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**SYMPOSIA PAPERS**

LAND RECORDS MANAGEMENT IN THE CONTEXT OF HEMISPHERIC TRADE  
INTEGRATION IN THE AMERICAS

GERENCIA DE DOCUMENTACIÓN GEOGRÁFICA EN EL CONTEXTO DE LA  
INTEGRACIÓN ECONÓMICA HEMISFÉRICA EN LAS AMÉRICAS

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ABSTRACT

Trade integration will have a negative fiscal effect on customs revenue, which accounts for up to half of all public revenues in many Latin American and Caribbean jurisdictions. Facing huge public deficits, governments will be looking to cut costs while increase revenues from other sources. With the increasing need for public investment in the social sector, particularly in basic education and health care at the local level, property taxation is becoming increasingly important as a future revenue producer. However, land taxation implies accurate, agile, up-to-date data on parcel size, value and ownership. This basic informatic infrastructure is not readily available in most of Latin America.

GPS, first used in Albania, and now in places like Trinidad and Costa Rica, is paving the way to dramatically reduced cost, greater speed, and broader opportunities for private sector participation. When combined with decentralization efforts and greater transparency, these efforts will play a very dramatic role in the future economic recovery of the Region, while laying the groundwork for regional economic integration with enhanced fiscal revenue from property taxation. In this way, trade integration will become possible without sacrificing the social sector.

RESUMEN

Integración económica producir un impacto negativo en términos de ingresos aduaneros, los cuales representan hasta la mitad de todos los ingresos públicos en varias jurisdicciones latinoamericanas y caribeñas. Ya con déficits públicos grandes, los gobiernos buscarán reducir costos mientras fomentan ingresos de otros lados. Además, con el aumento de necesidad de inversión en el sector social, primordialmente en educación y salud básicas, se ve un papel tremendo para los impuestos prediales para agregar a las fuentes de ingresos. Al otro lado, un impuesto predial implica un sistema de información con datos correctos, ágiles, y actualizados referente al tamaño, valor y dueño de cada parcela. Tales informaciones no están disponibles en una gran parte de América Latina.

GPS, usada primero en Albania, y ahora en lugares como Trinidad y Costa Rica, ha logrado una gran reducción de gasto, mayor rapidez, con amplia oportunidad para la participación del sector privado. Cuando se agregan esfuerzos de descentralización y transparencia de gobierno, los proyectos tendrán un impacto fuerte en la recuperación económica regional con mayores ingresos fiscales a través de impuestos prediales. De tal modo, se hace posible la integración económica sin sacrificar al sector social.

## 1. POLICY ORIENTATION AND CONSIDERATIONS

1.1 Reich has noted that governments must promote jobs, education, training, and investment,<sup>1</sup> supporting the platform and vision of jobs, work, and responsibility that Clinton ran on in 1992.<sup>2</sup> In the U.S., the budget deficit has made financing of investments very difficult. Consequently, the government has had to address a fundamental paradox: how to increase social investments while decreasing the budgetary imbalances. Meanwhile, the government has been challenged to do more with less. Looking for greater efficiencies, a new initiative has been advanced to "Re-Invent Government" with a view toward increasing service and efficiency at decreased cost.<sup>3</sup>

1.2 Similar policy objectives extend throughout Latin America and the Caribbean. However, most governments are in even worse shape than the United States. Governments typically have large deficits. Education, health care, employment and other strategic investments are woefully underfunded. In most cases, the well-to-do are not even asked to pay their share, with income taxes evaded and compliance with land taxation dismally low. Further, a major part of the Latin American and Caribbean population remains excluded from the economic, social and democratic life.<sup>4</sup>

1.3 The Hemisphere's democratically-elected heads of state all met for the "Summit of the Americas" in Miami in December 1994 to agree on hemispheric trade integration within ten years, with full implementation within twenty years.<sup>5</sup> Trade integration translates into reduction if not elimination of trade barriers. In the context of world market integration, the conservative and corporate elements of society stand strongly behind initiatives such as the World Trade Organization (WTO)<sup>6</sup> and the North American Free Trade Agreement (NAFTA), which promise increased investment and incomes. The Free Trade Agreement of the Americas (FTAA) will be the world's largest free trade area, encompassing 34 countries with a current total population of about 750 million and a combined gross domestic product (GDP) of more than US\$8 trillion.<sup>7</sup>

1.4 Despite the international policy support for free trade, perhaps the gravest threat to the region is poverty.<sup>8</sup> To a large extent, Latin American and Caribbean governments have relied on import duties to generate large amounts of public revenues: for example, customs represents about half of all revenues in Belize and the Dominican Republic, and about a quarter in Peru. These import duties often represent trade barriers, and many will have to be dismantled

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<sup>1</sup> Reich, R., The Work of Nations, 1992.

<sup>2</sup> Bill Clinton & Al Gore, "Putting People First: How we can all change America," 1992.

