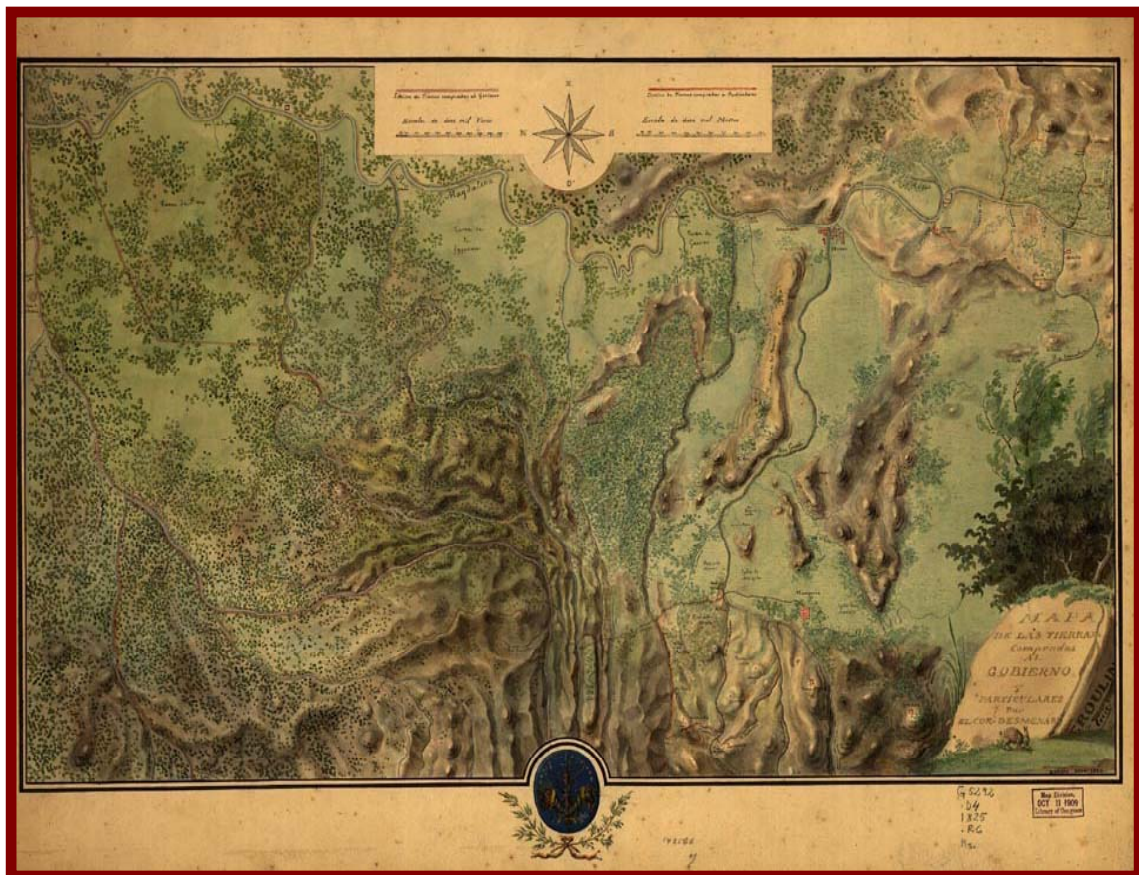


Feasibility of Creating a Comprehensive Real Property Database for Colombia

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(slight revisions for 2003 web version)

(The findings, perspectives, assertions and opinions expressed in this report are those of the author alone and do not necessarily reflect or represent those of the United States Army, The United States Government or any part of it.)

Comments, corrections, and suggestions are invited by the author. Please address them to demaresg@leavenworth.army.mil



Regarding the illustration on the title page:

Titled Mapa De Las Tierras Compradas Al Gobierno Y Particulares Por El Coronel Desmenard (Map of the Lands Purchased from the Government and Private Persons by Colonel Desmenard), this image of an 1825 property map was taken from the “Luso-Hispanic World in Maps” collection of the Library of Congress. The original, by Roulin (NFI) is colored pen-and-ink, 39x59cm. at a scale of approximately 1:125,000.

On the Library’s website is found the following caption material: “In 1819, a political union of the present-day nations of Venezuela, Colombia, Panama, and Ecuador was achieved. This federation known as Gran Colombia was led by Simón Bolívar. Much of Bolívar's efforts involved establishing a nation and government in the midst of the continuing struggle for independence from Spain. Despite attempts to consolidate the central government in Bogotá, the period between 1819 and 1830 witnessed considerable internal dissensions that climaxed with the secession of Venezuela and Ecuador from Gran Colombia in 1830. During that time, Gran Colombia arranged for a loan of £2,000,000 sterling from Great Britain. In partial repayment of the loan, British creditors were granted lands in various provinces of Gran Colombia which they in turn attempted to sell to immigrants. This motivation appears to be the impetus for the commissioning of this detailed and beautifully rendered map of a portion of Mariquita Province (now Tolima Department) west of the Magdalena River. Map includes roads, streams, towns and settlements, delineation of government and private lands, and carefully rendered pictorial representation of vegetation, cultivated fields, and relief. ... Contemporary background information for the colonizing schemes can be found in Alexander Walker, Colombia: Being a Geographical, Statistical, Agricultural, Commercial, and Political Account of that Country (London, 1822).”

Summary of Results and Recommendation

The Defense Intelligence Agency asked the Foreign Military Studies Office (FMSO) to determine the feasibility of producing a digital database of Colombian real property, and to express the usefulness of such a database. The resulting study determined that it is feasible and highly recommended that such a database be constructed.

United States government foreign policy decisions pertaining to Colombia are inadequately informed if made in the absence of intelligence regarding the ownership of real property.

Only a few years ago such an assertion would have been not only curious but unreasonable -- not so much because property ownership did not influence political actors in foreign countries, but rather because such intelligence could rarely be had. Even when US decision-makers recognized the potential benefits of knowing who owned what in foreign countries, the intelligence challenge was generally insurmountable, at least beyond immediate and anecdotal investigation. Today, property data can be obtained, organized, analyzed and presented in ways that support foreign policy and strategy. A convergence of new technologies, including global positioning satellites, and expanding technical protocols, such as the National Spatial Data Infrastructure, makes provision of property intelligence practicable. The implication for the intelligence community is compelling: Property ownership intelligence should figure along with economic, political, social and military intelligence as part of the suite of product types regularly provided by the intelligence community.

The potential uses of this property information include, but are not limited to support for asset forfeiture or denial; precision eradication of illicit crops; money laundering tip-off; alternative development control and contract monitoring; prediction and prevention of human rights violations; avoidance of collateral damage in military operations; support of territorial military strategies; improved understanding and expression regarding economic effects of aid projects; long term capital creation; corruption limitation; improved disaster relief planning; support to ecological protection strategies; and equitable tax assessment practices.

A property intelligence program would be especially valuable in Colombia because of the variety of uses to which the data can be put, and because a great deal of effort and money has already been expended by developmental agencies toward modernizing the Colombian real property ownership regime.

Recent on-site research in Colombia suggests the following regarding the potential to develop property intelligence there.

- Real property ownership data in digital form covering thirty percent of Colombia's surface (an estimated sixty percent of formally owned parcels) is available for purchase and can be obtained and processed for use within six months to a year.

- Complete ownership information on another twenty percent of the surface of Colombia (an estimated additional thirty percent of the owned parcels) can be obtained and

processed for use within twelve to twenty-four months, but will require a combination of records digitization, completion of some basic cartography, plat surveying and title clarification.

-- Property ownership on the remainder of Colombia's surface (and the remaining percentage of the parcels) can be formalized and the corresponding data obtained within two to four years, but will require completion of basic cartography, plat creation and surveying, and title establishment.

The Colombian government is attempting to formalize land ownership throughout the country and to digitize the related data. As it is now, results of that effort will not be realized for several years at best. Moreover, there is a strong possibility that the resulting data will not be totally transparent, or not provided in a timely and comprehensive manner to USG agencies. A multi-agency program of assistance can be implemented to accelerate the Colombian government cadastral program, foster and monitor transparency, and gain timely use of digitized and digitally mapped description, ownership, use and value data for property throughout Colombia. This data would be unclassified, openly obtained and could be made available to the full range of GOC and USG participating agencies. A portion of the data could be made available on a public Internet site.

The value of real property information is multiplied when applied in the context of other Global Information Systems (GIS) data. In Colombia, readily available unclassified GIS data includes humanitarian, ecological, energy resource, demographic, political, geophysical and general infrastructure information. An optimal program of assistance designed to assemble a comprehensive property database, mounted within the context of a full range of GIS information, would cost an estimated *twenty million dollars* over a three-year period.

The author recommends that a coalition of benefited agencies (perhaps to include DoD, DoJ, DoS, NIMA and USAID) sponsor a Colombia GIS database project featuring real property ownership data as outlined in this report. A suggestion regarding expenditures and responsibilities can be found in Exhibit F. The funding distribution as proposed therein is abbreviated as follows:

NIMA	\$1,700,000.00
DoJ	\$3,000,000.00
DoD	\$7,000,000.00
USAID	\$8,300,000.00

Feasibility of Creating a Comprehensive Real Property Database for Colombia

Contents:

Summary of Results and Recommendation	3
Glossary:	7
Introduction.....	8
<i>Overview</i>	<i>12</i>
<i>Asset forfeiture or denial</i>	<i>12</i>
<i>Precision eradication of illicit crops</i>	<i>13</i>
<i>Money laundering tip-off</i>	<i>13</i>
<i>Prediction and prevention of human rights violations</i>	<i>14</i>
<i>Avoidance of collateral damage in military operations</i>	<i>14</i>
<i>Support of territorial military strategies.....</i>	<i>14</i>
<i>Understanding and expression regarding economic effects of aid projects.....</i>	<i>16</i>
<i>Alternative development contract monitoring</i>	<i>16</i>
<i>Long-term capital creation and corruption limitation.....</i>	<i>17</i>
<i>Improved disaster relief planning</i>	<i>18</i>
<i>Equitable tax assessment practices.....</i>	<i>19</i>
<i>Support to ecological security strategies.....</i>	<i>19</i>
Current Condition of Property Ownership in Colombia.....	19
<i>Overview</i>	<i>19</i>
<i>National cadastral office.....</i>	<i>20</i>
<i>Bogotá cadastral office</i>	<i>21</i>
<i>Cali cadastral office.....</i>	<i>22</i>
<i>Medellín cadastral office</i>	<i>22</i>
<i>Antioquia cadastral office.....</i>	<i>23</i>
<i>Land registry offices</i>	<i>23</i>
<i>Professional real estate boards</i>	<i>23</i>
Potential for development of the property regime.....	24
Description and Availability of Related GIS Data.....	25

<i>Overview</i>	25
<i>Geographic studies at IGAC.....</i>	25
<i>Land-use planning</i>	26
<i>Colombian Geographical Society.....</i>	27
<i>Colombian academe.....</i>	27
<i>Regional and Local GIS data.....</i>	28
<i>Holdings of other Colombian federal agencies</i>	28
<i>Holdings of commercial firms.....</i>	29
Plan for Acquiring Comprehensive GIS Data Featuring Property Information	29
<i>General considerations.....</i>	30
<i>Organizations and activities</i>	30
1. A GIS data clearinghouse.	30
2. A scholarly forum.	32
3. Data acquisition effort.....	33
<i>Cost and Time</i>	35
Assumptions, Challenges and Shortcomings.....	35
Diplomatic and Institutional Support Requirements.....	37
Recommendations.....	37
 Exhibit A: (not included, TBP) Mapping Colombia: The Correlation Between Land Data and Counter-terror Strategy	
 Exhibit B: (not included, TBP) Development of property intelligence	
 Exhibit C: (not included, TBP) Selected additional materials	
 Exhibit D: Initial research prospectus	
 Exhibit E: (not included, TBP) Curriculum vita of researcher	
 Exhibit F: (not included, TBP) Proposed Budget & Task Matrix	

Glossary:

AUC	United Colombian Self Defense Forces (<i>Autodefensas Unidas de Colombia</i>) At the time of this report, the AUC was supposedly in the process of disbanding, a follow-on force called the National Self Defenses Movement, MONA, to take up some of the slack. The AUC has been the second largest armed outlaw organization in Colombia with perhaps as many as 8,000 armed fighters. The AUC and the FARC are enemies.
Cadastre	A public record of property boundaries and related ownership, use and tax information. 'Cadastral' is the adjective.
ESRI	Environmental Systems Research Institute, vendor of ArcGIS software. ArcView and ArcInfo are lesser-included, compatible licenses in the ArcGIS product line.
FARC	Revolutionary Armed Forces of Colombia, also referred to as the FARC-EP or Revolutionary Armed Forces of Colombia - People's Army (<i>Fuerzas Armadas de Colombia – Ejército del Pueblo</i>). The largest of the outlaw armed forces facing the government, with perhaps as many as 16,000 armed fighters. The FARC and the AUC are enemies.
FMSO	Foreign Military Studies Office, Ft. Leavenworth, Kansas. The Foreign Military Studies Office is dedicated to the study of emerging threats and creative methods of addressing these threats. It belongs to the Training and Doctrine Command of the United States Army.
GIS	Geographic Information Systems (common reference to digital, geographically specific data and related systems used to collect analyze and display it).
GOC	Government of Colombia.
ICDE	Colombian Spatial Data Infrastructure (<i>Infraestructura Colombiana de Datos Espaciales</i>) a Colombian interagency GIS cooperation agreement.
IGAC	Colombian National Geographic Institute (<i>Instituto Geográfico Agustín Codazzi</i>).
NIMA	The United States' National Imagery and Mapping Agency.
Raster Image	An Image scanned to digital format and composed of individual pixels. The image quality of a raster image is higher than a vector image, but changing the size of an image adds or subtracts pixels from the image, changing its composition. When a printed map is scanned on a standard scanner, a raster image is produced. The image has been 'rasterized.'
Vector Image	An image composed of shapes, rather than individual pixels. The shapes used to create the image are defined by sets of instructions (mathematical formulas). Resizing a vector image does not change its quality. When a printed map, or a selection of lines and areas on the printed map are converted to a vector image, we say it was 'vectorized' or 'live digitized.' The image is 'live' because the vectorized image can be manipulated in a variety of ways that a rasterized image cannot. In order to allow all the forensic uses to which land ownership data can be put, it is necessary to vectorize property (cadastral) maps.

