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Capacity development and PGIS for land demarcation: innovations from Nicaragua

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Introduction

In early 2004, the Gaspar Garcia Laviana cooperative, located in the community of Telpaneca in Nicaragua, requested technical assistance from Acción Contra el Hambre (ACH) for the purpose of making an inventory of local land parcels. A project was designed to seek a local alternative solution, including a low-cost methodology with a pronounced social dimension that would be easily accessible to all local organisations.

This article describes how they tried out and developed a methodology called communitarian cartography. This method aims to prevent and resolve conflicts related to land and natural resources' access and use. It uses dialogue between all concerned actors and easy handling precision tools (GPS and GIS).

Background

The province of Madriz is one of the most vulnerable regions of Nicaragua. The vulnerability is not only physical and environmental (prolonged drought). It is also based on some structural elements (see Box 1).

ACH wanted to help with conflict prevention and resolution over resources and to make the process of recognising producer's rights more efficient, while simultaneously placing the process within reach of the poor. So ACH designed a pilot

Box 1:

Vulnerable production systems

It relies almost completely on single-crop farming of basic grains. It depends for cash on the sale of surplus production once the basic subsistence level has been exceeded.

Access, use and tenure of productive land

In Madriz, approximately 9% of current properties stem from the unfinished 1980s Sandinista agrarian reform process. This left behind considerable insecurity in the land tenure system (see Box 2). Short-term land leasing arrangements prevent adequate land management processes or investments in farming. Approximately 25% of small producers cannot prove their land is entered in the Property Register. There is no cadastre system, so existing information regarding property is often erroneous, leading to conflicts over borderlines between properties as well as between municipalities.¹

Technical and economic limitations in both civil society and among public authorities in Madriz hamper the use of innovative methods to promote and disseminate local mechanisms that might allow for proper land and natural resources management and territorial planning.

¹ Cadastre: a parcel-based land information system that includes a geometric description of land parcels, usually represented on a cadastral map. In some jurisdictions it is considered separate from, but linked to, the register of land rights and holders of those rights (land register), while in other jurisdictions the cadastre and land register are fully integrated. (FAO, 2002)

Box 2: Agrarian reform in Nicaragua

Nicaragua has a long history of conflicts over property. This reached a crisis point in the 1970s. After a civil war overthrew President Somoza in 1979, the revolutionary government of the Front Sandinista of National Liberation (FSLN) made agrarian reform a priority. It orientated land reform in two directions. First, by the creation of big farming governmental companies built on the base of the properties expropriated to the family Somoza and his relatives, (APP, Area Propiedad del Pueblo). Secondly, the rural sector began to organise cooperative production.

But the land rights distributed by the agrarian reform programme were often incompletely formalised. Some beneficiaries even lacked deeds to their land. After the government changed in 1990 and the transition back into a market economy began, severe disputes over property rights ignited. Land distributed during the Sandinista period became hotly contested as the new government actively sought to safeguard the interests of the pre-Sandinista owners. A substantial fiscal cost was incurred to compensate former owners for lost land (Broegaard *et al*, 2002; Iram, 2000; Corral, 1999; Baumeister, 1999).

project with a more integral and innovative focus.

In 2002, ACH carried out a study on land tenure and the market for land in Madriz. The ACH team then developed a participatory cartography model to be used as a tool for local natural resources and land management. These activities in turn led to the onset of a process of reflection with local organisations and small farmers (producers).

The study found that:

- In Nicaragua, half the farmers do not own the land they work, or own only small, low quality parcels. Inappropriate land use, poor access and the lack of articulation between national land policies and local land rights practices have led to serious conflicts over land tenure.
- The legalisation and registration of rural property, particularly smallholdings, is prohibitively expensive.
- There is a demand from communities and cooperatives for adequate solutions to local management and physical planning of the territory.

The Gaspar Garcia Laviana cooperative was established on land expropriated during the agrarian reform process, and specialises in the production of coffee and basic grains (beans, maize, sorghum). Lacking government aid, the cooperative faced problems in accessing credit. In addition, the former owners returned and claimed the land, and were later indemnified. So the members of the cooperative began to divide the land among themselves, while keeping the overall property intact under the original title. Two kinds of parcels were distributed, for coffee or basic grains production. Gardens were also 'privatised' to the families of cooperative

members, and to other families who lived in the community. The cooperative left some areas of coffee and forest to collective management to honour their collective debts. The leaders expressed the need to make this division of the formerly collective property 'official'.

