
SECTION V
DISCUSSION AND ANALYSIS OF THE URBAN TITLING UNIT (OTU)

The final constraint is at OTU. This is the problem of indemnization: No titles can be issued until the former owner is paid. In terms of process, to obtain a title on land claimed by a previous owner, title cannot be granted unless the prior owner has been indemnified by the government. In other words, title should normally pass from the prior owner to the state via indemnification, and then from the state to the present occupant. This involves a complicated process with the Oficina de Cuantificación de Indemnizaciones together with OOT and Catastro Fiscal.

Once OTU receives verification that a former owner has been paid, it proceeds to have the parcel inscribed in the name of the State. Then, INETER can divide that larger lot into the small urban parcels. Once this is done, OTU drafts an *escritura*, a legal document which transfers the lot from the government to the new owner. This is then inscribed at the registry, and a title is given to the new owner.

Of 87 neighborhoods investigated by OTU, 23 were in hands of the state or institutions of the state. Consequently, these could be issued *escrituras* as soon as survey information was ready. The *escrituras* would then be presented to the registry for inscription. Once inscribed, the occupant could be given a title.

However, on 54 of these 87 *barrios marginales* remain titled to former owners. This means that there are about twice as many in private hands as in public hands. Ten more remain in a mixed state of public and private ownership, complicating the process. Until these lands are state property, no *escrituras* can be issued.

Although OTU investigated 87 neighborhoods, there are a total of 166 *barrios marginales* that need titling. Because of a lack of physical cadastral information from INETER a complete picture of the neighborhoods is impossible at this point, and OTU is prevented in its review of the other neighborhoods. Interestingly, more former owners could be compensated if accurate, up-to-date geodetic survey information existed. Correct boundary definitions are crucial to OTU's effort to provide adequate compensation. If digitized boundary information was available, INETER could overlay current *barrio marginales* boundaries on old cadastral maps and more accurately determine where *barrio marginales* overlap public (state) or private lands. This would facilitate the process of approving or deny former land owners claims and generally ameliorate the indemnization process.

A political agreement to deny former owners the remedy of recuperation of the asset and allow for only monetary damages would allow the state to get its hands on the property

sooner. This would remove the constraint of lack of state ownership. However, such a solution may not have a consensus either domestically or internationally.

Interestingly, when compensation has been paid, and survey information is available, OTU works quickly. For example, in the Annex to Villa Libertad, there are about 1200 individual parcels looking for title. Cadastral information was complete in February 1995. Legal research at the registry was also completed that same month. Legalization of the parcelization was completed in April 1995, with 705 *constancias catastrales* (survey information cards needed for titling) being issued. Almost instantly, 700 *escrituras* were then issued from OTU. But then OTU hit the registry bottleneck. Only 450 of those have actually been registered and inscribed.

Currently, OTU is processing 5,000-8,000 *escrituras* per month from the government's lone notary. This could easily be increased by adding a second or third notary, complete with assistants and equipment. This would double or triple production.

SECTION VI CROSS-CUTTING THEMES

Complicating the titling effort is an organizational structure that makes coordination difficult. Dispersion of land administration among units of government. The fiscal element remains inside the Finance Ministry, as does CNRC, OTU, OCI and OOT. The legal description of property is under the control of the Supreme Court. The physical description of the land falls under the purview of the *Ministerio de Construcción y Transporte*. The attorney general for property is an employee of the Justice Ministry.

Similarly, there are various donors involved in differing initiatives with different timetables. UNDP has supported the Catastro Municipal through its HABITAT Program. This is basically an urban, fiscal cadastre, property maps are being digitized, where available, and updated or created where possible. The software being used is Integraph's Micro Station (a CADD software that is used in many places as the base software for GIS/LIS) and SysCAD (a relational data base developed for the UN and used in other LIS, notably in Bolivia). The Mayorality of Managua insists that this equipment be used exclusively for the Managua fiscal cadastre.

The World Bank program is trying to address national organizational needs in the area of the cadastre. It is funding a nationwide geodetic survey and updating of the national network of geodetic control points in rural areas in support of a long-term program whose aim is to modernize the land administration. The end product of this will be the implementation of a multi-purpose cadastre (or multi-purpose land information system - MPLIS). The estimated completion date for this project is June of 1998.