Feasibility of Establishing a Comprehensive GIS Property Ownership Database for Colombia

Introduction.

In May 2001, the Foreign Military Studies Office (FMSO) accepted from the Defense Intelligence Agency's Counternarcotics Office the task of determining the feasibility of producing a digital database that would include boundaries, ownership, use and value of real estate throughout Colombia. The National Imagery and Mapping Agency (NIMA) was informed of and participated in the initial steps of the investigation by way of their liaison to DIA. The Defense Attaché Office, Bogotá hosted the research team while in Colombia. The findings and comments in this document are those of the author. The methodology and extent of the research effort used as the basis of these findings is presented in Exhibit D. The curriculum vita of the author is provided as Exhibit E.

The author anticipates that the audience does not have to be convinced of the importance and utility of comprehensive property information. However, readers new to the issue are invited to read the materials provided in Exhibits A and B. The research was inspired by assertions that:

1. There is a positive correlation between formal land ownership and material progress;
2. There exists a complementary relationship between formal land ownership and social peace;
3. Informally owned and unregulated land ownership favors illicit land use and violence;
4. Property manipulation is an overlooked dimension of outlaw political and military strategies and behaviors;
5. Collection of property information on a strategic scale is made feasible by new technologies; and
6. Property information can be used in support of law enforcement, military, developmental, economic, and diplomatic decisions and programs;

Therefore, some effort should be mounted to obtain and organize property data in support of USG decision-making. Specifically as to Colombia, the following general conditions pertain to the potential availability of useable, precise property information:

-- Real property ownership data in digital form covering thirty percent of Colombia's geography (an estimated sixty percent of formally owned parcels) is available for purchase and can be obtained and processed for use within six months to a year.

-- Complete ownership information on another twenty percent of the surface of Colombia (an estimated additional thirty percent of the owned parcels) can be obtained and processed for use within twelve to eighteen months, but will require a combination of

records digitization, completion of basic cartography, plat surveying and title clarification.

-- Property ownership over the remainder of Colombia's surface (and the remaining percentage of the parcels) can be formalized and the corresponding data obtained within two to four years.

The Colombian national cadastre office (a subordinate office of the Colombian National Geographic Institute (*Instituto Geográfico Agustín Codazzi*, IGAC) has established an objective of formalizing land ownership records for all Colombian territory within its competence by the end of 2005. Any US initiative based on the findings herein should include as a goal the accelerated completion of this Colombian objective. In return for funding and technical assistance in meeting the goal of full formalization and modernization of property ownership, the USG should require complete transparency of records and possession of copies of all basic database files (likewise as to the four independent cadastral offices in Colombia, discussed later in this section).

A disproportionate amount of illicit activity naturally occurs in the least-regulated 10% of plots and 50% of surface area. In addition, some of the most important forensic benefits of land records formalization would be foregone if the last 10% of owned parcels and 50% of surface area were not included in the formalizing process. Long-term societal benefits of a transparent, accurate regime of land ownership, value and use information will accrue if all Colombian land is brought into the regime. The cost of achieving formal property ownership for the last 10% of the surface area could, unfortunately, be as much as the previous 60% depending on the physical security challenge.

There is no place in Colombia where cartography, cadastral formation and digitization of registry files cannot be speedily accomplished, although in some areas this may require military or police escort for the protection of administrators, surveyors and other technicians. Several outlaw elements exist for whom the extension of the legal property regime is obviously not beneficial. While the creation of files and precise mapping does not assure government presence and authority in such outlaw areas, the creation of digital files (with their characteristic permanence and visibility) provides a useful tool for extension of government presence and authority. Moreover, formal property records constitute a public manifestation of the contract between government and populace to support basic rights.

Cost estimates for obtaining this property data are included in matrix form in Exhibit F. The suggested project involves an expenditure of twenty million dollars. It must be emphasized, however, that twenty million dollars does not represent the cost of formalizing and systematizing Colombia's land ownership. The project would accelerate the process, and more importantly would assure transparency and make the data useable for all the purposes listed in this study. The goal of a project at a twenty million dollar level of commitment would be the acquisition of a digitized property ownership database for all of Colombia. The database would be unclassified, openly obtained and could be made available to the full range of GOC and USG participating agencies.

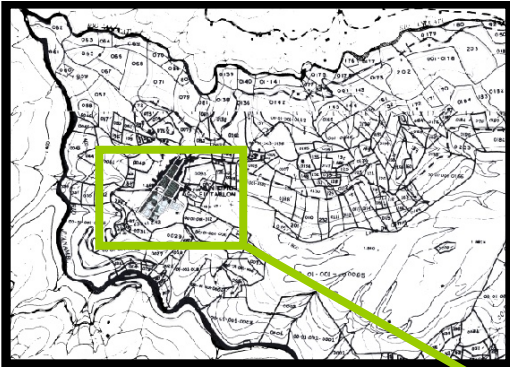
During the course of the feasibility study, the author postulated a number of conditions and preconditions for the success of a large-scale property information effort. Surviving are that the:

- a. database be made available within a period of time that makes it useful to decision-making and operations related to the current conflict;
- b. database be reasonably and economically subject to frequent update;
- c. effort be consistent technically, and obey protocols used by the relevant Colombian government institutions, notably and principally IGAC;
- d. product be useful and available to the full range of government agencies;
- e. result include a dimension that supports open scholarship regarding the data aggregated;
- f. responsibility for database integration and for the physical location of the database server initially should be US, possibly at the USGS EROS Center in South Dakota. At an appropriate point in the development of the project, these responsibilities would be turned over to the Colombians, probably to IGAC;
- g. property data be presented in the context of other, wide-ranging GIS data;
- h. quality auditing mechanisms be incorporated in the program from the outset;
- i. mechanisms for protecting intellectual property rights be incorporated wherever appropriate;
- j. project be provided broad academic and bureaucratic support and participation in order to promote confidence, to attract additional layers of information and to sustain itself over time;
- k. project and product remain unclassified to the extent possible.

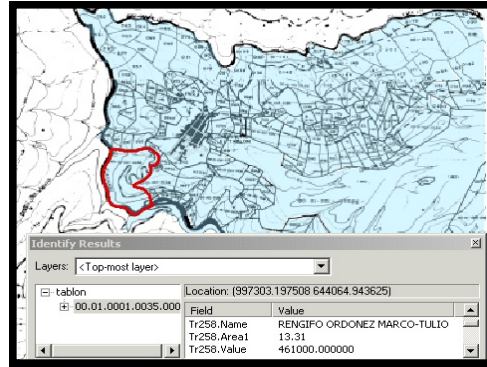
A brief, visual example of a typical forensic process that can be applied to GIS cadastral data is offered on the following page. The example was developed at FMSO from actual cadastral information purchased in Colombia.

One Man's Property in Tablon, Nariño

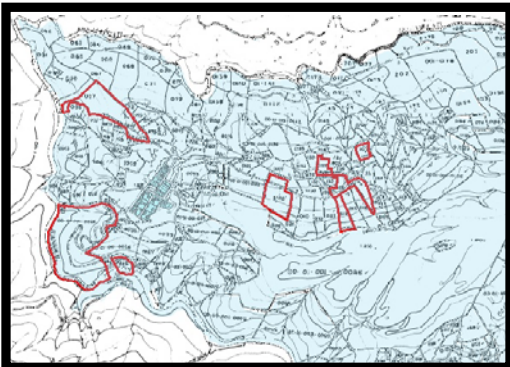
The series of images below shows a typical forensic process that can be applied to GIS cadastral data. The images were created at FMSO using GIS software and actual cadastral information purchased in Nariño Department, Colombia. Shown is the property owned by one man. From left to right, top to bottom: 1. the 1:10,000 cadastral map; 2. the same map matched to ownership data with one owner-plot identified; 3. other properties owned in the locale by the same man; 4. a magnification of the county seat; 5. the same man's urban residence; and 6. urban properties owned by a few of his siblings. This process can be applied to the entire country.



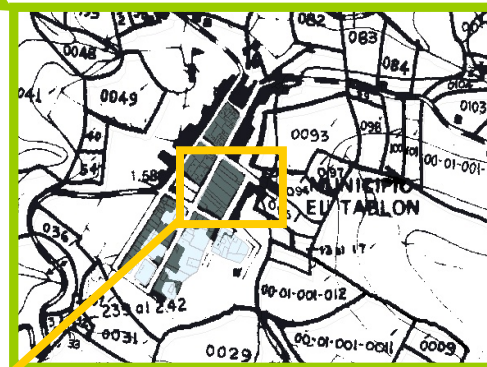
1. Official Tablon County property map



2. ArcGIS map with one plot selected



3. Other plots belonging to same man



4. Zoom to urban area w/block highlight



5. Highlighted block with man's residence.



6. Man's siblings' urban properties

Uses of Property Ownership Data.

Overview

Asset forfeiture or denial

Precision eradication of illicit crops

Money laundering tip-off

Alternative development control

Prediction and prevention of human rights violations

Avoidance of collateral damage in military operations

Support of territorial military strategies

Understanding and expression regarding economic effects of aid projects

Alternative development contract monitoring

Long-term capital creation, corruption limitation

Improved disaster relief planning

Equitable tax assessment practices

Support to ecological security strategies

Overview

Land ownership records have an established relationship to intelligence, but only as part of cover story for espionage in fictional literature, or as a counterspy's trick for identifying some individual's whereabouts. Land records are well developed in many western societies, but are usually considered the purview of local bureaucrats, courts and squabbles. Today, however, these records are subject to computer aggregation and data mining. As such they now lend themselves to strategic consideration and support to major policy decisions. Uses are suggested below in relation to the current situation in Colombia. The same uses are relevant throughout the Andean region and beyond.

Asset forfeiture or denial

This is perhaps the most powerful and obvious forensic use of land ownership information. It is possible to build a universal database of real property ownership throughout Colombia, which entails the sewing together of GIS and other geo-referenceable data from a number of separate entities. Such a database can be linked to other databases of addresses, phone numbers, passports, water bills, etc. Inclusion of land information in database cross-referencing is doubly attractive because land records have inherent stability and reliability. People do, of course, cheat the records, often to avoid taxes, but such cheating is self-limiting, and can actually be helpful to law enforcement. The special characteristic of land records resides in the ultimate need of an owner to prove his identity in quiet-title court actions (a challenge in court to establish ownership). Since property is a contract with the State for the recognition and support of specific preferential rights, an ostensible owner cannot pretend he is someone else for very long, or indeed his ownership preference will disappear. At any rate, the use of cutouts or dummy-owners is a red flag for the detective. There is rarely a legitimate reason for one to pretend his land belongs to another.

A commentary from a web site dedicated to opposing US counternarcotics in Colombia is revealing. At <<http://www.fear.org/interna2.html>> we find the following:

Under current Colombian law, goods can be confiscated only if prosecutors can prove during a criminal trial that the goods were purchased with the proceeds of criminal activities.... The government has been forced to return most of the goods it has confiscated. From 1989 to 1995, the government seized more than 400,000

acres of land from suspected drug dealers. About 270,000 acres of that have been returned.