A detailed description of the experience

The pilot project was born from a request made by the cooperative, and the methodology was developed as the project advanced. The ACH technical team became increasingly specialised, and exchanged information with GIS experts in order to address any problems.

The cooperative leaders defined the project, after they had presented it to all the cooperative members. A meeting and public assembly was held with the community (approximately 200 people). At the beginning, some had doubts. But afterwards, everybody agreed to participate. Details of the project and its origin were explained, along with development activities and expected outputs. This allowed ACH to answer questions about the process and to organise how the community would participate. Landowners interested in helping the technical team were identified in order to start the first trial geo-referenced survey.

Two teams of six or eight people were created (one or two cooperative directors, the land owner, two or three people owning adjoining land, and two witnesses). These teams were trained by a technical team to use Geographic Positioning System (GPS) equipment, Geographic Information Systems (GIS), and in participatory mapping and land surveying techniques. The teams were maintained through the duration of the project. Women took part in the process as owners and as neighbours. At first, they sent their sons to act as representatives on their behalf. But after a discussion with the cooperative we insisted that it was important for the women to also participate.

The first survey involved geo-referencing points at rivers, roads, agricultural parcels, forested areas and homes in the community. This information allowed us to test the initial work, correcting errors, and generating some degree of critical discussion with local leaders. Valuable information was obtained for validating the way in which the methodology was being applied (groundtruthing).² This made it possible to calibrate the topographic map being used and obtain reference points for the community. This activity was very important at the beginning, because it allowed us to set working precedents before embarking on the measurement of the actual agricultural parcels.

² See e.g. www.missiongroundtruth.com/groundtruth.html for a description of how groundtruthing works.

Box 3: Variables

- Date
- Name of owners
- Zone
- Size of area estimated by the owner
- Years of use
- Current crops sowed
- Production per crop
- Organic
- Observations ref. natural resources
- Observations ref. conflicts
- Observations ref. possible loss of GPS signal³
- Probability of error as estimated by GPS equipment

Before any land surveying took place, the cooperative and farmers decided what information they need. They created a field form to record descriptive information for each parcel, and a database in which to store the information once collected.

The database was jointly designed with producers, based on the needs they expressed. It collected information regarding measurements, agricultural production, and the presence of conflicts concerning the land use and natural resources. Box 3 lists the variables contained in the database.

Once trial activities concluded and meetings had been held, the teams of owners, witnesses and owners of adjoining land came together to carry out geo-referenced surveys of the parcels, to create maps showing how the properties fitted together. The witnesses were important, as they were able to testify that the land belonged to the owner and to guarantee that the process of delimitation was done well.

We developed three different **classifications for the land parcels and data gathered**:

- perimeter of the cooperative;
- boundary limits between communal areas, forests and protected land; and
- property lines between parcels owned by producers who are cooperative members.

For the first stage, we established that the cooperative consists of 890.5 hectares, with a perimeter of 26km. This took several days, and 12 producers participated. Two people held the GPS equipment and took readings, while another two cleared the underbrush in areas that were difficult to access. Several producers in charge of different zones participated in establishing the borderlines between community spaces and protected areas, which totalled 80 hectares and were sub-divided into twelve areas.

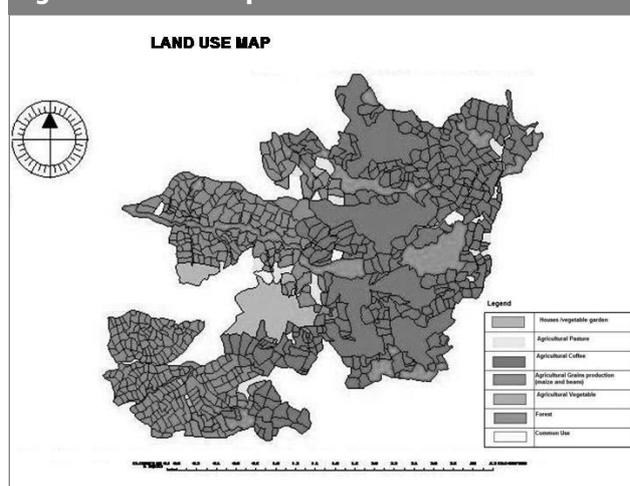
Finally, to establish exact boundaries between the parcels,

