

Characterizing Trails for Emergency Response

A collaborative innovation for risk management in Monserrate, Bogotá



437,591

yearly visitors indirectly benefiting from the project

3,762

emergencies registered between January and July 2026

60

hectares covered both with RGB drone mapping and LiDAR

9

government, civil society, and community stakeholders engaged

5

trail safety and accessibility variables mapped

2

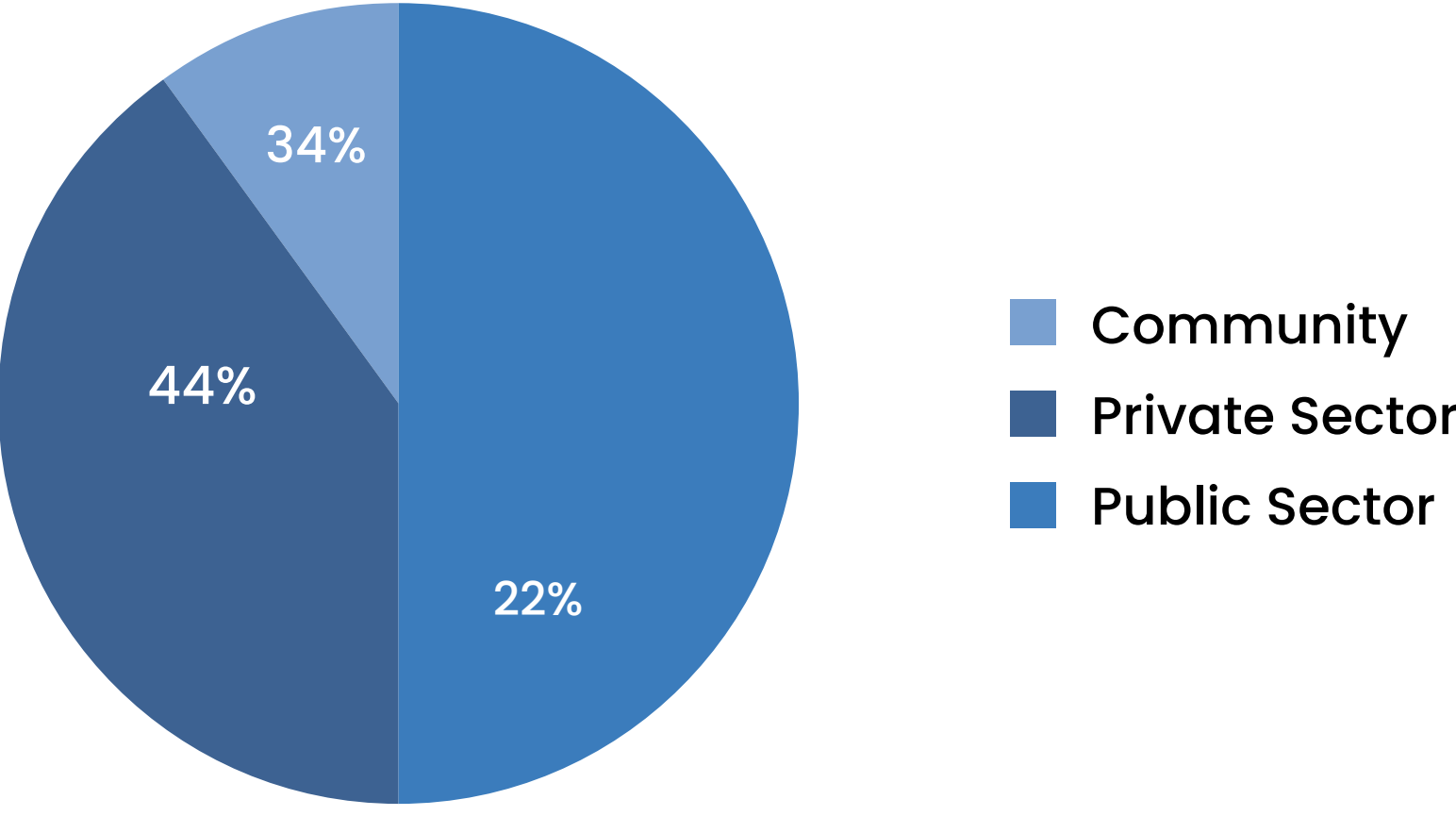
geolocated tools created for trail and incident reporting

Each weekend, thousands of people use the trails of Monserrate for recreation, sport, and tourism. But when someone gets lost or an emergency occurs—such as a wildfire, rescue operation, landslide, or hazardous-material incident—pinpointing the exact location can become a race against time. Reports often rely on vague references such as “I’m near a large rock” or “I passed a fallen tree,” making it difficult for emergency teams to quickly locate the incident and determine the safest and most effective route to respond.