Even the lands that the Colombian government returned to suspected drug traffickers are worth tracing. It will be important to have visibility of where they are (or where their most attractive assets are) in order to support other forensic and criminal tracking activities. One of the phenomena immediately identified by this field study was the tendency of rural landowners to own many non-contiguous properties and to have intricate land ownership relations within families. Only a GIS-mounted cadastral database can expose and interpret these relationships.

Precision eradication of illicit crops

Advantage can be gained with limited eradication assets by targeting specific agricultural fields based on information about payment contacts between specific cultivators and specific traffickers. Knowledge of the whereabouts of cultivators and traffickers can allow for optimal sequencing of eradication. Individual trafficking groups can be targeted for business destruction. In other words, rather than attack crops in a general way such that the burden of the loss is absorbed broadly by the trafficking industry, eradication can be planned against one set of traffickers at a time, thereby endangering the business viability of that set of traffickers and forcing higher risk-taking behavior by that set.

As noted elsewhere in this report, the feasibility study quickly uncovered the fact that even landowners with smaller plots own or share ownership in other non-contiguous holdings. It would be useful to know if a complaint regarding destruction of a licit crop is being forwarded by a cultivator who is simultaneously growing illicit crops elsewhere. If so, it will be easier as a matter of policy and public relations to reject his plea. Not only would such a plea be easier to reject, the cultivator would be less likely to have made it in the face of clear records regarding the nature of his holdings.

Money laundering tip-off

The prices paid for real property, at least in Colombia's rural areas, are often difficult to determine because no official document requires their reporting, and because the use of brokers in rural area sales is uncommon. Larger properties are often appraised, however, and most regions in the country include urban centers where the use of real estate agents and appraisers is normal. These real estate professionals are attuned, often by way of their personal business networks, to market activity and prices paid for land. When more money is paid than the market should bear according to the experience of the appraisers, or when land moves in a market that otherwise would be stagnant, the real estate professionals generally become aware. The experience of these individuals suggests that on many of these occasions such market activity is likely to involve money-laundering, speculation, part of a larger extortion scheme or some combination of these. Land fraud can be intricate, but in Colombia's violent rural areas, its tracks do not go unnoticed by those who have their eye on the market. This study determined that it would be feasible to implement a methodology for a nation-wide market index sufficiently sensitive to tip-off anomalies in a timely fashion for forensic purposes. Combined with asset forfeiture, this could be a powerful counter-racketeering tool.

Prediction and prevention of human rights violations

The market anomalies noted in the paragraph above as to money laundering would also be useful for anticipating displacement of populations or mass murders. Land extortions have the predictable effect of driving out marginal agriculturalists, often causing an exodus of client workers. In areas where indigenous or ethnic communal properties predominate, the same level of market sensitivity does not exist, but contiguous and sub-regional properties will be affected. To the extent that a formal market regime can be extended in rural areas in many regions, there is likely to be a higher visibility of illicit land pressures, because persons who follow the land market will doubtless be aware of changes in value patterns. In respect to cases in which communities have already been made victims of violent land competitions and have been displaced, a formal land regime can help verify claims, identify origins and fix responsibilities. A highly relevant book on this subject is John P. Powelson's The Story of Land: A World History of Land Tenure and Agrarian Reform (Cambridge, MA: Lincoln Institute of Land Policy, 1988), which highlights correlations between civil violence and informality in systems of property ownership.

Avoidance of collateral damage in military operations

Cadastral maps, often to the scale of 1:500 or better, provide information on building capacity and use. Public services, cultural patrimony, residence density and the like are regularly noted because these factors bear on the taxability of properties. Coding areas for targeting avoidance could be done relatively quickly and precisely if a comprehensive, up-to-date cadastral database were made available. In this context, too much emphasis can be placed on the difference between "rural" and "urban." Even in rural counties where 1:10,000 mapsheets are the cadastral norm, urbanized areas with only a few hundred inhabitants are still mapped at 1:500 and include street addresses and matching land use codes.

Support of territorial military strategies

(This section is based on the author's article "Mapping Colombia: The Correlation Between Land Data and Counter-Terror Strategy," included in its entirety in Exhibit A)

In order to maximize security and for economy of force, the FARC created networks of movement corridors within the blocks and mobility corridors between the blocks. Some of these routes comprehend standard road and river transportation infrastructure and are used to move large quantities of illicit product. Secondary routes are more often used for the movement of units and materiel. In mountainous areas it is common that the routes follow ridgelines. The FARC has worked to control owners and ownership of properties along all of the movement and mobility corridors (it is suspected that this is especially true along remote ridge line routes), thus helping to assure operational security. The FARC does not enjoy widespread mass support in the Colombian population, even in rural areas. It has, however, carefully proselytized or terrorized in select locales related to its nation-wide, logistics-based strategy. Meanwhile, the AUC appeared to have a varied and growing popular support base exceeding that of the FARC -- but less so along many of the logistics corridors. The FARC may have more successfully targeted its population control efforts in support of its logistics network. Lately, the FARC is known to have assisted in the formalization of property holdings by peasants under their direct control in active drug cultivation areas, one being the Puerto Leguisimo area in Putumayo. Additionally, the guerrillas may have effectively purchased some mineral mines, either by using cutouts to gain control of licenses or by surrounding publicly owned mineral extraction sites with peasant clients

and then formalizing the ownership of those properties. These rumors could be verifiable through examination of the cadastral records. The Colombian government may determine that it is necessary to more actively entreat, or even to move some rural populations. Comprehensive knowledge about land tenure, along with an analytical tool able to directly compare corridors, land tenure and attitudes would be extremely useful for economy of force. If a strategy is mounted to colonize or decolonize certain areas, it will only be well done if informed thoroughly regarding land ownership and ownership patterns in the affected zones.

When the Colombian army reentered San Vicente Caguan in the former clearance zone in February 2002, it found that fleeing FARC units had destroyed government offices, with the exception of the land registry office. The records of land ownership did not show a rash of takings by the guerrillas, and apparently land values had not changed appreciably (although they were extremely low from the outset). In Puerto Leguísimo, the local FARC commander accepted letters of introduction from the government to permit workers of the cartographic institute to complete cadastral formation for hundreds of agricultural properties in the area under its immediate control. One has to ask why the FARC would be willing to have the government formalize property ownership. The answer is troubling, considering the implication of accessorial behavior by the Colombian government. If the FARC has control of the occupiers, it can enforce a sharecropping relationship, force sale or mortgage, tax, etc., all the while using government-provided records to facilitate and legitimize its actions. It also acquires options if the area is overtaken by government troops or by another outlaw entity. In case of some interim or final negotiated settlement, the outlaw leadership has put in place the basis of legally controlling population and territory, the population controlled by feudal connections to the land, and the land controlled by a client population. The guerrilla leader thereby succeeds in becoming a great landowner, or *terrateniente*.

The AUC was in part born of the frustration of ranchers at the failure of the Colombian government to protect their rural properties from the FARC. Conceivably, the historical and geographic bases of the struggle between the FARC and the AUC could be painted using existing cadastral maps by tracing back to relevant ranch properties and their owners. Furthermore, the property-based origins and purposes of the AUC logically drive it to augment formal ownership of land in areas it considers strategically important. Recent urban combat among the FARC, AUC, ELN and lesser groups in the city of Medellín seem to attest to the selective importance of commercial property and its relationship to rural terrain. Recent urban combat between outlaw groups in Medellín broke out over control of the major land route to the Urabá Gulf and Atrato River Valley lowlands to the northwest. The Urubá-Atrato area involves major illicit logistics corridors. Logically, if the government controlled the corridors more completely, the fighting in Medellín would not have occurred. Contest of the route between outlaw groups would be mooted if control were already lost to the government in the rural region to the northwest. To attain control, the government will have to pursue a strategy that recognizes land ownership as a key element. Formal, visible and protected property rights should be the foundation of long-term government presence in the area of Colombia facing Panama. Until that is achieved the area will be outlaw in all respects, and Medellín will continue to suffer periodic violent eruptions. If not made a priority, people of the Urubá-Atrato lowlands are condemned to suffer forced displacements and mass killings.

Also in northern Antioquia, a secondary network of rural transportation routes runs through the Dabeiba, Peque and Ituango municipalities to the west of the Cauca River. It has been a major confrontation area between the AUC and the guerrillas. Warfare imposed and suffered in this mountainous sub-region encapsulates the nature of the conflict in Colombia. Almost all combat, human rights cases and criminal encounters relate to the dominance of passage routes used for illicit purposes. Putting a stop to intra-outlaw combat in the area will require a greater presence of government military force in order to physically deny use of the zone's passes for illicit product shipment. Pacifying the region in the long-term, however, may require a change in the mix and quality of real property ownership. There are few proven treatments for the kind of social poisoning that years of ruthless competition for the control of land causes. One antidote is to redistribute populations and property ownership. The Colombian government may decide to embark on programs changing ownership of land in local areas most affected by the violence, perhaps by empowering ethnic communities and better securing communal land rights, or perhaps by encouraging private ownership by persons and organizations more likely and capable of resisting outlaw incursions. Regardless of the details, any land-oriented part of a solution will depend for integrity on precise, electronically available, complete records of ownership interests at key locations. Precision lends juridical strength to the documentation, as well as future market confidence. Electronic availability (transparency) helps defend the ownership documentation against fraud and corruption, and it allows individuals and non-governmental organizations to monitor land policies.

The value of land in locales such as the Peque -- Ituango passes may be elevated in the minds of outlaws intending illegal use; nevertheless, many properties in the area will be abandoned or subject to forfeiture as the law-abiding seek safety elsewhere (or are otherwise eliminated). These abandoned properties need to be identified in detail, but the information must be visible at a strategic level so that the evolution of ownership serves a peace-intending initiative of the government rather than outlaw competitiveness. If the government does not mount a national property strategy that helps mitigate the cycle of violence, property strategies mounted by outlaw groups will continue to catalyze it.

Understanding and expression regarding economic effects of aid projects

A steady increase in average equity gained in real property in a given area, as reflected in increases in appraised market values, is a legitimate indicator of overall improved material success. Keeping indices of land value and equity over time would be a practicable method of determining the impact of aid projects in various areas. This could be done by comparisons with areas of a similar economic makeup where programs were not initiated. It is likely that aid projects will have been helpful if positive gains in equity are experienced in a project area.

Alternative development contract monitoring

USAID has in the past contracted with the United States Geological Survey's International Program to mount GIS-based land use records in association with sustainable development/alternative crop programs in Peru. Some of this work can be seen online at USGS, <<http://edcsnw3.cr.usgs.gov/ip/treecropshome.html>>. (See further, Highlighting Peruvian Coffee at <<http://www.perucoffee.com/>>.) The project description states,

“The Alternative Development (AD) Program is part of a joint U.S. and Peru counter-narcotics strategy that combines effective law enforcement with social and economic development for sustaining the reduction achieved in illicit coca production. The AD program supports this strategy through activities that (a) strengthen the licit economy and (b) strengthen social capital and economic infrastructure.”

Sustainable development/alternative crop programs depend for accountability on the monitoring of contracts with agriculturalists. It behooves program designers to have in their possession an accurate account of the properties under the control of agriculturalists participating in the programs.

Long-term capital creation and corruption limitation

The best expression of the importance of land records to economic development is by Hernando de Soto in The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else (New York, Perseus Books Group, 2000). As de Soto puts it,

“Leaders of the Third World and former communist nations need not wander the world’s foreign ministries and international financial institutions seeking their fortune. In the midst of their own poorest neighborhoods and shantytowns, there are – if not acres of diamonds – trillions of dollars, all ready to be put to use if only the mystery of how assets are transformed into live capital can be unraveled.”

De Soto’s argument extended a line of free-market theory outlined in his earlier bestseller, The Other Path: The Invisible Revolution in the Third World (New York, Harper & Row, 1989) for which de Soto gained international recognition. De Soto and his team of researchers exhaustively documented that for the poor to advance materially they need to be able to create capital, and that in most developing countries, they cannot. One result can be violent class confrontation. In de Soto’s words,

“Class confrontations in this day and age? Didn’t that concept come down with the Berlin Wall? Unfortunately, it did not. ... What the West calls ‘the underclass’ is [elsewhere] the majority. And in the past, when their rising expectations were not met, that mass of angry poor brought apparently solid elites to their knees (as in Iran, Venezuela, and Indonesia). In most countries outside the West, governments depend on strong intelligence services, and their elites live behind fortress-like walls for good reason.”