Figure 1: Map showing the boundaries of the various parcels, identified by owner



Source: ACH

Figure 2: Land use map



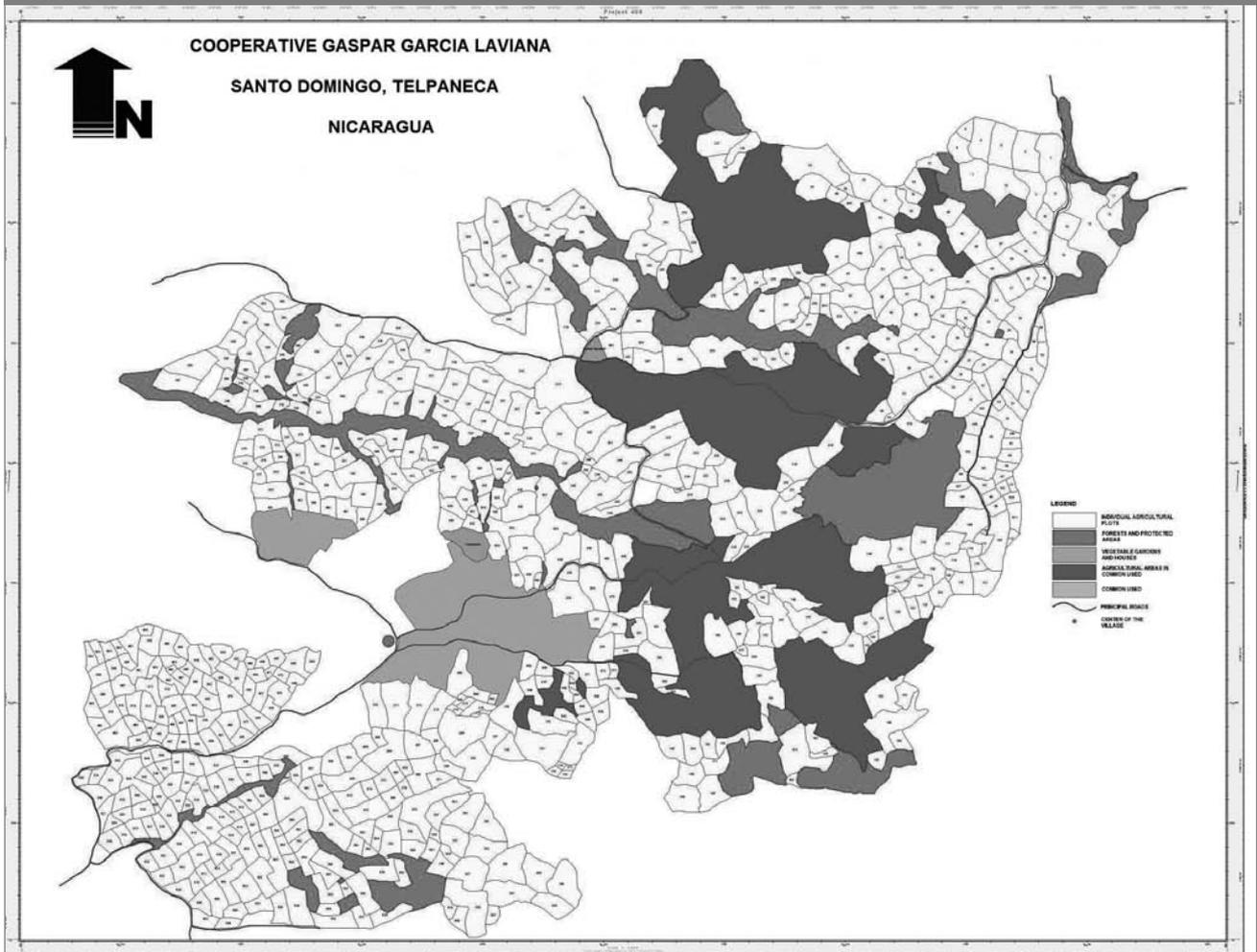
Source: ACH

the owners themselves took measurements, using GPS equipment in the presence of all other neighbouring owners and two witnesses, who certified the information being registered. This aimed to ensure that these boundaries were respected and to prevent further conflict. Following that, the information about the parcel was entered into a field form.