This Colombia Flying Labs initiative aligns with the “Monserrate Inteligente” project, which aims to develop a digitally mapped and georeferenced trail system to improve emergency response while providing a replicable model for other high-risk natural areas.

Collaboration in action: The initiative brought together 9 public institutions, community actors, volunteers, and technical partners in a shared effort to improve trail safety and emergency response in Monserrate:

- Cuerpo oficial de Bomberos de Bogotá (COBB)
 - Sistemas de aeronaves, robótica y tecnología (SART)
 - Equipo Técnico de rescate (ETR)
 - Búsqueda y rescate de animales en emergencia (BRAE)
 - Grupo Forestal especializado para la gestión integral de incendios forestales
- Instituto Humboldt
- Colombia Flying Labs
- ESRI Colombia
- UAV Latam
- Geomap
- Hikers
- Volunteers
- local community members



Outputs	Outcomes	Short Term Impact	Mid/Long Term Impact
• A detailed drone-based survey of the priority trail area • High-resolution orthomosaics • 3D terrain models • DTM and DSM datasets • LiDAR capture for high-detail terrain characterization • A Survey123 form for trail condition and point-of-interest data collection • A Survey123 incident reporting form for emergencies, including geolocation, event type, and severity • A concept for an interactive geoviewer/app showing trail difficulty, points of interest, signage, elevation profile, and safety information • A standardized data model to support future scaling and replication • A collaborative workflow integrating tools, procedures, and governance approaches for urban risk management	The project generated concrete, usable information that can strengthen emergency response and trail management: • Trail sections were characterized with elevation profiles, travel times, difficulty levels, safety points, and key landmarks • High-risk areas for lost-person incidents and difficult access were identified • Areas requiring improved signage were identified • A georeferenced evidence base was created to support faster and more informed emergency routing • A standardized structure was created to allow the model to be replicated by other government institutions • Public institutions and community actors worked together to create a shared operational understanding of the trail environment • Drone data was translated into practical decision-support tools and reporting formats	In the short term, the project strengthens Bogotá’s capacity to respond to emergencies in Monserrate and surrounding trails by making reliable geospatial information available to emergency teams. It helps: • Improve route planning for emergency response • Support quicker and safer deployment of response teams • Reduce uncertainty when locating incidents • Strengthen coordination between fire services, health actors, police, civil defense, and other institutions • Promote the practical use of drones, sensors, and GIS tools in risk management	Over time, the initiative can help consolidate a more precise, collaborative, and technology-enabled model of risk management in Bogotá’s Cerros Orientales. The project creates a foundation to: • Strengthen the technical capacities of the Bogotá Fire Department and partner institutions • Promote continued use of dynamic trail mapping and geospatial tools • Expand interinstitutional coordination for prevention, preparedness, and emergency response • Replicate the approach in other sectors of the Cerros Orientales and in other protected or high-complexity visitor areas in Colombia • Inform broader risk-management policies and strategies grounded in evidence

Roadmap toward sustainability and full adoption

- 1. Operational use:** El cuerpo de Bomberos de Bogotá and its operational team using the mapped trail information, forms, and routing logic in emergency preparedness and response operations.
- 2. Institutional integration:** The geospatial datasets, reporting tools, and trail-characterization model can be integrated into the working practices of public institutions responsible for emergency response, environmental management, and trail administration.
- 3. Continuous updating:** Through Survey123 and community reporting, trail conditions and incidents

- can be updated regularly, helping keep the system relevant and useful over time.
- 4. Interagency coordination:** The model creates a base for stronger coordination between the Fire Department, health services, police, civil defense, and other public actors involved in the area.
 - 5. Replication and scale:** The standardized data model and collaborative learning project empower the Bogotá Official Fire Department to extend the initiative to additional trail sections in Monserrate, other areas of the Cerros Orientales, and similar high-risk natural spaces in Colombia.

What Twilio’s support helped unlock

Local leadership turned a known challenge into a shared innovation opportunity

What began as a response to limited trail knowledge and difficult incident location became a collaborative effort to build a more precise and actionable understanding of the territory.

Community knowledge became operational intelligence

The project combined institutional expertise with local experience from hikers, visitors, and nearby communities, helping ensure that the information produced reflects real conditions on the ground.

Data became action

The initiative showed that drone imagery, LiDAR, and GIS create the most value when they are linked to practical workflows, shared responsibility, and tools that emergency teams and communities can actually use.

Discover the details:

- StoryMap [link](#)
- Survey123 trail information [form](#)
- Survey123 incident reporting [form](#)
- Video: [Experiencia senderista](#)

