

LAND OWNERSHIP, SIMPLIFIED

A double rainbow holds a symbol of peace over Vista Hermosa, a village that's been severely impacted by the armed conflict

MARY JO WAGNER REPORTS ON A PROJECT THAT ENABLED INDIGENOUS COLOMBIANS TO CONFIRM THE BOUNDARIES OF THEIR PROPERTIES FOR THE FIRST TIME IN HISTORY – USING JUST A SMARTPHONE AND A GNSS RECEIVER

On a warm morning in August 2019, Horacio Bonilla set out to walk his land as he's so often done for five decades. A founder and lifelong resident of Colombia's Santa Teresita del Tuparro Indigenous Reserve in Cumaribo, Chief Bonilla knows this terrain like the lines and marks on his weathered hands.

The walk on this day, however, served a specific purpose. With the aid of a GNSS receiver, he and his Sikuani peoples would be able to definitively confirm the unclear boundaries of a section of their property between themselves and their neighbours – for the first time ever. The historic exercise would potentially bring harmony to a region where land rights between the Indigenous and neighbouring farmers have been in dispute for decades.

"Many people have settled here over the years and they've continued to alter the limits of our reserve," says Hernando Sanchez, a Sikuani leader who's also lived on the reserve his whole life.

"We were born and raised here. We know what land is ours, but being able to prove the boundaries of our land has been difficult."

Resolving that lack of clarity is a primary focus of Kadaster International's Land in Peace project, a Dutch-Colombian joint effort that uses Bluetooth-enabled GNSS technology, smart phones and a mobile data collection app to survey, map, formalise and register rural land in post-conflict regions. Designed to streamline traditionally time-consuming and expensive mapping techniques, the project's efficient fit-for-purpose (FFP) methodology is enabling landowners to quickly and easily map their land in real time while also planting the seeds for serious land administration reform at the highest levels.

Targeting three remote regions in Colombia, the initiative has successfully demonstrated that complex, deep-seeded land-rights issues can be peacefully resolved with simple yet technically advanced solutions. And, it has helped cultivate stability, dignity and pride for hundreds of people who have longed to be officially recognised as landowners.

Simplicity rules

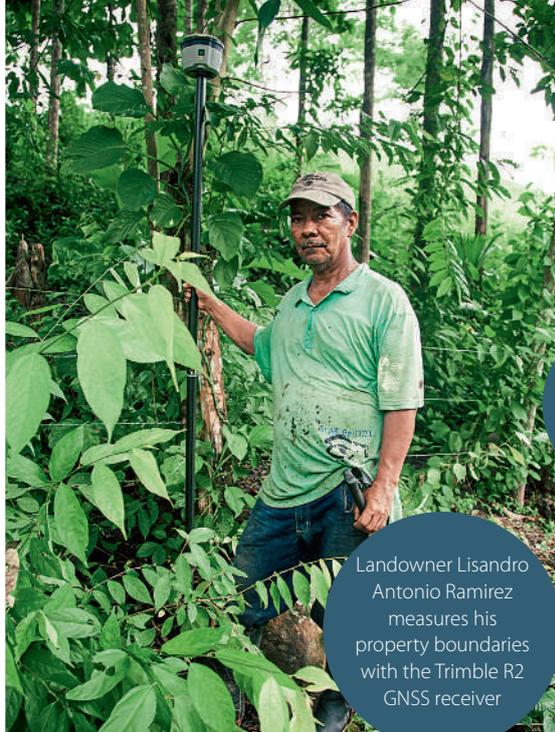
Land reform has been a core issue of conflicts in Colombia for decades. Armed conflicts and

land-ownership inequity have left millions of parcels rural land unmapped and without titles.

With a joint interest in improving land reform, Kadaster partnered with a number of Colombian institutions, including the National Register of Property (SNR), the Land Agency (ANT) and the National Cadastral Mapping Agency (IGAC), to launch the Land in Peace (LIP) project. Having completed a small FFP proof of concept in 2015 near Bogotá, the Kadaster team knew it needed a robust yet straightforward technological solution to bring speed and accuracy to the field.

After field-testing various combinations of tethered single receivers, Bluetooth-enabled receivers, tablets and smartphones, the team chose a compact, Bluetooth-enabled GNSS receiver from Trimble that can deliver centimetre-positioning accuracy in real time to any mobile device.