The map shows the boundaries of the cooperative, using for its background a topographic map at a scale of 1:50 000. GIS thematic maps were generated (scale 1:5000), using Map Maker Pro software (see Figure 1). Several thematic maps were generated on subjects such as land use, organic agriculture or the sub-division of parcels by size and function (see Figure 2).

³ ACH technical team were monitoring the loss of GPS signal during the survey

Figure 3: The complete set of parcels of the Gaspar Garcia Laviana Cooperative



Source: ACH

An important result of the project is a map of the parcels owned by members of the community. These are represented on a geo-referenced map of the Santo Domingo community. On that map (scale 1:5000) are the 688 parcels that make up the cooperative, including eight forested areas and the important points such as rivers, roads and footpaths (see Figure 3). The type of crops being grown or soil use in each area of the cooperative can also be seen (coffee, basic grains, unused), along with land not yet incorporated to the cooperative and land for which individual titles have been granted.

Along with the process of compiling data, it was important to organise legal seminars for community members and cooperative leaders (see Box 4). These explained legal issues about the collective title and individual use of land

parcels within the cooperative. Attendance at these seminars was exceptional. Participation was very constructive.

The process appears to have been successful in resolving conflicts over land use. The inventory of parcels revealed several conflicts existing at the cooperative (see Box 5). These were either resolved when the land was surveyed in the presence of witnesses at the moment of surveying, or during assemblies of members of the cooperative.

After the land parcel surveys were done, the technical team and the leaders of Santo Domingo discussed how to organise the information collected – and afterwards, how the information would be accessible for the community. This discussion built on the earlier development of the field forms. The leaders of the community decided to order the information in a general and individual manner.

Box 4: Related workshops

ACH has organised other workshops in the community, tackling other subjects of communal interest and concerns, such as legal rights over natural resources in rural areas. Other legal issues discussed included the rights of Indigenous people, property rights, access to and land use, water, and forestry resources (fuelwood, animal life, vegetative material) that are used by different people sharing the same rural territory (owners, producers, users). The information was presented with a historical perspective, always relating rights, laws and practices. This allowed participants to exchange opinions and reflections, based on concrete examples taken from the territory and the community. Another workshop subject was the Nicaraguan law pertaining to the national cadastre, its objectives and functions, and laws relating to the combination of individual and communal rights in the management of land and local resources.

Box 5: Different conflicts related to natural resources use

Resource	Conflict	Nº of cases
Land	Disagreement in the drawing property lines	15
	Movement of monuments or landmarks	5
	Use of rights of way	2
	Appropriation of unallocated parcels	2
	Conveyance of land not paid	1
Forest	Advance of agricultural frontier into forestland	17
	Use of forestland on individual parcels	12
	Disagreement on land use near property lines	3
	Dispute over water use rights	2
Water	Poor management of wells on individual parcels	3

Feedback from the community was gathered during different workshops and debriefing meetings with technical staff and leaders. This has been ongoing since the project began. The ACH technical team has presented the results to the community in a general assembly and has accompanied the cooperative in the presentation of the results and their use. Once the project concludes, the Gaspar Garcia Laviana cooperative will continue to promote the prevention and protection of communal areas and has already presented its inventory of parcels to the Telpaneca mayor's office.

A paper registry of properties

Each owner that worked on the GPS survey received a boundary certificate, reflecting the features of his/her parcel. It is just a certificate, as the demarcation limits have not been validated by National Cadastre Institution (INETER). However, since the start of 2006, ACH has been in discussions with INETER about a forthcoming cadastre project. INETER are interested in the approach that we have piloted. This will hopefully lead to some official recognition and help to validate our community cartography approach.

A public file of the properties 'measured'

A printed file was made including all the information pertaining to the parcels and given to the cooperative. The file is made up of a copy of each Boundary certificate for the individual parcels. This information will be in the cooperative's 'public domain' and can be consulted by any member.

The database

The information collected during project implementation means there is now a database recording information that has been discussed, and on which the producers have reached consensus about.

Impact

The experience has created a demand for education and assistance at the local level. This has come from the three mayor's offices, two municipal development associations, indigenous people living in the province of Madriz, and from the national level Land Group.

