



Environmental smart monitoring: Spatial data infrastructure powered by future-proof technology

Regional Autonomous Corporation of Cundinamarca | Colombia

Biodiversity is the **strongest natural defense against climate change**, and Colombia ranks among the most biodiverse nations on the planet. According to the World Economic Forum, nearly 10% of the world's biodiversity can be found within Colombia's borders. In fact, it's one of just 17 countries classified as "megadiverse" — having exceptional biodiversity, including a significant proportion of endemic species. Embracing this, Colombia is at the forefront of sustainability in Latin America, with innovative conservation initiatives such as payment for environmental services and the creation of ecological corridors.

Leading these efforts is the Regional Autonomous Corporation of Cundinamarca (CAR Cundinamarca), one of the most important and largest regional environmental

authorities in Colombia. CAR Cundinamarca acts as a guardian of the natural resources under its jurisdiction — which includes the rural area of the city of Bogota. It does this by collecting, analyzing and validating information from various data sources (e.g., satellites, stations and air and water quality sensors, etc.), as well as other information specific to its core activities. This allows it to define and specify the scope of environmental policies, plans, programs and projects aimed at protecting water, air, forests, wetlands and wildlife, while also enabling the sustainable development of the region.

Access to actionable data is critical to CAR Cundinamarca's mission; however, the decentralization of information, data interoperability challenges and lack of robust policies



and standards were imposing operational obstacles. To address these challenges, CAR Cundinamarca was the first environmental entity in South America to create a spatial data infrastructure. Named IDECAR, its objective is to foster data organization, systematization, standardization, sharing and use. To ensure success, the organization implemented Hexagon's smart monitoring solution, which includes ERDAS APOLLO, M.App Enterprise and Luciad technologies.

Untapped potential

CAR Cundinamarca's jurisdiction spans an area of 18,000 km² (approximately 6,950 square miles) comprised of 106 municipalities including the city of Bogota — home to roughly 20 million residents.

To fulfill its mandate effectively, it needs access to up-to-date information from across its extensive jurisdiction. Previously, the organization relied on many different databases and disparate systems, making it challenging to keep data updated, accurate and accessible. This led to tasks taking exponentially longer than necessary, delaying decision-making processes. Moreover, siloed and decentralized data withheld valuable insights, such as critical analyses, reports and research, resulting in operational inefficiencies like duplicate tasks and suboptimal use of financial and human resources.

Unlocking data

To gain better access to this decentralized data, enhance its spatial data infrastructure and modernize its GIS capabilities, CAR Cundinamarca implemented a robust data governance project, which was carried out in two large groups of activities by ENINCO, a Colombian consulting firm that contracted Hexagon to provide the necessary software.

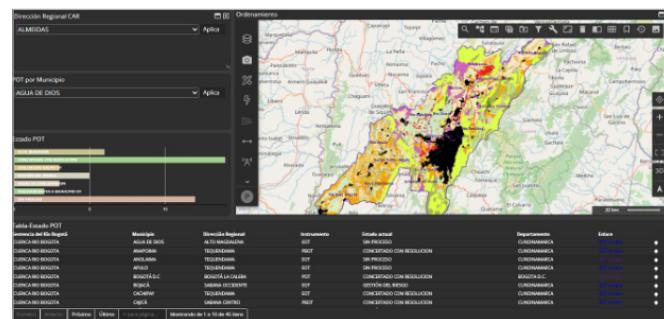
The project began with inventorying and cataloging over 1.5 million geographical and non-geographical data. Using ERDAS APOLLO, more than 68,000 geospatial assets, including databases, 3D data, imagery, metadata and vector data, were automatically imported, cataloged, linked and stored — all according to pre-defined rules outlined by the organization. Additionally, large imagery files were compressed by 90% with Hexagon's GeoCompressor and converted into ECW, a proprietary image format that significantly reduces file size while maintaining visual quality. With it, users can load, visualize and distribute large image datasets more quickly. As a result, data is now standardized, organized and easily accessible to authorized users.

Next, the project focused on the creation of a customized, web-based geospatial portal. Built on M.App Enterprise, it

incorporates advanced 3D capabilities enabled by seamless integration with Hexagon's LuciadRIA.

Several geoanalytical thematic dashboards were also built to support two strategic, missional projects for CAR:

- **SI Río Bogotá**, an information management system that focuses on the Bogota River basin and its surroundings
- **PESCAR**, an environmental assessment, monitoring and control platform that centralizes, processes and analyzes big data from a multitude of sources such as hydroclimatological and air quality stations, photogrammetry survey made by drones, camera trap and a wide range of thermal and optical cameras



Bogota River Geoanalytics: Public module for territorial planning that allows users to view and analyze information on land use and occupation and environmental zoning of the Bogota River basin

By implementing Hexagon technology, CAR Cundinamarca guarantees the administration, interoperability, governance and security of exiting geographic and non-geographic data. It can also rely on an official, always up-to-date source of actionable information for day-to-day operations and ad hoc analyses.

“Hexagon technology enables the centralization, administration and delivery of geospatial data in an orderly, standardized and quality manner, aligned with the geographic data governance adopted by the Corporation,” said Wendy Hernandez Suarez, leader of geographic information systems and geoinformatics for CAR’s Natural Resources Department. “This makes it possible to parameterize environments to visualize, use, analyze and improve existing thematic information.”