"This project depends on the direct involvement of the landowners themselves so if the technology isn't simple it can't be participatory," says Mathilde Molendijk, regional manager for Latin America for Kadaster International, the international arm of the Netherlands' official Cadastre, Land Registry



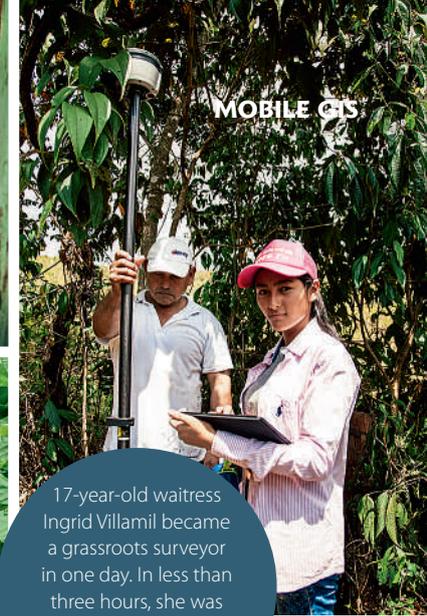
Landowner Lisandro Antonio Ramirez measures his property boundaries with the Trimble R2 GNSS receiver



Argenis Valencia in her kitchen in Vista Hermosa



Junior Efrain Cabrales leans on one of his cacao trees in Apartadó



17-year-old waitress Ingrid Villamil became a grassroots surveyor in one day. In less than three hours, she was taught how to record and map the field data with smartphones



Landowner Andrea Bohórquez and a grassroot surveyor record her property boundary measurements in Vista Hermosa



It's estimated that 60% of Colombia's rural land parcels aren't titled or have legal registration



Farmer José Jairo Capera takes a rest in front of his house in Apartadó

and Mapping Agency. "The geography is very challenging, so it has to be mobile and light to carry. And reliability is key because we're working in really remote locations. We need a single GNSS plug-and-play system that gives us precise measurements no matter where we are. We can't afford to have equipment failures."

Mapping with purpose

LIP initially chose two pilot regions to target: four villages in San Jose de Apartadó in the northwest and two villages in Vista Hermosa, a city in the central district of Meta. Both areas have been severely impacted by the armed conflict.

They consulted with each village's local Community Action Board to identify and map 250 unregistered parcels totalling 574ha in Apartadó and 170 parcels totalling 2,100ha in Vista Hermosa. After determining their area of interests, the team acquired any existing parcel boundaries from ANT's geoport and overlaid them on an Esri imagery basemap, a multi-satellite imagery mosaic map of the world. The satellite-image-based parcel map was both printed and uploaded to a GIS app installed on smartphones.

In February 2018, the project team was in the field. In each village, the team began by explaining the project's purpose and its technological methodology to the affected

villagers. After hearing how a parcel map could benefit them, several "grassroot surveyors" were eager to participate. The team showed the villagers the existing parcel map and after consulting the imagery, they planned their mapping strategy. The farmers learned how to use the GNSS receivers and young adults were taught how to record and map the field data with smartphones – a process that took less than three hours.

Six teams of farmers and youths set out to capture each farmer's property limits. Carrying the R2 GNSS receiver, they walked along the boundaries of their land, set the receiver on the points and collected decimetre-accurate positions in real time by connecting to the Trimble FieldPoint RTX correction service. Using a customised FFP data collection model, the GIS app integrated and recorded both the metadata for each GNSS point and its location coordinates, enabling it to draw the parcel boundaries in real time. Farmers could also capture other identifying information, such as roads or streams, to provide context for the parcel's definition. As each farmer with adjoining parcels did the same, the app built the boundary lines to create black-lined polygons.

Proof positive

Once farmers mapped their property's boundaries, they could view them on the

smartphone screen and verify the parcel polygon, its features and its calculated area. Their partner then photographed them and their ID cards and recorded their fingerprints, names and dates of birth, along with photos of their parcels. If they had documents that proved ownership or long-term connection to the land, those documents were also photographed and stored in the app.

On average, it took the team four days to measure and map the villages. And all of the field data was reviewed by a professional surveyor for quality control.

"The field work is incredibly fast," says Molendijk. "Not needing to set up and monitor a base station allows us to simply turn the GNSS receiver on, connect to the RTX satellite signal and get it to work. For the villagers, the receiver is a bit of magic. It's beautiful to watch their faces light up as they see the map of their land. Key for the government is that the 10cm to 30cm positioning accuracies we get are well within IGAC's precision requirements for the project."

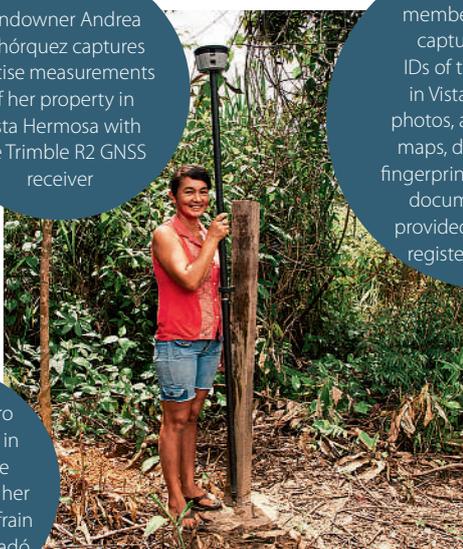
All the field data was uploaded into a Postgres database. They processed the data and finalised the parcel maps using SQL functions combined with open source QGIS software, and by the next day, the team was ready to share the results.