The cooperative Administrative Board now has a property registry that can be updated, including the maps made and a database. Members of the community also received some legal training and an experience in conflict resolution that should allow them to deal adequately with any future

Figure 5: Boundary certificate

COOPERATIVA GASPAR GARCIA LAVIANA COOPERATIVE
BOUNDARY CERTIFICATE

PARCEL NO. OF THE PLOT	1
OWNER	Daniel Gonzalez
JOB	El Balamo
YEAR ISSUED	15
SURFACE DEMARCATED BY THE OWNER (M ²)	2 m ²
SURFACE MEASURED BY THE GPS (M ²)	2.8
PERIMETER (M)	60.4
GPS POINTS (Easting, Northing)	5

GPS: GABRIEL 42XL
DATELINE GPS: WGS84
COORDINATES: UTM/SPS

FINANCED BY: CALTAGUICIA

EXECUTED BY THE COOPERATIVE OF GASPAR GARCIA LAVIANA AND:
ACCION HAMBURG

WARNING: IS NOT A CADASTRAL DOCUMENT

Source: ACH

Presentation of the results in an assembly of members of the cooperative



Photo: ACH

problems regarding environmental and legal management (inheritances, buying/selling, etc.). The participation of the entire community throughout has meant it has taken ownership of the project.

One direct result is that the cooperative is now working with local authorities to manage municipal ordinance. This is to help ensure the protection of the forest area of Santo Domingo with the local authorities.

This project has also had a positive impact on the organisation of the cooperative. It has helped to clarify the differences between individual areas and public areas. The cooperative has become a local reference, and other cooperatives have asked for technical assistance. The idea of local technical staff is being developed in a national programme of training of local mapping technicians and the Gaspar Garcia Laviana cooperative has a potential technician for this programme trained by ACH.

Land demarcation, done in a participatory way, allows transparency. It can show how repartition between members has been done. For example, after the land demarcation process, some women approached the leaders of the cooperative. They had realised that women had received less land and that their plots were not of as good quality. Also, in the majority of the cases, conflicts were about access to resources. For example, owners wanted water sources on their plot of land, or owners, with properties near the forest area, wanted to enlarge their plot of land by deforesting.

This experience was implemented as a pilot project, with a methodology that has been directly applied by ACH technical staff. The aim is that in the future, local organisations and institutions will be able to do the same thing after

some training and technical assistance. The technology used is accessible and inexpensive. The Mapmaker software that we used is free, or at least low in cost when compared to other GIS software. The purpose of involving the mayor's offices in the process was to strengthen sustainability, as they also have tools and their own safe installations at which to store information and to follow up on results.

Regarding the duration of leases and security of tenure: in this case neither issue was addressed. But both have been improved by the fact that individual boundaries inside of the cooperative's common title of property have been defined and are now known by all the members – so there is more transparency. When there is no assembly to adjudicate (such as in a cooperative), the discussion could be organised in a community meeting with the leaders of the community.

Conclusion

This activities developed in the community of Santo Domingo corresponded to a demand for an adequate, local and a low cost solution to deal with land use, the local resolution of conflicts, and also for a local mechanism for territory planning. The cost per hectare, unlike large land surveys, has been very low (approximately US\$7–10 per hectare including training and participation). In Telpaneca, the cost of legalisation is around US\$70 per Manzana (0.7ha). But first, the cooperative had to identify the boundaries of each of its members. This demarcation is the first step before starting any legalisation process. One cadastre specialist told me that costs for international projects are around US\$100/ha. Similar experiences in Africa appear to cost around US\$17.

It should be added that the cooperative is well organised and its members are very much involved. These were also key factors in the success of this experience. We believe that to replicate this experience, others should focus on both community organisation and leadership. To succeed, the methodology needs the strong participation of the community throughout the process. In Santo Domingo, participation was important. But equally so was the involvement and motivation of the cooperative leaders. At the end of the project, they followed with the presentation of results to local authorities of the province of Telpaneca and they succeeded in having a municipal ordinance that mentioned that the community was in charge of managing the forest area.

This project has also the potential to be replicated, as both the context and the participatory approach can be

easily adapted. Since this first experience, the methodology has also been used in the demarcation of limits in the community of Las Sabanas in Madriz, with local authorities' contribution.

It also has the potential for local participatory management of natural resources. It allows for graphic reconnaissance work, and promotes participatory discussions about situations. The process also led to a spirit of positive discus-

sion, an exchange of views, and broad consensus within the community about the final boundary maps. All these elements tend to strengthen the concept of social participation as an important mechanism to find lasting and sustainable solutions. Furthermore, recognising all the actors involved in decision-making could be the best way to generate positive changes – not only in the management of natural resources but also in sustainable territory planning.

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