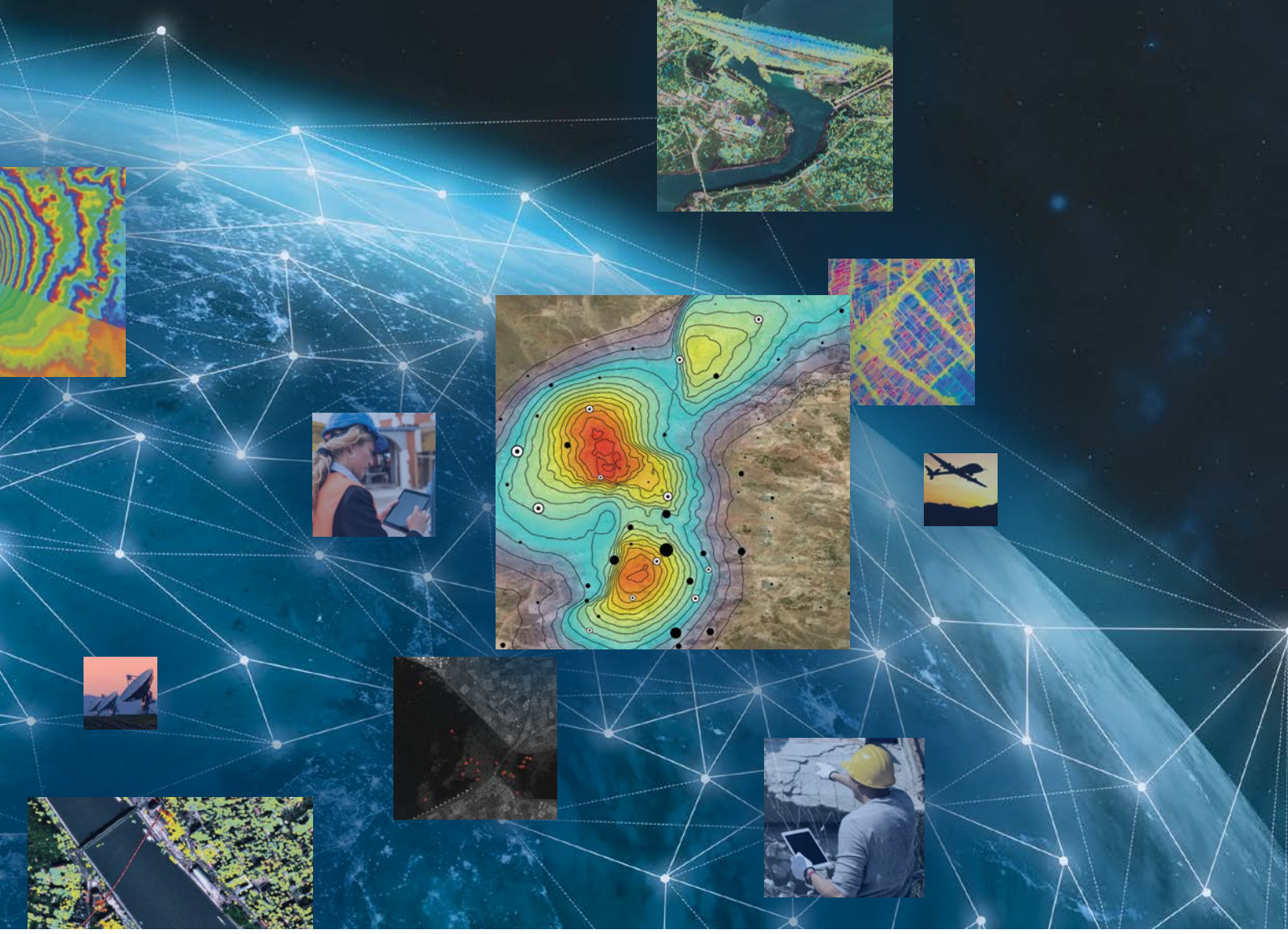

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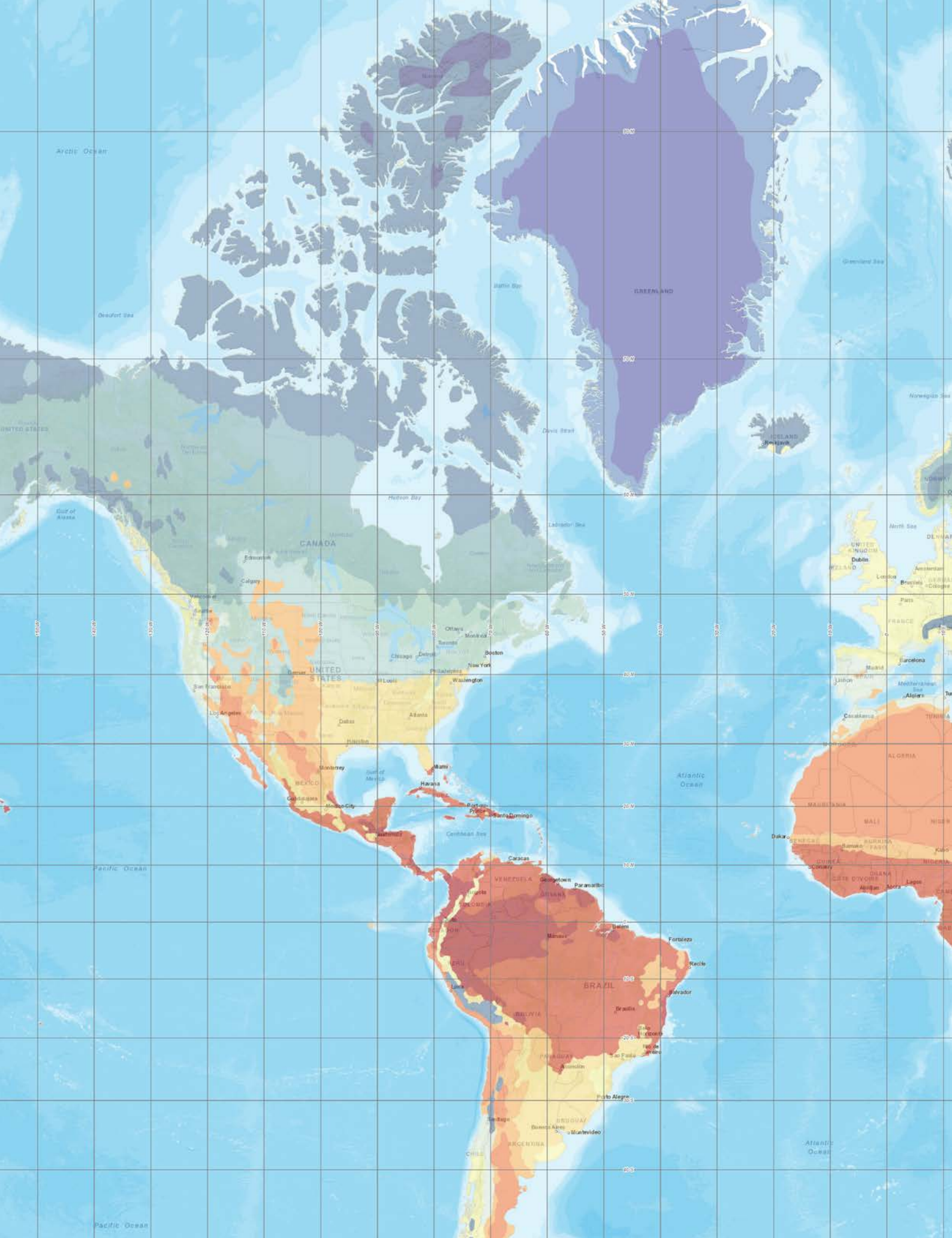
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Monterrey
Gulf of Mexico
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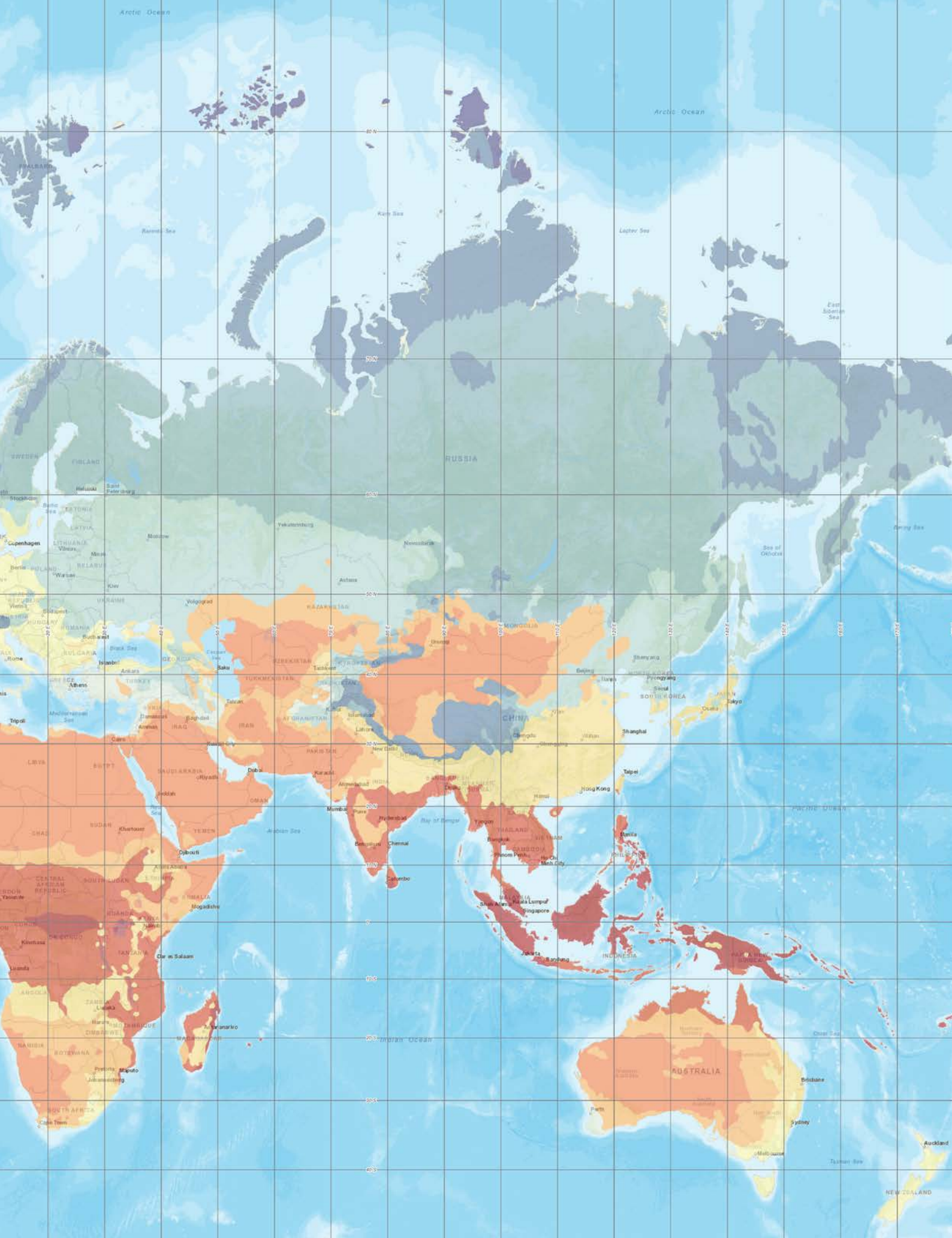
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ROMANIA
Bucharest
Black Sea
BULGARIA
Rome
Istanbul
Ankara
GEORGIA
Caspian Sea
Baku
UZBEKISTAN
Tashkent
KYRGYZSTAN
TURKMENISTAN
Urumqi
MONGOLIA
Shenyang
Beijing
Tianjin
Pyongyang
Seoul
SOUTH KOREA