In the urban areas, the Vice Minister for Property's program with the IDB/UNDP is supporting an attempt to title 100,000 small urban lots, mainly in Managua, within 18 months. This information will complement the World Bank's program. If all three programs, the HABITAT, World Bank program, and the IDB/UNDP program, are successfully completed, the end product should be a fully functioning MPLIS.

Finally, the Mayorality of Managua is issuing its own "adjudications" for small urban lots (only applicable to its own property). These adjudications may or may not have any legal authority, and are done without any geodetic survey information for the parcels.

Another concern is compatibility of hardware, software, data collection standards, and mapping standards. Any hardware or software purchased for use in processing and analyzing spatial information should be compatible with the equipment in the country. A recurring theme in conversations with many government officials is the long term objective of putting in place a MPLIS for the whole country of Nicaragua. If the MPLIS is to have full

functionality, incorporating data from multiple agencies and being of use to multiple agencies and organizations, then data collection standards must be decided upon and followed, and all data must be referenced to common control points (these points should be geodetic control points established by INETER). Also, hardware and software must be standardized in order to facilitate the integration of this system.

One example of how information could be shared through the creation of an MPLIS is in the area of cadastral information. For the cadastre, INETER could be made the steward of the physical cadastre. It would be charged with collecting and updating information relating to parcel size and location (i.e. geodetic information). INETER would write this information into the system. All other users (such as the registry, fiscal cadastre, etc.) could read this information and print it out, but they would not be able to access and change the information. Similarly, the registry would be the steward of information relating to parcel ownership. They would be able to update and change this information. Other agencies that need this information could read and print out the information for their own use, but they would not be able to change it. Through this type of system, redundancy of information gathering and entry would be decreased, and information accuracy and speed of accessing this information would be increased.

At present, the coordination that is needed to make this type of system a reality is lacking. Different government agencies are collecting similar information and re-recording the information. Often this information is collected to differing standards, and graphics produced from this information are produced to differing standards, making comparison and exchange of information across agencies difficult if not impossible. This also means that much on-going data collection within the government is wasted. Exemplifying the frustration felt by this wasted effort, the President of INETER noted that, even though many of the state agencies (such as electricity and sewage utilities) have received Integraph's Micro Station software from different donors to help them manage their facility networks, because of differing or non-existent standards, these agencies produce pretty pictures, while only INETER and INRA produce accurate maps. The implementation of standardized procedures and mapping standards would go a long way to reduce this phenomenon and also to improve the efficiency and decrease the costs of many of the GON responsibilities.

SECTION VII CONCLUSIONS AND RECOMMENDATIONS

Can 100,000 urban parcels be titled in 18 months? The clear answer is no. And they will not be titled in even a longer period without a more substantial investment. The INETER proposal itself takes up most of the approximately US\$500,000 project budget. This leaves problems at the Registry and OTU unaddressed.

Below are specific recommendations for action in each of the relevant institutions.

A. INETER

If it is decided, given all the competing interests involved in the geodetic surveying of the *barrios marginales* of Managua, that the best way to accurately survey all of the parcels in the 166 *barrios marginales* is through the use of photogrammetrically corrected aerial photographs, then INETER's proposal and the specifications laid out in their proposal are complete. If a contractor is hired using these specifications, then the completed product should be adequate, in most cases, for delineation of the property boundaries on the photograph. Given this, there is one specification that could be added to the technical specifications for the aerial photography contract. This is the addition of a GPS receiver connected to the camera unit. This would allow for the inclusion of a control point at the principle point of the photo (if the coordinates are differentially corrected).

Still, there are potential problems with choosing the photogrammetric option. The two most notable are:

- 1) Timing. As was mentioned earlier, it will take at least 6 to 8 months to go through the contracting out of the project. This will make it difficult to finish the geodetic surveying of all of the parcels in the 18 month timeframe, let alone, deliver titles to all of the parcels during that time frame (given the other current bottlenecks in the process).
- 2) Identification of parcel boundaries on the photographs. The key to accurate aerial surveying is the ability to identify boundaries between parcels on the aerial photographs. From our short tour of six barrios in Managua, it appears that this may not always be possible. While it is true that most parcels have identifiable boundaries, in the form of walls, fences, and/or trees planted on the boundaries, it is also true that the trees, especially in the older *barrio marginales*, obscure the exact location of the boundaries from the air. In cases where this is true, it will be necessary to do some

form of ground surveying in order to accurately place these boundaries on the cadastral map. This limitation will decrease the effectiveness of the aerial surveying.