The inability to create capital can be blamed, in part, on a lack of formalized property regimes -- the kind that in the advanced economies survey, record, protect and represent property rights of all kinds. “In the West [...] every parcel of land, every building, every piece of equipment, or store of inventories is represented in a property document that is the visible sign of a vast hidden process that connects all these assets to the rest of the economy.” Because this formalized property culture does not exist for the masses of the world’s productive poor people, “most people’s resources are commercially and financially invisible. Nobody really knows who

owns what or where, who is accountable for the performance of obligations, who is responsible for losses and fraud, or what mechanisms are available to enforce for services and goods delivered.” The upshot of a failure to create precise, reliable documentation of property rights, property courts, title insurance, brokerage laws and the like is an invisible world of dead capital - assets worth literally and measurably trillions of dollars, but which cannot attract investment.

De Soto’s book provides efficient insight into the relationship of material progress, property and human rights in many failing lands. It also includes a matured set of specific actions for enlivening dead capital and establishing the legal and administrative framework for mass economic success. Prominent among these is the creation of precise, available, fraud-proofed property records. In response to this compelling assertion, major investment has already been made in Colombia by international aid agencies. Typical among these is an Inter-American Development Bank (IDB) project, ‘Land Titling and Modernization of the Registry of Deeds and Cadastre (1027/OC-CO).’ The total cost of this single IDB project was initially set at \$104 million, \$38.5 million of which was financed by the IDB. A description of this project can be found online at < <http://www.iadb.org/EXR/doc98/apr/co1027e.pdf>>.

Likewise, “USAID launched the Inter-American Property Systems Initiative (ISPI) as the mechanism through which to implement the property registration mandate. The Initiative supports USAID objective in Latin America of contributing to the alleviation of poverty in the region by improving access to income-earning market opportunities.” USAID is already committed to the development of land records. See <<http://www.summit-americas.org/propreg.htm>>.

Programs such as those mentioned immediately above have achieved progress in Colombia. Many millions of records have been digitized and many functioning local offices established; however, these programs have not required the presentation of data. Not being focused on obtaining information, the registry development efforts have not insisted on a proof of product. The culture of the financing institutions, being oriented toward the development of services in favor of the less economically well-off, overlooked a crucial aspect of the stated goals. Transparency and comprehensiveness give land databases power to resist corruption and to inspire investment confidence. Nevertheless, the developmental efforts have not required that there be any presentation of the data that would prove their transparency and completeness. The program suggested as a result of this current research takes a different, although completely complementary direction, seeking the information and thereby leveraging development of the processes by which it is obtained.

Improved disaster relief planning

Geographic Information Systems are considered indispensable in modern disaster relief planning. On this point, the author recommends the University of Wisconsin Disaster Management Center, which can be visited online at <<http://dmc.engr.wisc.edu/courses/seminars.html>>; and the site “Remote Sensing and Geographical Information System for natural disaster management” at <http://www.gisdevelopment.net/application/natural_hazards/overview/nho0011.htm>. Inclusion of property ownership, land use and appraisal data among the GIS data layers offers obvious utility for determining losses and, at times, for fixing responsibilities.

Equitable tax assessment practices

Thousands of counties in the United States are transitioning to GIS-based tax assessment maps, many available on the open Internet. For a one–page description of a typical on-line GIS-based county tax assessment map collection in the US, see <<http://www.co.lake.il.us/gis/MapGallery/understanding.htm>>. The parameters of what constitutes equitable in a given social context are generally described in applicable tax codes and administrative policies. Given the shape of equity as described by the codes, however, the physical measurement and recording practices bear heavily on fairness of the tax burden, not to mention efficiency in collection (assuming that system perceived as fair are more likely to enjoy compliance). Also, in order to assess or question the standard of equity reflected by tax codes and policies, some way of visualizing the effect of the code’s application must exist. Today, GIS technologies, if nourished with precise and comprehensive data, provide the optimal tool for examining the spread and weight of the tax burden. In Colombia, tax code, application, compliance and benefits are a constant debate, but the issue has so far been argued without the light of widespread, accurate, current information. This can and should be remedied.

Support to ecological security strategies

Policy options such as the use of conservation deeds and other deed restrictions, selective fencing policies and other species range control measures, hunting restrictions, research easements, wildlife protection zoning, special tax assessments, ecological guardianships and other practices familiar to conservationists can be effective in areas where private property dominates or where it is mixed with public lands. These practices are obviously less effective to the extent that the property regime is informal. Fixing responsibilities for environmental degradation is also aided by clear, precise records management and mapping. In the Colombian context see for instance, María D. Álvarez, “Forests in the Time of Violence: Conservation Implications of the Colombian war,” 2002, *Journal of Sustainable Forestry* , 15 (NFI), found online at <<http://www.columbia.edu/~mda2001/>>.

Current Condition of Property Ownership in Colombia.

Overview

National cadastral office

Bogotá cadastral office

Cali cadastral office

Medellín cadastral office

Antioquia cadastral office

Land registry offices

Professional real estate boards

Overview

Cadastral coverage, responsibility and authority in Colombia is divided into five major parts: the national cadastral office and four independent cadastral offices, these being the Federal District of Bogotá, Antioquia, Medellín and Cali. The existence of the independent cadastral offices is related to historic anti-federalism. The offices are politically, administratively and budgetarily independent, but take technical guidance from the national cadastral office and follow the same technical protocols. Technical and professional conditions among the cadastral offices are unequal and unification of the offices is not foreseen.

The national cadastral office is a directorate of IGAC, which is a dependency of the Ministry of Interior and Public Credit (*Ministerio de Hacienda y Crédito Público*).

The cadastral offices are responsible for appraising land values as the basis for taxation. The tax rates vary as a percentage of market value and no general figure for the relationship between the appraised value and market value would be broadly accurate. According to many familiar with the system of appraisals and the market for real property, an appraisal of around fifty percent of market value would be typical.

The cadastral offices are charged to keep records of the size, location, use, potential use and tax currency of all properties. In order to fulfill all the requirements of Colombian administrative law, a seller must produce certification from the cadastral offices showing the precise, bounded description and location of land to be sold, as well as any tax debt. This process seems to be followed as an exception, however, in many rural areas, and often in the city.

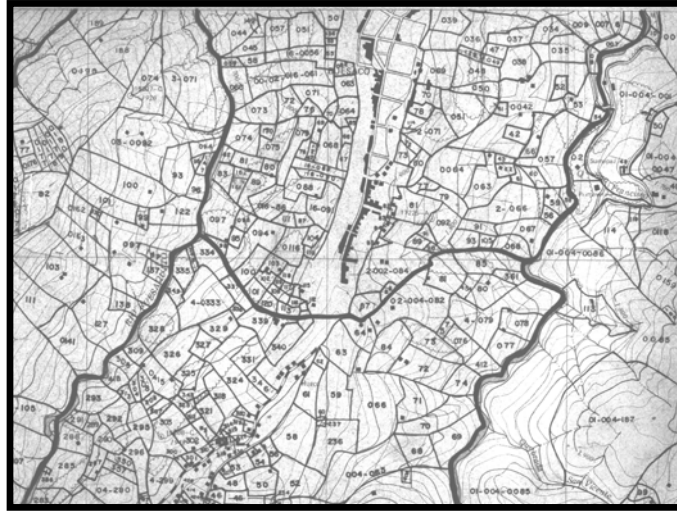
The cadastral offices are not the official record of ownership of a property. That function belongs to the registry offices of a separate ministry, the Superintendency of Notaries and Registries, described later.

In the course of many land transactions, new owners often consider it sufficient to register using a bill of sale in the registry without consulting the cadastral office or having received a certificate of description and assessment from the seller. Therefore, the cadastral records, while determinant of the location, shape, size and tax value of a piece of land, are not legally sufficient to establish definitive ownership.

Historically, the cadastral office records have not been compatible with the registry files. That is to say, until recently there was no common field of data that made the two sets of files easily reconcilable. Even descriptions of location and size have not always been of the same type in both record sets. It may be that in the course of reconciling the two sets of land records, thousands of location and size inconsistencies might arise. For reasons not discerned during the course of this study, recent efforts by national and international agencies to systematize the cadastral and registry files did not establish a method of reconciliation. Today there is at least a technical intention and a technical method for so doing. Each of the properties listed in the registry file carries a *matricula* number, which is assigned to the corresponding property in the cadastral files.

National cadastral office

The national cadastral office maintains records on more than seven million properties. This constitutes around three-quarters of the recorded properties, and covers a least ninety percent of the national territory. Most of these records are on computer media, in alphanumeric order and include physical, economic and juridical information; however, the maps associated with the cadastral files are analog. There is no geographic visibility of the information that allows it to be readily compared to other georeferenced information. The cadastral office is pursuing a process, supported in part by loans from the Inter-American Development Bank, to hand digitize the property lines found on the analog cadastral maps such as the one shown below.



Typical 1:10,000 scale cadastral map.

The current process of vector-digitizing is labor intensive, requiring laborious tracing of the property lines using a mouse. The process, often termed “live digitizing,” produces vector images as opposed to raster images, the vector images being subject to a different type of value assignments and mathematic manipulation.

The cadastral office receives updates, supposedly on a monthly basis, from the twenty-two sectional offices of IGAC. This data is sent as a report on magnetic media. The basic data files normally remain at the sectional offices. The cadastral maps are normally kept at the sectional offices, and are not sent to IGAC’s central office in Bogotá. This means that in order to create a geo-referenced database of all Colombian properties, cadastral maps from each of the twenty-two sectional offices will have to be retrieved for digitization. In addition, in order to do strategic manipulation of data records on a national scale, the basic data files, rather than data transformed into report format, would have to be retrieved from each of the sectional offices.

Bogotá cadastral office

The Federal District of Bogotá has one of the four independent cadastral offices in Colombia with 267 employees at the city’s Municipal Administration Center. The Bogotá cadastral office is seemingly well-funded and well-led.

Cadastral information for the Federal District of Bogotá is almost entirely digital, aggregated in an ArcInfo® database. The district is divided for cadastral purposes into just over 1,100 cadastral sectors and 41 separate layers of information. These layers are available for sale to the public and are priced by virtual map sheet (most at 1:2,000 scale) and by layer. The cost of the layers per map sheet area ranges from about six to fifty dollars. The entire digital map, in the form of ArcInfo® files with all 1,100 sectors and all correlative layers is priced retail at 295,000,000 pesos or about \$150,000. A separate agreement could be reached on updating.

Cali cadastral office

Organized similarly to that in Bogotá, the cadastral office in Cali has four divisions -- Cadastral Formation, Conservation, Cartography and Systems. The office has records on 505,000 urban plots and about 16,000 rural plots. It is in possession of a digital plan based on 1993 aerial photography and completed in 1995. The plan includes 35 urban data layers and 25 rural layers in ArcView® format, and it covers 37,000 urban hectares and 30,000 rural hectares.

The cadastral office has no employees who know how to work the digital plan software, and while the city planning office apparently has a current ESRI license, the Cadastral Office does not. The 1995 plan has not been updated in seven years. From Jan 1, 1982 until December 31, 1995, the office had 235 employees, from Jan 1, 1996 to Jun 30, 2001 it had 90 employees, and from July 1, 2001 to the present it has had 25 persons. These cuts seem to reflect a political decision on the part of the Cali municipal government to not have a current, accurate and transparent cadastral record. The most likely reasons for maiming the cadastral office follow:

- A. Select interests do not want transparent land records due to their obvious forensic utility;
- B. Select interests do not want the tax assessments to reflect true values or identify their properties for taxation;
- C. Probably in service to A and B above, the office had become so crowded with unqualified political pawns (reportedly including dozens of wholly illiterate persons) that its reduction became broadly accepted as a reasonable efficiency measure.

The effect of the reduction is perfectly understood by the technicians in the cadastral office who remain. Millions of dollars in tax revenue are forgone by the failure to update appraisals. Meanwhile, tax rates have been rising to make up needed income. Forensic uses for both criminal and civilian courts are stymied. Land-use planning is made unreliable and many opportunity costs are incurred by city services.

Medellín cadastral office

The Medellín cadastral office maintains cadastral changes, but the cadastral office sold the rights of publication and sale of cadastral information to another government entity, the Medellín Public Enterprises (*Empresas Públicas de Medellín*, EPM). The cadastral office is located in the old administrative building while the EPM is located in the new administrative center (*Centro Administrativo de Medellín*). The cadastral maps are integrated into the municipal digital plan, mounted on Intergaph® software, and constitute four of several dozen layers of municipal data, which is for sale. The prices for digital data from the EPM are a little higher generally than at the Bogotá cadastre; however, the Medellín cadastre is in better condition than Cali's and can be purchased in its entirety.