For each village, communities were invited to come together in a public forum



Rural Vista Hermosa. This region was heavily affected by the armed conflict; guerrillas left a large number of landmines in the area, putting the rural population at high risk

Land in Peace team members assist a landowner in measuring his land limits using the Trimble R2 GNSS receiver



Landowner Andrea Bohórquez captures precise measurements of her property in Vista Hermosa with the Trimble R2 GNSS receiver

Land in Peace team member Laura Becerra captures the photo IDs of two landowners in Vista Hermosa. The photos, along with parcel maps, digital signatures, fingerprints and supporting documentation were provided to ANT for land registering and titling

Edita del Socorro prepares a meal in her kitchen. She farms cacao with her husband Junior Efrain Cabrales in Apartadó



to view the results of the field surveys. Visualising the maps on a large screen, the team moved from parcel to parcel, asking each landowner and his or her neighbours to examine their plots. If each person neighbouring the particular parcel agreed to the measurements, the black borders changed to green. Each landowner then signed a digital document agreeing to the property limits. All of the parcel maps, digital signatures, fingerprints and supporting documentation were then provided to ANT in a geo-database for the formalisation process of registering and titling.

“Watching the boundary lines change from black to green is special, not only because it means there is no longer any uncertainty around land limits, but because it means landowners can finally receive a title and be recognised by the government as the legal owner of their property,” says Molendijk.

In Apartadó, 133 villagers are receiving an official land title from ANT. And in Vista Hermosa, the data for 160 rural parcels has been collected and ANT is preparing the titles.

The success of the two pilots elevated the profile of LiP to the highest levels of the Colombian government. Buoyed by the interest and support, the project team expanded their focus to the indigenous

rural land of Cumaribo in eastern Colombia, a region with some of the longest-running land disputes in the country.

Feeling seen

Covering an area 1.5 times the size of the Netherlands, Cumaribo is home to 34 indigenous reserves scattered across 3.3 million hectares. Tensions around the 200,000ha border region of Santa Teresita Indigenous Reserve have been of particular interest for IGAC.

Populated by 86 communities, most of the reserve’s borders are defined by rivers and creeks. But there is one particular stretch of about 20km where no natural boundaries exist, leaving land limits up for interpretation. That ambiguity has created fierce tensions among the Sikuani leaders and neighbouring cattle farmers.

In August 2019, Kadaster and IGAC team members followed the same process, first bringing together people from both sides of the ‘fence’ to acquire consensus and buy-in to each map of their boundaries. In total, eight 1,000ha parcels needed to be measured.

Armed with the GNSS receivers and smartphones, each survey team navigated by car, motorcycle or foot and used RTX to capture precise position points of their

boundaries, drawing their land limits in real time as they moved. Photos of the leaders and farmers, along with any land-rights documentation, were also taken; in one day, all the mapping was complete.

The next day, for the first time in history, about 30 people gathered to view their land limits together. Anxiety was high as there was deep distrust between the two sides. But because they had mapped their land themselves, it enabled them to take ownership of the process and their measurements. That created an environment of trust rather than animosity.

And by the end of that day, the LiP team had provided irrefutable clarity to decades of uncertainty.

“We’ve shown the government that land rights can be confirmed through efficient, affordable, accurate mapping and direct participation,” says Molendijk. “What’s even more meaningful is seeing the pride on the people’s faces. For the first time, they feel seen by their government. And the skills the youth have learned could give them access to opportunities they otherwise wouldn’t have. That’s what makes this work incredibly rewarding.”

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GeoConnexion New Website

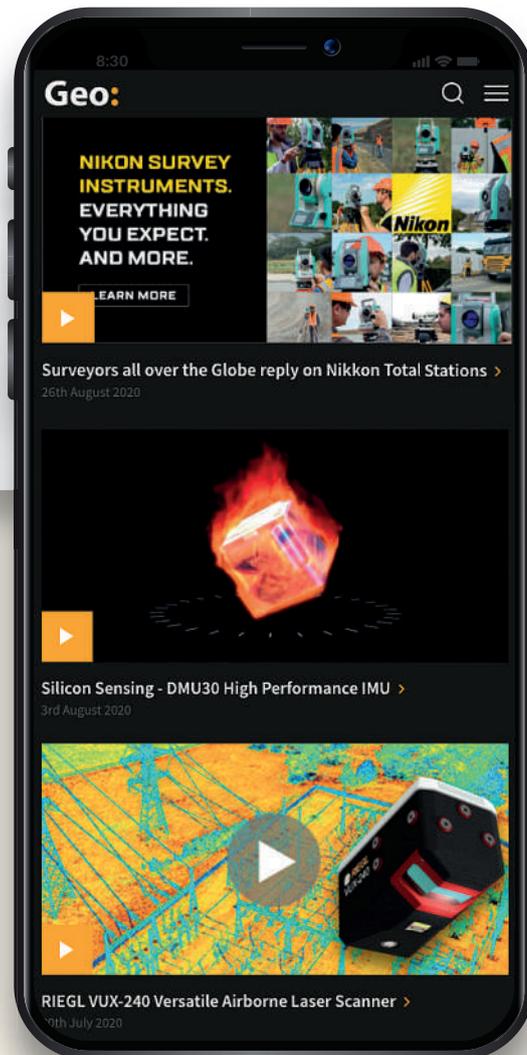


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