With these concerns in mind, we would like to suggest two other options that INETER may wish to consider.

I. GPS Survey.

This option is based on work that the Land Tenure Center has done in conjunction with the Albanian Land Privatization Project.¹² In brief, this methodology consists of surveying in first order/second order control points with the use of differential GPS. A GPS receiver is set up as a base station (in this case in Managua). At least one GPS receiver is used as a rover in the field. With this receiver first and/or second order control points are located¹³ and monumented.¹⁴ Next, traditional methods (theodolite and tape) are used to survey in the parcels from the first/second order control points.

¹² An explanation of this methodology is found in Barnes, ASPRS article, February 1995.

¹³The readings taken using the rover GPS will have to be differentially corrected in order to get the level of accuracy needed to consider these as first/second order control points. Differential correction of the points should be done every evening (or the next day) after the field surveying with the GPS has been done. It must be done before the surveying of the parcels are carried out. One warning: the accuracy of the GPS points will be contingent on the GPS surveying method used and/or the amount of readings taken by the GPS receiver at each point (i.e. the amount of time the receiver is located at the point). In Albania, sub-meter accuracy (+/- 50 cm) was obtained with 6 readings (30 second occupation time) using the C/A code differential positioning with carrier smoothing and advanced processing method. Increased accuracy could be obtained by increasing the occupation time at each point. See Barnes et al. "The Design and Comparative Evaluation of a GPS Methodology for Cadastral Surveying and Mapping in Albania." LTC Publication. September 1994.

¹⁴In the barrios in Managua it was noted that manhole covers would be ideal locations to use as first and/or second order control points as they are already on the ground in the barrios, are immovable, and can also be seen in 1:5000 scale air photos (and thus could be used as ground control points for the aerial photography - if it was flown in conjunction with the surveying or at a later date).

Comparison of the "Wisconsin Model" in Albania vs. traditional tilting models				
Jurisdiction:	Timeframe	No. of Parcels	Cost per parcel for Survey	Cost per parcel for titling
Albania	11/94 to 7/95 (10 months)	approx. 72,000	\$3 to \$5	\$1
Honduras	9/83 to 10/87 (49 months)	94,028	\$120	\$35.20
Ecuador	4/87 to 10/87 (6 months)	74,972	\$50	\$167
St. Lucia	12/84 to 4/87 (29 months)	approx. 52,000	\$96	\$39

Sources: J.D. Stanfield update on 7/14/95 for Albania. G. Barnes, "A Comparative Evaluation Framework for Cadastre-Based Land Information Systems (CLIS) in Developing Countries" (Land Tenure Center Research Paper 102, 1990) for Honduras, Ecuador and St. Lucia.

Advantages:

- 1) **Timing.** Given the possible delays in starting the aerial photography, this method may be faster. As soon as the GPS units are obtained and personnel are trained, the locating of control points could be started, differential corrections done, and then parcel surveying completed.
- 2) **Employment.** While it will take highly skilled individuals (in this case--2 individuals to lead the teams doing the GPS surveying) to identify and survey in the control points, the surveying of the parcels with traditional methods could be done by surveyors leading teams of lower skilled individuals. This may be advantageous given the unemployment problems in Nicaragua.
- 3) **Better identification of parcel boundaries.** Given the reality of boundary obstructions due to trees along parcel boundaries, on the ground surveying can avoid these problems.
- 4) **Because immovable objects will be used as the first and second order control points,** aerial photography taken at a later period can be post-facto included in the cadastral information base provided by this method.

- 5) After using the GPS units to establish first order control points in all of the barrios, the units could be used to survey in the individual parcels concurrently with the traditional methods. Carrying out the two methods concurrently could increase the speed with which the parcel surveying is done. Also, a test comparing the two methods' speeds could be devised on the fly, to see if it might not be faster (and more accurate) to use GPS to geodetically survey all parcels.