The Medellín cadastral office coordinates some appraisal activities with the other counties that make up the Valle de Aburrá. Recognizing the economic, social and fiscal advantages of formalized property ownership, Medellín's city government has in the past three years, legalized approximately 8,000 lots in economically disadvantaged areas. City officers believe the process of cadastral formation has contributed to positive evolution of several neighborhoods. Some zones that are considered high-risk for environmental reasons have a low

priority for formalization. As many as 150,000 of the 650,000 lots mapped by the office remain un-legalized.

In Medellín there is an office called the *Observatorio Inmobiliario*, supported by a French grant, whose mission is to monitor the urban real estate market. The researchers did not have the opportunity to visit that office.

Antioquia cadastral office

The Antioquia cadastral office is not as complete as that of the city of Medellín or as damaged as that of Cali. The department consists of 127 counties, about 40% of which now have digitized cadastral information off 1:10,000 and 1:25,000 scale base maps. Antioquia used AutoCad® software, which is compatible with ArcGIS® products.

Land registry offices

Real property registrars are named to all of the departmental capitals and to a number of other cities. Registrars to the departmental capitals are named directly by the President of the Republic. Registrars are subordinate administratively to the Superintendency of Notaries and Registries and the Superintendent, who is also appointed by the President, generally names those registrars sent to posts other than the departmental capitals. The Superintendency is subordinate to the Ministry of Law and Justice (*Ministerio de Justicia y Derecho*). The registrars direct the registry offices, known as Offices of the Registry of Public Instruments (*Oficinas de Registro de Instrumentos Públicos*). The offices are organized into what are called Registry Circles (*Círculos Registrales*) into which may fall several to many counties (*municipios*). Only about one in ten *municipios* has a registry office.

The researchers visited the Registry of Public Instruments (*Registraduría de Instrumentos Públicos*) in Cali, and unlike the cadastral office, the registry appears to be efficient and disciplined. The registrar gave the researchers a thorough tour. She also discussed administrative matters and relations with the cadastral office. The Cali registry is the axis of a registry circle that includes Cali and its surrounding counties (the *municipios* of Cali, Jamundí, La Cumbre, Jumbo, Restrepo, Vijes and Dagua). The registry employs 91 individuals and maintains more than 700,000 files. Eighty percent of the information managed by the registry is digitally systematized. Registry personnel expressed complete willingness to share data with the cadastral office. The registrar maintains backups of all magnetic information and sends an update to Bogotá on a monthly basis. The registrar knew of no practical or legal reason that the files could not be shared.

Professional real estate boards

There are 22 professionalized real estate boards in major urban areas called *Lonjas de Bienes Raíces*. The government does not regulate them, and, in fact, there are few, if any, professional standards or statutes that specifically regulate the behavior of real estate agents or agencies. Appraisers are required by the government to pass an exam and meet some specifications in order to produce certifiable appraisals. The Lonjas, through the national association of Lonjas, produce their own standards for membership and behavior based on international practice and norms of the legal profession.

Importantly, members of the Lonjas, and especially their established community of officially qualified private appraisers, constitute a body of individuals with unique, extensive, direct knowledge of the real estate market. Most of that knowledge is related to the urban landscape, since few rural parcels are sold through agents. Nevertheless, the community of professional real estate agents is an untapped information resource regarding the market for land -- including pace of activity, normal price levels and market anomalies. Few groups of people are more aware of activities that bear on the value of land, including social conflict.

Although the real estate professionals are less aware of changes in rural land markets, the Lonja has of its own initiative begun projects to index price levels in various parts of the country and is interested in expanding formal commercial activity into the rural areas. Lonjas leaders indicated they would be enthusiastic participants in a project to establish a comprehensive index of values because such a database would be immensely helpful to their industry.

Potential for development of the property regime.

Developing a modern, formal land ownership regime is a larger, more challenging objective than that of obtaining property data. A modern property regime includes mechanisms for trust building and for market fluidity. These mechanisms include title insurance, a regulated brokerage profession, professional property inspectors and appraisers, statutorily specific “quiet title” actions, clearly delineated occasions for self-help in regaining possession, enforceable punishments for unlawful self-help, enforcement of restraining orders and eviction, transparency of ownership files, well-publicized statutes-of-fraud that require transactions in real estate to be in writing, signed, notarized and registered, requirement that mortgages and encumbrances of all kinds be recorded or be without state enforcement, and so on. This litany of needs is included to underline an important disclaimer: creating property data (even if is technically exact, judicially correct and accessible) is not equivalent to creating a property regime similar to that known in the United States.

Nevertheless, the quality and utility of the data is highly dependent on the level of development of the property regime. Numerous developmental agencies from a variety of countries have contributed to modernizing the property regime in Colombia. To the extent these efforts have failed, it is due in part to the aid organizations’ not having insisted on their obtaining a product in the form of transparent, digital property data. Neither USAID nor the IADB (and this probably holds true for other aid organizations) can produce results of their efforts in the form of property data. This fact responds to the culture of the organizations and their core missions. In this case, since the developmental result was to be transparent information, it is interesting that no proof of result was demanded. To some extent, the strategic developmental goal of establishing a modern property regime must be prompted, accelerated and audited by insistence on the lesser goal of obtaining the data.

The evolution of rational property law designed to provide the State with adequate property information and to promote social peace is not something that is purchased quickly with the creation of geo-referenced lines. The evolution of a regulated real estate agency profession and the development of institutions such as title insurance are longer-term and dependent on

developments over which foreign influence cannot easily or quickly be brought to bear. Nevertheless, while it is the whole strength of the property regime that lends importance and power to the property records, development of the records will be an important inducement toward development of the regime. Property records, even when incomplete due to unreported leaseholds and other tenancies and encumbrances, allow the development of specific questions regarding anomalies of use and ownership. Those questions can lead to formalization of records. The process is likely to generate wider observance of the law and wider appreciation for the effect that appropriate ownership laws can have.

Description and Availability of Related GIS Data

Overview

Geographic studies at IGAC

Land use planning

Colombian Geographical Society

Colombian academe

Regional and local GIS data

Holdings of other Colombian federal agencies

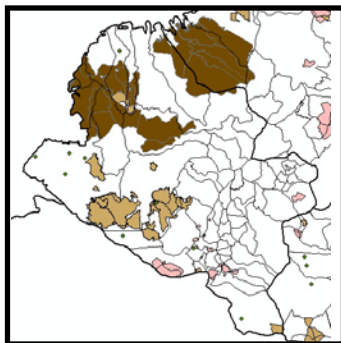
Holdings of commercial firms

Overview

A variety of government agencies produce GIS data, almost all of which is compatible with the ESRI® software product line. In response to a GIS technical protocol and data-sharing initiative creditable to IGAC, Colombian federal agencies and many departmental and municipal entities participate in a digital information sharing agreement called the Colombian Spatial Data Infrastructure (*Infraestructura Colombiana de Datos Espaciales*, ICDE). A thorough PowerPoint® presentation on ICDE (in Spanish) can be made available by the author on request. Other, non-governmental entities also possess GIS data, usually in ArcGIS® compatible formats. These entities include NGO, industrial federations such as the coffee federation, a few GIS companies, and a number of academic institutions.

Geographic studies at IGAC

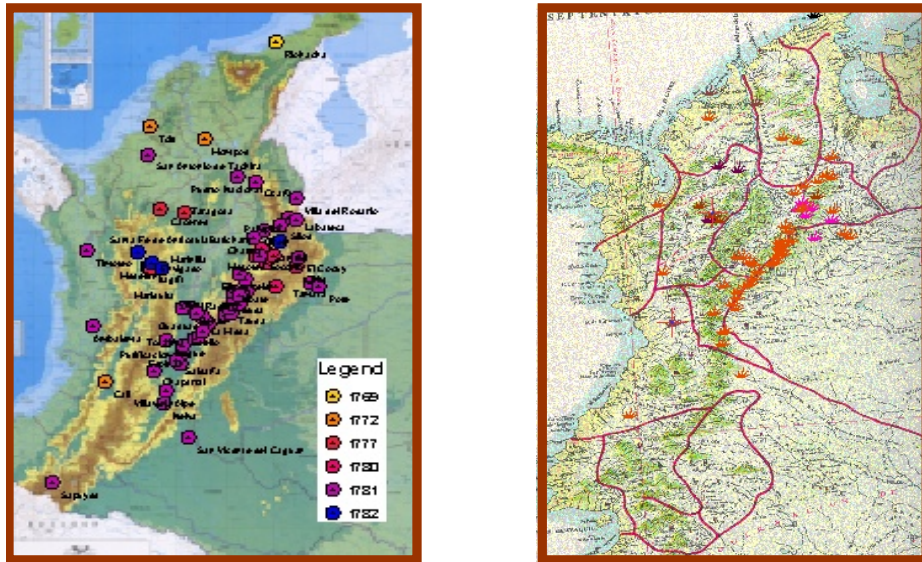
IGAC has been sponsor and publisher of a lengthy series of geographic studies including atlas of soils and land use, geographic analyses of demographics and regional studies. Most of these studies are high quality, and much of the material they contain is relevant to US programs and technological applications. IGAC's production rate has fallen severely in recent years, most of the studies obsolescent or of historical interest.



“Colombian Indigenous and Black Communal Properties in Nariño”

The digital map to the left was created at FMSO from files purchased from IGAC. It can be redrawn at multiple scales along with property ownership, infrastructure and other GIS data.

As for historical maps, IGAC possesses many dozen older maps that would interest scholars, but that are not being properly archived or preserved. IGAC is interested in digitizing these holdings, a mission that could be accomplished at moderate cost.



Comuneros Rebellion

These two maps show Colombian towns where the 18th century uprising known as the Comuneros Rebellion occurred. The date and location data is from the Colombian National Museum of History. The image on the left was created by geo-referencing locations in the ArcGis® program and using a 1993 IGAC map as the background. To build the image on the right, the same locations were automatically registered onto a scanned reprint of a 1772 map found in Atlas de Mapas Antiguos de Colombia, also an IGAC product.

Land-use planning

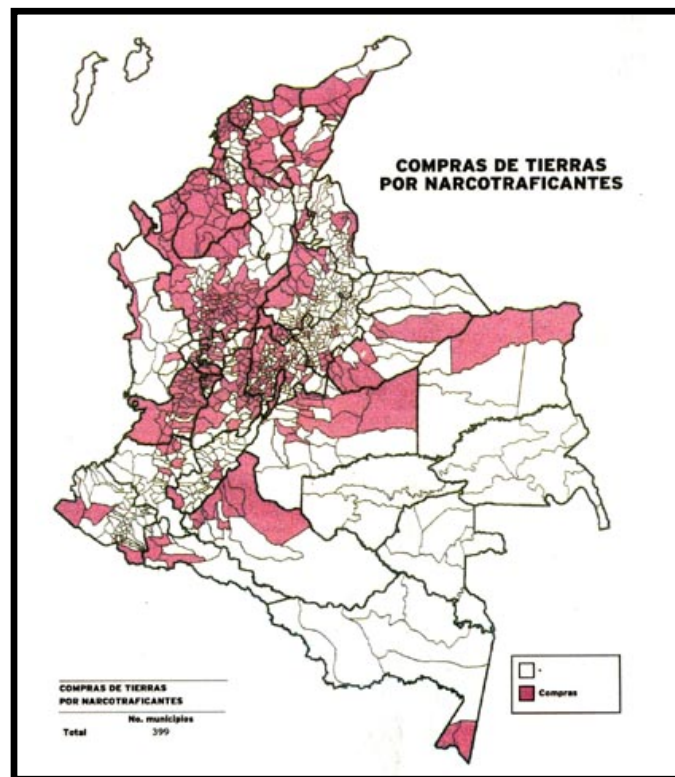
About the time of the adoption of the 1991 Constitution, the Colombian government, as well as a broad slice of Colombian academicians, embraced land-use planning and its methodologies. An extensive set of laws and regulations has been promulgated to guide land use in consonance with cultural, ecological and economic values and goals. These can be explored exhaustingly at the website of the Colombian National Planning Department at <http://www.dnp.gov.co/> >. Because so much of the methodology of modern land-use planning depends on territorial mapping, and because the regime of land-use regulations in Colombia requires that plans be produced by subordinate political/administrative entities (normally down to the county level) a great deal of semi-centralized GIS data is available. This material is extremely uneven in scope and quality, but may be very useful in select locales, especially when combined with more consistent and verifiable data.

Colombian Geographical Society

The Colombian Geographical Society, created in 1903, is an official entity of the Colombian government belonging to the Ministry of Education, through which it receives a modest budget. It augments this budget through the sale of services and products and by occasional grants and private donations. It is a member organization of the national college of academies along with the Academy of History, Academy of Medicine, etc., and is given considerable intellectual autonomy. The objective of the geographic society is to promote geographical studies, especially those relating to Colombia's national territory. The society is capable of organizing and completing significant academic works, and its president claims to be able to do so at a cost commensurate with or less than private academic intuitions, and much more economically than commercial firms. Whether the society is positioned to complete some of the more technical aspects of GIS mapping is less certain, but there is no doubt that it enjoys strong governmental and academic relationships. Optimally, the society would be willing to participate as principal scholarly consultant to the "Project on Colombian Conflict and Development" outlined elsewhere in this study.