<sup>3</sup> See generally, Gore, A. Creating a Government that Works Better & Costs Less: Report of the National Performance Review (Sept. 1993).

<sup>4</sup> Agency for International Development, Congressional Presentation: Fiscal Year 1996, 1995, p. 538.

<sup>5</sup> Summit of the Americas, "Declaration of Principles: Partnership for Development and Prosperity: Democracy, Free Trade and Sustainable Development in the Americas," Dec. 11, 1994. Only Cuba did not participate in the Summit. The goals of the Summit were: (a) Making Democracy Work: Reinventing Government; (b) Making Democracy Prosper: Hemispheric Economic Integration, and (c) Making Democracy Endure: Sustainable Development.

<sup>6</sup> The WTO is the successor to the General Agreements on Tariffs and Trade (GATT).

<sup>7</sup> Agency for International Development, Congressional Presentation: Fiscal Year 1996 (1995) p. 537.

<sup>8</sup> Schneider, M. (Assistant Administrator for Latin America and the Caribbean for the U.S. Agency for International Development), Statement at the 1995 Hemispheric Policy Forum, Institute of the Americas, Feb. 28, 1995, p. 4.

in the trade integration process. Already facing high fiscal deficits, as central governments begin to lose import duty revenue, they will have two options. First, they can cut spending even more. Many will probably do this. Further, spending cuts will imperil the most vulnerable citizens: children, elderly, disabled, indigenous groups and the poor. Indeed, the Summit of the Americas concluded:

It is politically intolerable and morally unacceptable that some segments of our populations are marginalized and do not share fully in the benefits of growth. With an aim of attaining greater social justice for all our people, we pledge to work individually and collectively to improve access to quality education and primary health care and to eradicate extreme poverty and illiteracy. The fruits of democratic stability and economic growth must be accessible to all, without discrimination by race, gender, national origin or religious affiliation.<sup>9</sup>

1.5 With domestic U.S. programs, the present administration supports health care and education as two top priorities. "(H)ealth-care costs are the number one cause of labor disputes, bankruptcies, and growth in the federal deficit."<sup>10</sup> Further, Bill Clinton and Al Gore have said, "Government fails when our schools fail."<sup>11</sup> Health and education domestic policy extend to foreign policy, as foreign policy seeks to support programs that address inadequate health services, particularly in the area of basic, preventive, and reproductive health care; education systems, especially for girls and women; technical and business skills and access to technology; and other related social services and institutions that facilitate broad-based participation, especially by women, indigenous peoples, and other disadvantaged groups.<sup>12</sup> If trade integration means elimination of public revenue and hence social sector development, a hemispheric-wide trade agreement may not be feasible.

1.6 Alternatively, governments can seek to replace lost customs duty revenue through other means. Options may include improved efficiency of current income tax collection practices, value added taxation, and land or property tax. Value added taxation is being tried in a few cases. In Venezuela it has already been tried and abandoned.<sup>13</sup> Property tax requires an agile, transparent, up-to-date, reliable information source on: (a) property size and location, (b) property value, and (c) property ownership. Such systems are scarce to non-existent in Latin America and the Caribbean. Despite anticipated political unpopularity, there seems to be a rationale for instituting property tax systems. First, they already exist in most countries: implementation would simply make legislation cohere more closely with market reality. Second, lack of enforcement of land taxation is an implicit subsidy to the rich, who can evade paying for their fair share of government expenses. This subsidy has allowed large estate holders to retain ownership despite being uncompetitive in the market. This means the poor have an even harder time gaining access to land. Enforcement of property tax laws will allow the poor to participate on a more level playing field. Third, strong environmental reasons exist for imposing a land tax, which often results in an intensification of land use, and better management practices.<sup>14</sup> In general, land formalization lends greater security of ownership to landholders. This

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<sup>9</sup> The Summit of the Americas Declaration of Principles, as cited in Agency for International Development, Congressional Presentation Fiscal Year 1996 (1995) p. 539.

<sup>10</sup> Clinton & Gore, op cit., p. 107.

<sup>11</sup> Clinton & Gore, op cit., p. 16.

<sup>12</sup> U.S. Agency for International Development, Strategies for Sustainable Development (1994) p. 30.

<sup>13</sup> Ley de Impuesto al Valor Agregado (IVA), Decreto 3.145, Sept. 16, 1993; G.O. 35.304, Sept. 24, 1993.

<sup>14</sup> See generally, John D. Strasma & Rafael Celis, "Land Taxation, the Poor, and Sustainable Development," in Sheldon Annis, Poverty, Natural Resources, and Public Policy in Central America (1992) pp. 143-165.

security means owners can take longer term views for management of their property. Often, this interest translates into better care for the land and more investment in trees and soil maintenance.