Disadvantages:

- 1) Accuracy. The method as used in Albania only yielded +/- 50 cm. accuracy for points surveyed in using GPS. This accuracy can be increased, but it will mean that occupation time of the GPS units at each point will be increased. In Albania, occupation time was 30 seconds in order to get the +/- 50 cm accuracy, it has been suggested that one may need to be located at a point for between 30 - 60 minutes in order to get the +/- 5 cm that INETER considers first order accuracy. This amount of time per point will decrease the speed with which the surveying can be done. Given this, if 4 first order points are to be identified in each *barrio marginales*, a reasonable estimate of the time needed would be 42 days (1.5 months). If eight first order points, 84 days (3 months). However, as soon as first order points are surveyed in a *barrio marginales*, the teams using traditional methods can start to survey individual parcels within that *barrio marginales*.
- 2) Cost. A cursory examination suggests that this method will cost more per parcel (in dollar figures) than the per parcel cost of photogrammetrically surveying the parcels. However, this is a rough estimate. When it is considered that even with the photogrammetric surveying, a certain amount of ground surveying will need to be done in order to fill in parcels that are obscured from the air, costs may be similar in the long run. A more thorough study of the cost comparisons should be done before this is considered a definitive disadvantage.

II. Mixed Aerial Photography and GPS Surveying

This method would be a hybrid of INETER's proposal for photogrammetrically surveying the *barrio marginales* and the GPS surveying presented above. There are two scenarios from this proposal.

One would be purchasing all of the GPS equipment necessary now, using the GPS receivers to locate first and second order control points in the *barrios marginales* that are identifiable from the air, and starting the process of using traditional methods to survey parcel boundaries. When the contracting process is complete, procure the aerial photography and use photogrammetrical methods to delineate parcel boundaries in those *barrio marginales* not yet complete. Where parcel boundaries can not be identified on the photographs, continue to use traditional methods in order to survey the boundaries.

The second scenario would be to start now and use GPS receivers to identify first order ground control points in the barrios for the aerial photography. Next, contract a firm for carrying out the aerial photography, procure the aerial photography and use photogrammetrical methods to delineate parcel boundaries for all of the boundaries. Finally, for those parcels whose boundaries are obscured in the photos, use traditional methods to survey the boundaries.¹⁵

¹⁵It should be noted that INETER currently has aerial photography for some of Managua that was taken in 1993. This photography was taken using a recalibrated 1967 Zeiss camera that had been mounted in an aircraft from the Sandinista Air Force (the plane crashed before the whole city could be flown). If this option is chosen, INETER could start the photogrammetrical portion using these photos.

Advantages and Disadvantages of the Two Approaches:			
First Scenario		Second Scenario	
Advantage	Disadvantage	Advantage	Disadvantage
Timing. Because work could start right away, the surveying could be done in a more timely manner.	Two methods will be used instead of one. Because traditional geodetic surveying of parcels will be done before the boundaries are located photogrammetrically, questions of methodological consistency may be raised. If this option is chosen, it may be necessary to photogrammetrically delineate parcel boundaries in <i>barrio marginales</i> where surveying is already completed in order to compare the precision between the two methods being used and verify that they are comparable.	Because all of the parcel boundaries that are viewable from the air are being delineated through photogrammetric methods, issues of comparability between methods will be less critical. It may still be necessary to verify comparability between the methods.	Timing. Because surveying work would have to wait until the aerial photography is obtained, the process of surveying parcel boundaries may be slower if this scenario is used.

Recommendations:

- 1) If cost is the overriding concern the proposal as presented by INETER may be the best option for geodetically surveying all of the *barrio marginales*' parcel boundaries. However, before this is definitively decided, a more in-depth cost analysis of all of the methods outlined above should be carried out. Specifically issues of how much surveyors cost a day should be identified.

- 2) If the timeframe is the major concern then option II, scenario 1 should be considered. This hybrid method may be the best way to cover all of the bases: carry out geodetic surveys of all the parcels in a timely manner, provide the other interested parties with aerial photographs of Managua and, also, provide increased employment opportunities while not expending the amount of resources that could potentially be needed to carry out option I.

Other recommendations:

- 1) In order to help INETER obtain an initial estimate of the number of parcels within the different *barrio marginales*, INETER should collect information from other government agencies that provide services within the barrios. Examples of the type of information that could be available follow.

From our afternoon tour of six *barrios marginales*, it appeared that the majority of the *barrio marginales* have sewers in them, electrical lines, and that many of the parcels have water lines. If these utilities were put in by the Mayorality or by the utility in question, then there may be sketch maps of these lines (sewers, water lines, and electrical lines) available through the Mayorality or the utility. These sketch maps could give INETER's surveyors rough estimates of the layouts of the barrios and possibly the number of parcels in each *barrio*. This information could help INETER plan its surveying strategy.