Colombian academe

A number of books on Colombian conflict and development, written by Colombian scholars, include geo-referenced or geo-referenceable data. One example, shown below, is a thematic map, mounted in what appears to be ArcView[®] format, of Colombian counties where narcotraffickers had purportedly purchased land. Colombian are an invaluable source of data and analysis.



Colombian Counties where known Drug Traffickers Purchased Land

(by Alejandro Reyes Posada, Internet site [La Geografía de la Violencia](http://www.la-geografia-de-la-violencia.com))

Regional and Local GIS data

The feasibility study considered local GIS efforts in Bogotá, Cali, Medellín, Popayán and Pasto. The project's real estate advisor believes that a number of other larger cities and numerous departmental and county governments have also developed GIS databases, often with the assistance of international aid. For the same reasons indicated earlier, obtaining the data requires direct coordination with these local offices.

Holdings of other Colombian federal agencies

During the course of the feasibility study, the researchers visited several Colombian government agencies rumored to produce or possess GIS data. These agencies included:

DANE	National Administrative Department of Statistics (<i>Departamento Administrativo Nacional de Estadísticas</i> , DANE) is the equivalent of the US Census bureau with additional duties related to those of the US Agriculture Department. DANE maintains a digital database and sells digital mapping information in ArcGIS® compatible format by layer of information and map area. Several layers of information for all of Colombia can be purchased for about \$15,000. This information does not include cadastral data and many areas of the country are without data. However, DANE technicians do considerable cadastral work including vectorization of rural property lines provided to DANE by IGAC.
ECOPETROL	The Colombian Petroleum Company, (<i>Empresa Colombiana de Petróleos</i> , ECOPETROL) produces a variety of GIS data layers related to the petroleum industry including pipeline easements exploration licenses, areas of geologic promise, etc.
IDEAM	The national Institute of Hydrology, Meteorology and Environmental Studies (<i>Instituto de Hidrología, Meteorología y Estudios Ambientales</i> , IDEAM) is comparable to the US Environmental Protection Agency. It creates and sells ecological assessment and threat data. It does some cadastral mapping for its own work. As a member of ICDE it is committed to share digital data with other government agencies. It has an active website at <agencies.http://www.ideam.gov.co/ideam/index4.htm>
INCORA	Colombian Agrarian Reform Institute (<i>Instituto Colombiano de Reforma Agraria</i> , INCORA). Established in 1961, it boasts over 40 years of activity delivering some 18 million hectares to rural agriculturalists. We have been

told that INCORA has extensive magnetic files indicating the names, properties and general locations of land that has been redistributed, distributed from government holdings and taken from large landowners. It is our understanding that this data has not yet been computer-mapped. Mapping the INCORA data alone on the ArcGIS® platform would provide an invaluable tool for developmental agencies.

INGEOMIMNAS

The national Institute of Geo-scientific, Mineral-Environmental and Nuclear Research and Information (*Instituto de Investigación e Información Geocientífica, Minero-Ambiental y Nuclear*, INGEOMINAS). The researchers visited functionaries at the institute. The most interesting GIS data layers created by the institute include cadastral mapping of exploration and extraction licenses.

Ministry of Agriculture

(*Ministerio de Agricultura*) The researchers visited offices of the agriculture ministry and were informed of a number of GIS layers produced there. A substantial quantity of GIS data is apparently available, much of it supposedly at no cost. Detailed geographic descriptions of licit crops are available and may be updated on a recurrent basis.

National Police

(*Policia Nacional*) Available police data includes, in Excel and Oracle formats, coded incident reports spanning about 8 years. These crime statistics can be geo-referenced using the ESRI® software.

Agencies not visited by the researchers are also said to possess relevant GIS data, including at least the Transportation Ministry (*Ministerio de Transporte*).

Holdings of commercial firms

The firm Techeca has done geo-referencing work for a broad set of clients and was contracted for a limited amount of geo-referenceing work in support of this study. Unfortunately, the caliber of global positioning equipment used by the company limits technical precision. Other companies, including Geosistemas, and a number of smaller companies, are operating and apparently viable, but only Techeca was contracted during the feasibility study. Overall, the outsourcing of selected work to Colombian firms such as Techeca appears wholly feasible, to include cadastral formation.

Plan for Acquiring Comprehensive GIS Data Featuring Property Information

General considerations

Organizations and activities

Cost and time

General considerations

The cost of gaining property data could suffer the same asymptotic effect that might be typical to an enterprise attempting to buy all the land in a given locale. That is to say, as the goal of gaining comprehensive property information progresses, each additional portion of information may cost more than the previous, the last ten percent costing far more than the first 70% and the last little bit perhaps impossible to obtain. Such could be the result of a perception by potential providers of data that the buyer will suffer an ever-higher price. Lawbreakers whose exposure is implied by cadastral transparency will pressure bureaucrats to keep information hidden. Additionally, well-meaning advocates of individual privacy may indirectly steepen costs, as could those generally opposed to any form of United States intervention.

Diligence, therefore, is important. The faster the goals of the project are realized and a new standard of public information transparency is established, the greater the likelihood of dodging the potential cost acceleration described above.

A fixed amount of technical capacity for conducting cadastral and GIS work exists in Colombia. In addition, security conditions vary from department to department but deteriorate rapidly in the areas where cadastral formation is most needed. The author considers the proposed plan to represent the fastest solution within the constraints of security, limited technical capacity and the requirements of supervision and quality control. The plan uses a mixture of Colombian government and commercial effort in order to maintain some flexibility and initiative in assigning locations. A combination of firms is suggested in order to crosscheck results. Almost all of the work is scheduled for completion within the first two years, allowing for some slippage and allowing contractors to attract technicians with two-year contracts.

Cadastral information in Colombia is geographically dispersed and its acquisition involves legal, cultural and administrative complexities that require in-country presence and the participation of Colombian facilitators. Exhibit F includes charts of the general relationship of the entities described in the budget matrix. At the center of the project is the Foreign Military Studies Office, which would maintain a liaison and operations officer at the US Embassy in Bogotá. Most coordination with Colombian entities would be accomplished through a small Colombian law and real estate firm.

Organizations and activities

The overall GIS project would have three interrelated dimensions: a GIS data clearinghouse, a scholarly forum and a data acquisition effort.

1. A GIS data clearinghouse.

It is essential that there be a single location for GIS data to reside and from which it is served. With a single data destination and source, gaps can be readily determined, currency and compliance monitored, etc. Technical reasons include matching map projections, sewing together multiple-sheet cartographic areas, testing commercial competing software and so on. It should be noted in this regard that the international development aid programs to develop the cadastres contained a strong current of decentralization, encouraging data to be held in local offices. While decentralization of property ownership information may or may not be a good idea, it does present a problem

for transparency. Decentralization obviously makes auditing quality more difficult, as well as obtaining disperse sets of data. This project must work against the current of decentralization, at least as to the residence of the database. The project will not disturb the decentralized format of the cadastral services and public availability of the information, but centralization in a single clearinghouse will allow for strategic uses.

The best choice for a clearinghouse is the USGS EROS Center in Sioux Falls, South Dakota. EROS has expertise capable of providing the following:

- a. Purchase and advise on the purchase of equipment and software
- b. Web design
- c. Data format and ingestion
- d. Internet mapping service
- e. Technical writing
- f. Provision of technical protocols
- g. Technical exchange
- h. Mirror web site maintenance
- i. Training (with technical exchange)
- j. Conference participation

Personnel at EROS are familiar with IGAC, and two EROS employees are native Colombians. Several of the EROS scientists are already fully informed regarding the project, the level of quality necessary and the technical challenges involved. EROS would require approximately three million dollars over a two-year period in order to complete the various assigned missions assigned to according to this proposal.

Once the data clearinghouse is in place, the processes for reconciling data types and media perfected, personal relationships established, and sub-products initiated, then the original site at USGS EROS Center can transition to become a mirror site, the residence of the primary server moving to IGAC in Bogotá.

The clearinghouse will have to deal with information at two, perhaps three, levels of transparency. One level of data would be completely unclassified and without need for restriction in any form. A second level of data, while reflecting no need for a security classification, may be subject to intellectual property rights protections, may be offensive in some way as to make child-access denial advisable, or may be in some other way considered sensitive by one of the participating governments. The clearinghouse might have to manage some data layers at a militarily classified level. One of the original design intentions of the study was to select a GIS platform that would allow data at any level of transparency to be available for use at the higher levels of restriction. That is to say, offices subject to information security measures in either the USG or the GOC could nevertheless import and compare lesser-restricted GIS information to their classified GIS data layers.

In order to determine the level of transparency and access appropriate to each data layer, a bi-lateral committee or other mechanism would be formed.

The EROS Center is a full participant and original designer of the technical protocols that are familiar to IGAC. IGAC is, in turn, the proponent of technical rules and institutional cooperation for GIS sharing in Colombia under the Colombian Spatial Data Infrastructure, ICDE. ICDE can be credited to some extent with making the current consolidation and reconciliation of GIS data practicable. On the other hand, much of the data cooperation envisioned by, and even mandated by ICDE, is unrealized. This is due in part to interagency competition and recognition of the power of proprietary information, but probably more because the Colombian government agencies operate under a market model of operations that demands they attempt to cover at least a portion of costs via the sale of product and services.

EROS would make all the processed data available to participating agencies in the US and Colombia in accordance with a schedule developed for the purpose. FMSO would assure delivery of raw data to EROS and to US government organizations able to submit the data to independent processing and analysis. FMSO would promote distribution of the EROS product to US government organizations that would otherwise not be aware of the product or could not access the clearinghouse.

2. A scholarly forum.

The second vehicle, a scholarly forum, would be a derivative of the ArcGIS® clearinghouse and data service described above. The forum would take shape in a series of workshops and conferences, and would be given a visible life through a website titled Geography of Conflict and Development in Colombia. The site would accomplish the following:

- a. Broaden support for the collection and aggregation and publication of GIS data. Importantly, the Colombian Geographical Society has close relations with the IGAC and is an autonomous, but government-funded, entity. Its support of the project will be immensely useful to its smooth functioning and longevity.
- b. Allow outside audit of the results of the GIS data acquisition effort. The data acquisition effort will not be taken on faith. The data will be broadly available for any interested organization to check for completeness, accuracy and relevance.
- c. Provide an engine for scholarly analysis of the aggregated data. There are hundreds of layers of information that can be obtained or generated. Without broadening the scholarly participation there is no practicable way that all of the valuable inspections and comparisons of data can be done by the number of available analysts in a timely manner. A goldmine of data deserves as much attention as it can be given.
- d. Identify previously unrecognized analysts and organizations able to contribute. One of the original purposes of the project, as expressed in the FMSO mandate, is to identify and create relationships with foreign security scholars. Via a quality website, not only will the data be effective, but will provide a venue to identify

and cultivate individuals and organizations capable of contributing to the rational analysis of the data.

e. Obeying the notion that “if you build it they will come,” the creation of a site in which diverse layers of geo-referenced data can be directly compared is likely to attract scholars with data layers they would wish to have incorporated. A website, like some of the existing scholarly “supersites” would hopefully become an engine for attracting otherwise unsolicited data.

f. Ultimately the most important effect of a scholarly website would be the potential to support public policy argument, decision-making and decisions made.

The overall intention of mounting a scholarly website is to present the consequence of acquisition, aggregation and reconciliation of GIS layers. The scholarly website would take as many of the most useable layers as possible, simplify their comparison and manipulation and broaden accessibility. Potential users not trained in ESRI® products or without access to ESRI® software could, nevertheless, compare a large array of data layers. The objective nature of the process would be self evident, the data being unrestricted in terms of its intellectual application. The site would incorporate selected images and analyses as an engine for debate, becoming a specialized electronic atlas. (IGAC has produced an electronic atlas of Colombia, the latest version not yet available for acquisition. The technical protocols associated with this project would allow rapid incorporation of IGAC atlas pages.)

A bi-lateral board of referees could be established to determine which analyses would be published on the Internet site.

Modest funding of participation in the forum by the Colombian Geographical Society (CGS) is highly recommended. It is further recommended that said participation be done in partnership with a suitable United States counterpart, possibly the American Geographical Society (AGS). To these pairings, IGAC/USGS and CGS/AGS, could later be added a counterpart pair of independent think-tanks, a pair of universities and, perhaps, a pair of news organizations.