“Our Hexagon solutions support spatial data analyses, automatic report generation based on customized geoprocesses and the creation of geoservices based on OGC protocols for the publication of CAR’s open data. It also strengthens CAR’s geospatial data catalog,” CAR Cundinamarca General Director Alfred Ballesteros added.

"This is all based on standards and international quality protocols for the exchange and interoperability of our data, complying with the guidelines established by the governing bodies in Colombia."

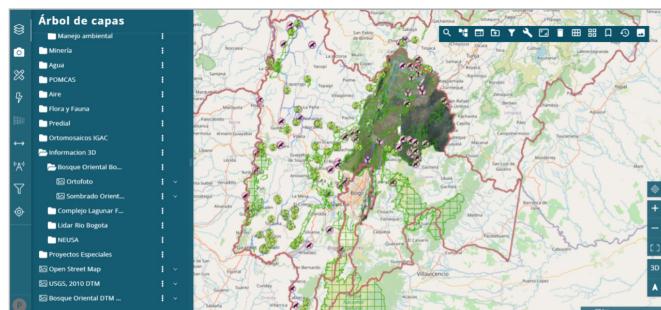
Real-world usage

From a data management standpoint, Hexagon's solution leverages automation rules to help cataloging users and system administrators maintain data governance across the entire organization. Either by mass imports or manual input, data is automatically classified, stored and standardized by ERDAS APOLLO and spatialized on M.App Enterprise to feed CAR Cundinamarca's geoportal and its geoanalytical dashboards.

Through web services, static data is made available on a web-based geoportal that offers more than 100 layers of information and robust resources that allow internal users to leverage orthomosaics, point clouds and 3D capabilities to display digital twins, model spatial analyses and visualize actionable information. To comply with Colombia's national open data policy, the geoportal can also be used by external individuals for many different purposes.



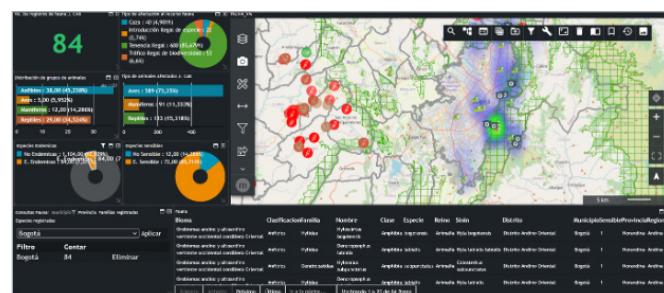
CAR Cundinamarca's geoportal: An integrated 3D visualization of point clouds, digital terrain models and orthophotos, leveraging M.App Enterprise, Luciad and ERDAS APOLLO



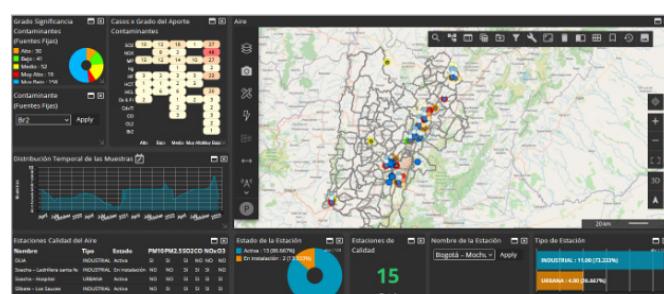
Example of CAR Cundinamarca's geoportal with more than 100 layers of information

Users can also explore and visualize dynamic data on geoanalytical dashboards equipped with advanced filters, search tools and reporting functionalities that support a wide range of use cases. These include analyses, research, planning and real-time monitoring of information related to:

- Air and water quality
- Biodiversity
- Risk management
- Soil usage
- Territorial cadaster
- Mining activities
- Strategic ecosystems



Fauna Geoanalytics: Allows users to view, analyze and monitor data on typical animal species of Colombia and areas where illegal animal trade occurs



Air Quality Geoanalytics: Public module allows users to view and analyze air quality indicators, based on data from urban areas and close to industries located in and around the Bogota River basin

"Because it is structured by parameterizable APIs, Hexagon technology made it easy to configure a tool without the need for extensive development time," Ballesteros said. "For end users, the interface provides tools for data analysis that do not require specialized knowledge or industry-specific software. This means the georeferenced data can be managed and visualized easily, even by non-technical users."

Looking ahead

The organization plans to deploy Hexagon's smart monitoring solution for disaster management and environmental protection. This cutting-edge technology will enable the early detection of hazardous situations and suspicious activities with the potential for environmental damage (fire, erosion, deforestation, illegal mining and crop cultivation, among others), allowing it to assess risks and take swift action.

"Hexagon's smart monitoring solution leverages AI-based remote sensing software and computer-aided dispatch capabilities and will enable CAR Cundinamarca to automatically detect changes, manage alerts and efficiently coordinate field work, ensuring a proactive and holistic approach to safeguarding the environment," said Ballesteros. "This will aid us in our vision of being a territory resistant to climate change by 2035."



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Alfred Ballesteros

General Director

Regional Autonomous Corporation of Cundinamarca

Hexagon is the global leader in precision technologies at any scale. Our digital twins, robotics and AI solutions are transforming the industries that shape our reality.

Hexagon's Safety, Infrastructure & Geospatial division improves the resilience and sustainability of the world's critical services and infrastructure. Our solutions turn complex data about people, places and assets into meaningful information and capabilities for better, faster decision-making in public safety, defense, transportation, government and physical security.

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