Information such as this could also be tied to the cadastral maps, produced by INETER, to create an MPLIS. Even if the utility and Mayorality sketch maps are not currently geographically accurate, they could be digitized and known points on the digitized sketch maps could be geographically identified. Then, through a process called "rubber sheeting" the maps could be brought into rough geographical accordance with the cadastral maps.

2. As already noted, INETER has a Pentium PC, plotter, printer equipment, and software that can be used to create and house a computerized land information system. With this project they will be obtaining more equipment, that will further increase their capacity. However, it does not appear that they currently have, nor does it appear that they have requested, a tape backup system. With the amount of information they have already digitized, and the amount they hope to process in the next 18 months, INETER's system should have a tape backup and backups of all of their information should be made on a daily basis. Without a tape backup and the regular backing up of the system, if the hardware crashes, all of the progress made by INETER could be lost.
3. A local area network (LAN) should connect all of INETER's hardware. This would facilitate the creation of an MPLIS. As more agencies are brought on-line the possibility of creating an inter-agency network should be investigated. For a truly

functional MPLIS to be established, all of the agencies, departments and offices that deal with land information should be connected over a network.

4. A GPS strategy for the country should be devised. One option that INETER may want to pursue is to permanently set up a GPS base station in Managua. This base could be set to permanently download the information needed for differential GPS. If private surveyors invest in GPS receivers that can be used as rovers, they could then buy the information needed to differentially correct the position locations that they collect with their rovers (or INETER could provide the service). This would make GPS surveying much more accessible to the average surveyor, and could also speed up the surveying process (and potentially lower costs) in the country as a whole. It would also allow INETER to recover some of the costs of the GPS base station.
5. In conjunction with the previous recommendation, INETER should consider locating a GPS base station on its office's grounds. A base station should not be left unguarded, where it can be damaged or stolen. It should be in a secure location.
6. Regarding the parcel surveying in the *barrios marginales*. Currently, INETER does not survey lots in areas where the occupant is on land unsuitable for habitation (i.e. near waterways, roads, parks, etc.). Rather than not survey these lots, INETER may wish to survey these lots, but not for titling purposes. Instead, the lots would be noted on cadastral maps as in need of relocation. This information would then be useful in calculating expenditures needed for relocating/evicting families from these areas. This information will enable proper planning and execution of more orderly neighborhoods. It will also provide health hazard and disaster prevention data.
7. In carrying out future survey work in Managua, INETER should seek to continue its policy of working with local community representatives to insure that all boundaries are agreed upon. Given the increased speed at which INETER hopes to work, it may need additional assistance to publicize its efforts. Such communication should be tailored to and targeted at the specific community to be surveyed.
8. To the extent that computer equipment is the limiting factor in processing of maps, INETER should reorganize to allow for 24 hour a day use of the computer equipment, working in shifts. This would functionally triple the computer access INETER currently possesses.
9. The Municipal Cadastre has had difficulties in coordinating information exchanges with INETER. It is suggested that the municipal officials be given office space within the INETER facilities, and that the municipal cadastre be relocated to that office. With a network established at INETER, the municipal (fiscal) cadastre would become part of the physical cadastre, thus initiating the first phases of an MPLIS.

Why does INETER need such exact survey information?

Any registry system is only as good as the maps it is based on. Many registry titling systems, including most of the standard, formal systems in Latin America, record the boundaries of land using north, south, east, and west coordinates.¹⁶ If property boundaries are not exactly rectangular, or if they do not exactly face north-south and east-west, this system of description of land produces gaps and overlaps. This means land can be legally and formally titled twice or not at all, depending on the location of the property.¹⁷ Thus, even the formal registry systems create uncertainty of tenure in many cases simply by the way they are designed, even in the absence of fraud or negligence. This makes field verification and mapping essential ingredients in any land titling program designed to reduce tenure insecurity.

B. PROPERTY REGISTRY

Currently, new titles to beneficiaries are being processed free of charge. The World Bank has agreed with the Vice Minister of Property to make Managua its pilot project for modernization of the registry. This will be an important contribution to urban tenure security. However, as the timeframe for the World Bank is much longer than the UNDP urban titling initiative, other measures are needed. These are detailed below.

¹⁶ J. David Stanfield, *Rural Land Market Implications of Titling and Registration Programs in the Latin America and Caribbean Region 5* (1991) (Land Tenure Center Report).

¹⁷ A similar phenomena occurs in the U.S. See Werner & Kratovil, *supra* note 25 at 258-9.