The Geography of Conflict and Development in Colombia Internet project would provide ease of conversation regarding the overall effort to aggregate GIS data and would provide a continuing forum and venue for tailored conversations about required data, the meaning and consequence of revelations and so on.

3. Data acquisition effort.

The above activities are useless without data content, so the essential activity of the program must be to obtain or create data with which to fill the GIS database. Location of much of the information is described in the paragraphs above. Organizational responsibilities for the data acquisition effort are described in Exhibit F, which includes budget breakdowns by funding agency and service provider. It is summarized immediately below.

Colombian GIS data can be placed in the following hierarchy:

a. Data already in digital geo-referenceable form in the hands of a US or Colombian government agency.

The bulk of this data is held by IGAC or will come into IGAC's possession as a result of anticipated progress in formalizing the national cadastre or completing thematic geographic work of the institute. Funding of specific cadastral activities will accelerate that process. The independent cadastral offices can also provide off-the-shelf data.

b. Data in the hands of governments other than the USG or GOC, international organizations or commercial organizations.

Original GIS data in this category is limited, but may be useful in some locales.

c. Data that must be specially generated by government agency, US or Colombian.

This would include original cadastral formation in areas with flawed or informal, up-to-date land records.

d. Data that must be obtained, generated or perfected by civilian contractors.

An optimal process for carrying out the tasks of: accelerating the formalization of property ownership in Colombia; causing the data to be transparent; and obtaining the underlying databases in support of USG decision-making and strategies would take two to three years and include the following three facets:

Facet 1: A 24-month effort to obtain existing digitized data, accelerate digitization of other existing property data, and establish accords for receiving digital data when available. The USG would:

- a. Purchase all currently available digital data from IGAC and the four independent cadastral offices of Bogotá, Cali, Medellín and Antioquia;
- b. Accelerate digitization of existing cadastral data not currently digitized;
- c. Purchase currently digitized registry data;
- d. Accelerate digitization of existing (but undigitized) registry data; and
- e. Contract association of real estate appraisers to develop a land value indexing system.

Facet 2: A 24-month effort to obtain full property data in areas currently subject to some level of formal ownership controls (50% of surface, 90% of parcels). The USG would fund acceleration of surveying, cadastral and registry efforts in select portions of the country related to counternarcotics project areas and where some formal land ownership is extant.

Facet 3: A 3-year effort to obtain complete property description, location, ownership and value assessment data throughout Colombia (100% of the surface area, 100% of the parcels). The USG would:

- a. Assist IGAC to create and deliver basic cartography and cadastral formation in unmapped and poorly mapped areas of the country.
- b. Contract local Colombian commercial geo-referencing firms to obtain specialized geo-referenced data, and to conduct quality control work, and other associated tasks.
- c. Establish and maintain a US-Colombia scholarly partnership program to provide academic stewardship for public dissemination, analysis and participation, and to facilitate aggregation of additional GIS data layers.
- d. Via the Foreign Military Studies Office facilitate and coordinate the various elements of the overall project and assure that it is responsive to a variety of interagency needs.
- c. Contract the USGS EROS Center to provide GIS services in support of the project.

Cost and Time

A comprehensive database can be 95% complete within two years. Some cadastral formation in outlying areas will take longer. The cost of the project as proposed is estimated at twenty million dollars. Exhibit F contains details of the estimated budget.

Assumptions, Challenges and Shortcomings.

No factors or conditions were discovered during the feasibility study that could be considered critical barriers. It is assumed, however, that some significant financial commitment by the USG toward Colombia will continue, that the overall effort by the Colombians to resolve their internal conflict will increase, and that the current welcome accorded to United States assistance will remain the same or increase. Acquisition of cadastral data in Colombia depends on Colombian willingness to provide such data. The author recommends a modest program to *accelerate* existing Colombian efforts to modernize the real property ownership. Such acceleration has several identifiable values: it brings the goal of modernization into a time frame relevant to the problem of winning Colombia's internal conflict; it encourages continued Colombian focus on the problem and it allows the USG to contribute with work in local geographies most immediately associated with US interests and programs. The primary interest of the USG in supporting the development of the cadastre in Colombia should be acquisition of the data, rather than simply assisting in the creation of the system. While the creation of a modern real property regime is, by itself, valuable for the peaceful development of Colombia, its cadastral and registry data will be optimally useful for counterterrorism and counternarcotics only if the USG possesses that data. For this reason, a mutually supportive relationship must be maintained among all the relevant organizational entities involved.

A potential challenge is presented by the autonomy of the non-IGAC cadastral offices. It is assumed that the problem of the Cali cadastral office can be solved, but only limited funding is included in the suggested proposal of this report.

This feasibility study and the associated recommendations do not include a plan for long-term maintenance of the cadastral files or updates of the comprehensive database. The recommended action supposes no more than a three-year period of database creation and

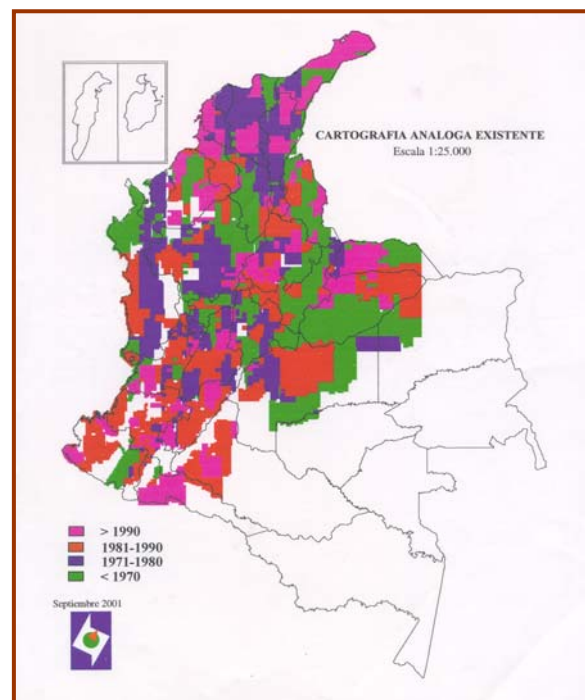
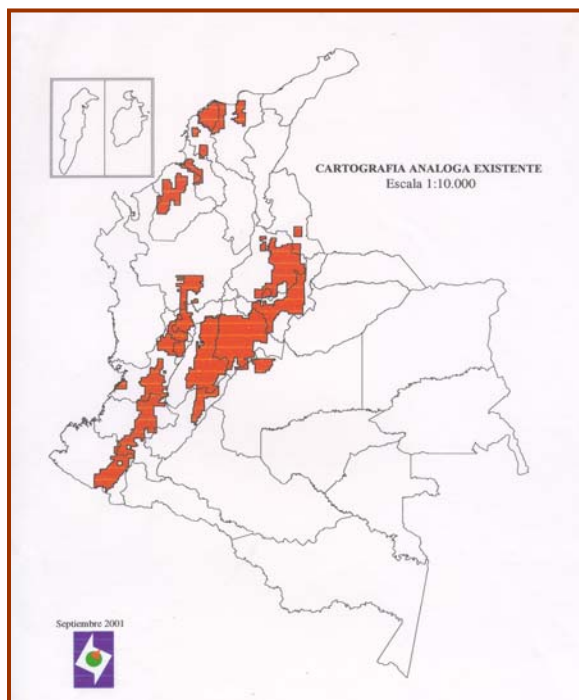
maintenance. FMSO assumes that the longer-term maintenance of the systems created will be stewarded by the Colombian government with the assistance of USG and international assistance entities. The longer-term values, beyond immediate forensic efforts, will only accrue if the databases are frequently updated.

IGAC and other Colombian government entities operate under a market model. The budgets of the organization are supplemented by the sale of their information products. Institutional health and survival concerns apparently impel information providers such as IGAC to establish prices on the basis of short-term profit. Prices for data and services are subject to negotiation.

Technical challenges include mass vectorizing of cadastral lines, integration of registry and cadastral office files and reconciliation of media types.

Urban cadastres are as important for counterterrorism and counternarcotics as are rural cadastres. The cadastral records of Bogotá and Medellín are well developed. Some of the other major Colombian cities, whose cadastres fall under the auspices of the national cadastre at IGAC, may have shortcomings and necessities that will be discovered.

Finally, basic cartographic coverage of Colombia is incomplete. The following images show national coverage for 1:10000 and 1:25,000 scale maps, the basic scales used for rural cadastral formation. The images present a good summary of the geographical extent of formal ownership of land in Colombia, and of the currency of the maps on which cadastral determinations are made.



Diplomatic and Institutional Support Requirements.

The recommended project would not map all of Colombia's real property. It would accelerate the process, ensure transparency of the data, ensure that the USG obtained the data, and would ensure widest possible application of the data. Even so, success could depend on explicit, active, senior diplomacy to build the Colombian government commitment to completion, modernization and public availability of cadastral and registry records.

In the case of the Cali cadastre, some additional involvement will have to be taken and attention paid to clarify the Cali public real property records. While the Cali cadastral jurisdiction controls perhaps only a few percent of the ownership records in Colombia, that percent could represent a considerably larger portion of records associated with organized crime. The project suggested here would address the question of the Cali records and includes a budget for purchase of the existing digital city plan and records. If the appropriate accords can be reached, then the program suggested herein could be easily expanded to accommodate a comprehensive Cali cadastral effort.

Recommendations.

The author recommends that a coalition of benefited agencies, including DoD, DoJ, DoS, NIMA and USAID sponsor a Colombia GIS project featuring real property ownership, as outlined in Exhibit F.

FMSO has determined that its participation in such a project would be in consonance with its basic mission and would contribute to FMSO's capability to complete other assigned tasks. As such, FMSO would enthusiastically lead a Colombia counterterror -- counternarcotics GIS effort if funding is established. This feasibility study, however, does not constitute a funding request from FMSO to any agency.

**Predictive Mapping for Plan Colombia Counter-narcotics:
Overlay of basic geography, demographics, real estate ownership data, business
imperatives and ecological constraints.**

(This document was produced in several versions beginning in June, 2001. The resulting research was delayed some months after September 11, but also gained new direction as it became apparent that the GIS mapping and ownership data was also relevant to countering the terrorist threat.)

Summary:

We can improve our ability to predict changes in narcotics production and trafficking, anticipate the effects of our decisions and programs, and examine actions and proposals of our partners and opponents. To do so this project proposes an interactive, multi-agency map that overlays basic environmental data, narcotics cultivation patterns, real estate ownership data, demographics and business model constraints in a way that can describe and predict outlaw strategies, and help nominate counter-narcotics targets. In short, we can better support Plan Colombia decision-makers.

Our institutional habit includes the use of map overlays in what the military has for some time called IPB, or Intelligence Preparation of the Battlefield. Some of the power of these graphic aids is difficult to realize when applied to a complex environment such as that in Colombia. The unique challenge presented by drug trafficking, including legal and diplomatic constraints, requires adjustments to the military method. However, the basic idea that we can graphically display data in multiple map overlays, and that so doing will reveal important truths, remains valid. Equally as important: by presenting data as geography it is easier to demonstrate the validity of analysis and to provide decision-makers with effective arguments.

Having posited geography (rather than economics or politics) as the anchoring discipline for this investigation, the world of military geography must nevertheless yield space to questions more familiar in law enforcement. Specifically, we need to map data regarding the ownership of real property. Ideally this would include every bit of terrain, or at least rural terrain, in Colombia. While a tall order, we believe the value of this information will be recognized as so essential to effective policy making that it will become a cornerstone of U.S. foreign relations to seek it. Currently, this kind of *GeoIntel* is not supplied to U.S. decision-makers. Information about tenancy relationships in drug cultivation zones, what changes have occurred in land values, or what the pace of real estate market activity has been should also be made available. We know little about Colombian land ownership, even while in the United States, land use planning and transparency of ownership has become a key planning factor.

Building a common platform for the display of information, including ownership and agro-business data will help bridge the worlds of law enforcement, military operations, diplomacy and developmental economics. In this regard we are aided by technological advances in digitized mapping and the widespread use of geospatial analysis software. If we can economically gather and input relevant data, especially property data, we are confident we can create a better decision support tool.

Hypothesis:

The following variables: militarily valuable terrain, changes in narcotics cultivation patterns, real estate ownership, business model constraints and environmental constraints can be mapped, overlain and compared in a way that helps describe and predict outlaw strategies.