JAPAN
Tokyo
Osaka
Athens
GREECE
TURKEY
Tripoli
Mediterranean Sea
Damascus
Beirut
SYRIA
Amman
Baghdad
IRAQ
IRAN
Tabuk
AFGHANISTAN
Kabul
Islamabad
Lahore
CHINA
Chengdu
Wuhan
Shanghai
Cairo
Kuwait City
PAKISTAN
New Delhi
LIBYA
EGYPT
SAUDI ARABIA
Riyadh
Dubai
Karachi
Ahmedabad
Taipei
Jeddah
OMAN
Mumbai
Pune
Hyderabad
Hong Kong
Arabian Sea
Bay of Bengal
Yangon
PACIFIC OCEAN
SUDAN
Khartoum
YEMEN
Bengaluru
Chennai
THAILAND
Bangkok
Manila
Phnom Penh
CAMBODIA
Ho Chi Minh City
Djibouti
ERITREA
ETHIOPIA
Colombo
CENTRAL AFRICAN REPUBLIC
SOUTH SUDAN
Yaounde
SOMALIA
Mogadishu
Kuala Lumpur
Singapore
Kinshasa
RWANDA
KENYA
Nairobi
Jakarta
Bandung
INDONESIA
Dar es Salaam
Luanda
ANGOLA
Lusaka
ZAMBIA
Harare
ZIMBABWE
MOZAMBIQUE
Antananarivo
Indian Ocean
NAMIBIA
BOTSWANA
Pretoria
Maputo
Johannesburg
AUSTRALIA
Brisbane
Perth
Sydney
Coral Sea
SOUTH AFRICA
Cape Town
Melbourne
Tasman Sea
Auckland
NEW ZEALAND
80°N
70°N
60°N
50°N
40°N
30°N
20°N
10°N
0
10°S
20°S
30°S
40°S
30° E
40° E
50° E
60° E
70° E
80° E
90° E
100° E
110° E
120° E
130° E
140° E
150° E
160° E
170° E

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