Anticipated Products:

As a result of this project, we intend to produce the following:

1. A *GeoIntel* feasibility report outlining results of field research into real estate registry, maps, titling and value. This report will estimate the time, cost and risks involved in collecting real estate data throughout Colombia. It will measure the potential for use of this data in support of eradication strategy. It will also explore the potential for uncovering hidden interests and alliances, supporting prosecutorial initiatives, and anticipating outlaw actions. While all of the goals of this project are expected to contribute to our understanding of the counter-narcotics challenge in Colombia, this objective could lead to a marked change in our overall approach to strategic law enforcement.
2. In cooperation with NIMA, an interactive map, using ArcView software, described in greater detail below, that will electronically overlay various forms of data as suggested by the hypothesis. The feasibility study is likely only to provide sufficient data to demonstrate some of the map functions and to suggest the viability of others if complete data sets are obtainable.
3. A classified strategic estimate regarding the future challenge for counter-narcotics efforts in Colombia. This major report is to be derived from reconciled business model inputs (production costs, product pricing, transportation variances, etc.), military terrain analysis, ecological constraints, and property ownership information. It will be based initially on the data obtained and the mapping achieved during the feasibility study.
4. A network of Colombian civilian security scholars.
5. An unclassified paper titled *Colombian Geography*. This paper, to be produced by FMSO, will outline, at the unclassified level, some of the kinds of analytical conclusions that might be drawn from geospatial data.

Purpose:

1. To identify likely changes in the counter-narcotics challenge in Colombia based on
 - a. variable outcomes of competition for key terrain,
 - b. changes in real estate market activities,
 - c. changes in the costs of agricultural inputs, and
 - d. other geospatial data.
2. Test a distinct methodology for identifying optimum targets for aerial and manual eradication of narcotics cultivation;
3. Establish professional contacts with Colombian civilian scholars familiar with the internal conflict and counter-narcotics challenge;
4. Reveal aspects of Colombian geography relevant to the counter-narcotics challenge.

5. Obtain a property data set the mining of which may reveal hidden political and familial affinities and interests that greatly effect the counter-narcotics challenge.

Complementary Value:

The project will also suggest better basic intelligence mapping to support a variety of interagency Plan Colombia decisions.

Assumptions:

1. Reasoned decisions by leaders of the FARC, ELN, AUC and the Government of Colombia (GOC) constitute by far the most important non-environmental factors in determining the location of narcotics crops on a strategic scale. This assumption specifically diminishes (but does not dismiss) the importance of aggregated decisions of peasant farmers, or the decisions of second-tier DOTs. This assumption also requires that decisions by the listed groups are not taken capriciously or without self-interested contemplation. The assumption is important to the ability of the analysis to extrapolate cause and effect based on logical responses of the various groups. It is at once the most important and the weakest assumption.
2. The goal of the leftist guerrillas is and will continue to be political dominance of Colombia. There exists a slice of expert opinion holding that the guerrillas do not wish to take the reins of Colombian government, but are instead satisfied by a status quo in which they are living well as outlaw capitalists and erstwhile revolutionaries. This study rejects that viewpoint and expects the ELN and the FARC to continue to strive toward total ownership of Colombia.
3. Exercise of military force will continue to be the principal tool used by outlaw groups to achieve political leverage and dominance.
4. Outlaw leaders will continue to make military decisions guided in large measure by the importance of strategic key terrain.
5. The major outlaw groups are involved in legal as well as illegal money-making activities.
6. Wealthy members and leaders of outlaw groups (including guerrillas, paramilitaries and other narcotraffickers) buy properties the prices of which have been artificially lowered by the war.
7. Outlaws will show a preference for investing in or underwriting illicit cultivation on lands that they own or in which they have a legalized ownership interest. This assumption does not propose fee ownership by outlaws as a necessary step in the chain of logic. It does lead to the further assumption that outlaws will make speculative or planning purchases of real estate in areas they expect will meet acceptable risk criteria for future cultivation.
8. The official peace process will not deflect guerrilla organizations from their goal path. While this study does not presume to classify or judge the peace process, logic demands that the guerrillas are not going to be dissuaded from their purpose by having been successful negotiators.

9. Real property records are sufficiently complete and accurate, and can be accessed. The feasibility study will state approximate costs and times to obtain enough data to achieve each of the goals.

10. Illicit product sales will continue to be a major if not indispensable source of income for all the outlaw organizations. If illicit product sales are not a taproot of outlaw organizations' ability to challenge state control and civil peace, then the goal of diminishing their income from illicit product production is likewise diminished in value. Reducing production could retain, however, the essential purpose of reducing the quantity of product reaching the United States market. Therefore, knowledge regarding illicit agricultural business factors will have a significance independently of this assumption.

11. We do not already know in detail who owns Colombian real property. If the U.S. government does possess this data, this project nevertheless proposes that the data be unified and made presentable in map form.

Method Summary:

The initial investigative steps would be roughly as follows:

1. Interview Colombian military and civilian strategists and historians to confirm identity of strategically key geography, and to debate assumptions.
2. Compare key geography with the current military situation.
3. Visit national mapping and data agencies – e.g., IGAC and DANE. Obtain property data.
4. Identify areas where real estate has suffered a precipitous loss of sale value as a result of the internal conflict.
5. Accompany a knowledgeable real property agent, registrar or attorney to land registry offices in the capitals of departments considered geographically strategic. Obtain property data.
6. Identify suspect property transactions. (Distress sales may have been made by innocent speculators, but are more likely to involve buyers who for whatever reason are not overly concerned about an outlaw threat.)
7. Lay property data over remote systems data.

8. Lay key military terrain locations, ecological constraint, business constraint (transportation, cultivation, harvesting costs), and socio-political data over the property and remote systems data.

Comment on the Logic:

We will combine property plat map data (which will itself be valuable) with transaction data, which is apparently available at department capitals. Securing information regarding land sales prices may be the most difficult step, and may require contracting real estate brokers. We also will want to interview Colombian scholars who have apparently corralled some of this information in the past (Alejandro Reyes Posada, for example). If there is a significant appearance of unlikely or pressured real estate sales in militarily significant zones, we could see a high incidence of narcotics cultivation on those properties as well. This can be checked against remote sensing data. Such a correlation suggests especially valuable targeting. Even if the crop sizes and sale values are not particularly important in and of themselves, the locations logically suggest ownership by outlaws or accessories. Therefore, targeting those properties more directly hurts the outlaw. Even if no narcotics crop is being grown on a particular land holding, ownership correlations might be made to other properties which are under drug cultivation and are registered to the same owner. These properties might then be subject to asset forfeiture. In other words, if we are successful in marrying military geography with real estate, agricultural and remote sensing data, we should be better able to assign and predict outlaw behavior. This would form a basis for a more painful eradication plan, and it might form, in some cases, a legally sufficient argument for the seizure of properties, even where illicit drugs are not being grown. Anecdotal information suggests that Colombians have been purchasing tracts of land along the coast of Ecuador and along the border region between the two countries. These purchases are most probably drug-related. If true, such purchases are a probable indicator of future illicit cultivation.

Whatever real property data we obtain, and this should be the most unique set of information, we need to combine it with other factors. Our doing so will be aided by expert opinion of Colombians. We should strive to collect as much historical data as possible so that correlations over time can be displayed on the map. Likewise we should incorporate as much social development and political data as possible in order to detect correlations between population, partisanship, and developmental factors with illicit crop cultivation. The possibilities for useful analysis are extensive, and almost any factor can be mapped. The data, however, must first be marshaled.

While in Colombia, we would take the actions listed below. They reflect the schedule and method outlined above:

1. Specify and prioritize geographic areas of interest. We are doing that now.
2. Visit principal government institutes to select and obtain appropriate 1:10,000 property sheets and other media. Obtain time, cost, reliability and availability information. Determine constraints. Take the ICAC and DANE institute tours and obtain other maps as an associated

benefit. Obtain the whole data set immediately, if possible. Obtain digital historical data sets on demographics, election results, socio-economic factors, etc.

3. Receive briefings on significant military geography in each department and in Bogota from Colombian G-2s and scholars if available locally.
4. Coordinate with our legal support in Bogotá and each departmental capital.
5. In each department capital, identify individuals familiar with land transfers, and who would be aware of land sales values. This may or may not be the same individual as our legal support. Gather as much land value data from these individuals as possible.
6. Study the maps obtained at the mapping institute to select plats we want to trace in each of three departmental land title registry offices and plats to physically visit.
7. Search the local records for the titling history of terrain we selected from the Bogota maps. We need to anticipate quite a variation in how the department capitals do business, and it is important that we get an idea about what that variation entails..
8. In each department overfly some terrain the records for which we have obtained. This is to cross-test the data. There is no need to overfly dangerous terrain for this step. It will be a sufficient test to use a couple of places that are easy to visit. We may be able to cross-check some dangerous terrain against GPS data from the crop duster systems.
9. Check data in reverse. In the department capitals, we select a piece of terrain in the local records and trace it back to the digitized map. We also visit a piece of terrain we personally visit, find it on the map, then in the docs. After all -- that is what the records are for. But we have to know how hard it is to do, how long it takes, how much it costs, and how accurate it is.
10. Return to Bogotá, revisit the mapping institute, reconcile doubts, obtain as much land registry data as possible. Consult Colombian scholars.
11. Buy commercial maps and compare those as well. Consult large commercial corporations with independent geospatial data holdings.
12. During in-between hours talk with scholars knowledgeable of the significance and history of certain terrain. Obtain appropriate books, articles, and other documents in order to map data in context.
13. If the methodology is fruitful, define the parallel data challenge for the border area of Ecuador before leaving Colombia.

Map Characteristics:

The analytical tool the project expects to generate may itself be the most important long-term benefit. On the basis of data marshaled during the investigation, NIMA will be asked to create an interactive, all-agency map that will allow the viewer, on all scales from national through departmental, municipal, and smaller, to display and overlay in any combination, the following:

1. Rural properties have been transferred in each of the past 240 months;
2. A sequenced display of property transfers over selected time periods;
3. Any selected period of time during the past twenty years and see a sequence of transfers unfold on a monthly basis during the period;
4. The pace of transfers (which months had the highest numbers of transfers, lowest, etc.);
5. Amount transferred by acreage during selected months;
6. Sequence of transfers over time by quantity of acreage transferred;
7. The names of registered owners, prior owners of all properties;
8. Date of individual transfers;
9. Properties owned, or purchased under the name (Select a location on the map at any scale, zoom to 1:10,000 scale or lower, find the name of the owners on plats, zoom out to a higher scale map, enter the same name in a dialog box, and have the map identify anywhere else in the country that property is owned under the same name;
10. Average sizes of plot in a given area;
11. Changes in average plot size in a given area over time;
12. Properties owned by identities that own multiple properties by categories of number of properties, e.g. identities with 1-5 properties, 5-10, 10-20, over 20;
13. Properties owned by owner identities that own multiple properties by categories of number of properties within select areas or zones;
14. Correlations of ownership locations among multiple property identities;
15. Rural terrain by sales value over time (A map of Colombia that shows the most valuable terrain according to prices paid during a given one month three month six month or one year period;
16. Sequence views to see the change in relative values by region and over time, adjusted for inflation and not adjusted;
17. Overlays of strategic terrain, infrastructure, etc. on any of the above views;
18. Interpolations and extrapolations of any of the above;
19. Agricultural limitations for select crops, changing variables such as rainfall labor cost, law enforcement restrictions, transportation costs, etc. Overlays of this info on any of the above views;
20. Ability to insert changes in a given agricultural economic variable, such as an increase in transportation costs, a destroyed amount of harvest, an increase in labor, etc, and see a corresponding change in the shape of the cultivation pattern;
21. Properties that lost face value, in 5% increments (That is to say, what properties were sold at a 5% loss, 10% loss, 15% loss, etc., on subsequent resale?)
22. No seam with similar Ecuador data.
23. Can draw on the thing as we like, also in multiple layers

24. Can scan other maps, such as commercial or tourist maps, size them to a given scale, and turn them into overlays that can also be adjusted artistically even if the data can't be changed.
25. What departments and municipalities have lost and gained displaced persons by totals and periods of time. (UNHCR, Desplazados)
26. Where are there environmental indications of precursor chemical spills
27. Where are population aid resources being distributed and when.
28. What votes were taken by party, by locality, over time.
29. Other as the project progresses.

Costs:

As determined by TWD.

Need for support:

Embassy support is critical and should be urgently sought. Embassy help in marshaling already recollected data from the various U.S. government offices, assistance with in-country travel, and help in obtaining appointments with Colombian scholars are all necessary for the success of the project. Especially sought is the expert opinion of embassy personnel.

The project may face the recurrent concern of embassy officials that any outside investigative effort could be a trojan horse for criticism. Embassy and other agency officials must be assured that the product will be useful for their purposes and goals, and that it will be used for the general support of future Plan Colombia decision-making, not as an information club for taking gratuitous whacks at U.S. or Colombian leaders.

Wrap-up:

Among other things, we can better describe and predict outlaw strategies. If this *GeoIntel* project gains acceptance across agency boundaries and in-country, the resulting product should be of long-term service toward this and other intelligence objectives.

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