1.7 As Finance Ministries begin to realize the consequences of trade integration on the national bottom line, and as politicians seek ways to advance a more inclusionary growth pattern, land records management and accompanying taxation policies will take on accelerated importance. Land, resource and agriculture projects, once driven by agrarian reform demands, will now be driven by fiscal concerns. International donors looking to make basic education and social services sustainable will also encourage local level land taxes. This is especially true if donors ever hope to "graduate" countries from Third World status by encouraging broadly-based programs to stem present levels of poverty.

1.8 Attempts to finance education and health care with local level revenue and management are now being tried. Experiments such as Bolivia's Popular Participation and Decentralization legislation or Mexico's PROCAMPO program already exhibit elements of such an approach. Only Cuba, Venezuela and the Dominican Republic do not currently have a rural land tax at least on the books. With only a few exceptions (like Chile), in most other places, systems on the books are not being implemented, due to old technological approaches, personnel deficiencies, infrastructure constraints and perceived political liability. The challenge in the coming years will be to make the current systems operable and more efficient. To this end, individual jurisdictions will need to take advantage of relevant regional experience to avoid the pitfalls of previous efforts, while taking advantage of lessons learned.

1.9 In the U.S., the Re-Inventing Government Initiative has mandated streamlining geographic data collection and maintenance, while improving data quality and compatibility, while reducing cost.<sup>15</sup> Within the foreign policy context, the U.S. has supported work toward "establishment of more equitable and more secure land tenure arrangements."<sup>16</sup> But how can foreign policy achieve that goal within the broader mandate, regional advances, and ever-advancing communications and technology? Why should the U.S. support the creation of these land management systems?

1.10 It is quite clear that the indirect benefits of land taxation are tremendous both for the host country and for the U.S. Private foreign investment will become more welcome as countries open up their registry practices to scrutiny. U.S. foreign investment, presently at risk in places like Nicaragua, Guatemala, the Dominican Republic or Honduras, due to poor land administration practices, will be more secure. Standardization of methodology will also go a long way to promote the massive regional investment contemplated by regional economic integration. In the global market, those that do not modernize will be left behind as uncompetitive. Countries once producing in the industrial age (or even still under feudalistic economies) must now turn and prepare themselves for the information age. Thus, in the end, the bottom line and the business community may be the ultimate driver of modernization.

1.11 An additional beneficiary of land records modernization will be the environmental movement. As Vice President Al Gore has noted market economics is not always environmentally-friendly.<sup>17</sup> Indeed, sustainable land use often turns on who has ownership to what resources, and on what basis. These are fundamentally tenure questions. Having accurate land information systems provides the informatic infrastructure necessary to make sustainable land and forest policy possible.

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<sup>15</sup> Re-Inventing Government/Presidential Executive Order 12906 (Apr. 11, 1994).

<sup>16</sup> 22 U.S.C.S. Sec. 2151a(b)(1) (1994).

<sup>17</sup> Gore, A. Earth in the Balance: Ecology and The Human Spirit, 1992, p. 337.

1.12 Francis Charles, Commissioner of Lands and Surveys for Trinidad, notes that most economies in developing world are being transformed into market-driven entities. As part of this effort, mapping and titling agencies must reorganize, be more client-driven, absorb budget cuts, and produce more revenue.<sup>18</sup>

1.13 For these reasons, land administration experts across the region will increasingly find themselves in the vanguard of the regional trade integration process. No longer relegated to ministries of collateral importance, cadastral and registry staff must now prepare themselves to contribute to high profile high impact activities of great national importance. The high profile role of land administration will go hand-in-hand with consideration of technological and management advances that have been piloted in North America (Canada, Mexico and the U.S.) and the developed world. These technologies and management practices are transferrable to Latin America and the Caribbean.

## 2. BACKGROUND TO LAND RECORDS AND LAND ADMINISTRATION

2.1 Land administration has always been important. Jeremy Bentham, the famous nineteenth century legal philosopher, stated:

Property and laws are born together, and die together. Before laws were made there was no property; take away laws, and property ceases.<sup>19</sup>

2.2 Canadian Law Professor Tom Johnson notes that in order to secure the expectations created by the laws of property, countries need to have an accurate and effective means of recording property rights.<sup>20</sup> Without that, property rights become meaningless, expectations of members of the society are not met, and socio-economic relations in the society will quickly deteriorate. The way rights are often recorded is through a property registry and a related cadastre.

2.3 A great deal of funds have already been dedicated to mapping and land management exercises, although often in an inefficient manner. H.R. Schwendener of the Leica Corporation asserts only 15% of the world's surface has a modern cadastral mapping system, at a scale of 1:25,000 or better.<sup>21</sup> Dale and McLaughlin note the U.S. alone will spend about US\$90 Billion on the collection and management of spatially related data between 1986-2000.<sup>22</sup> Nancy Tosta of the Federal Geographic Data Committee asserts that the Federal Government alone spends over US\$4 Billion per year on collecting and managing spatial data, with state and local governments spending much more.<sup>23</sup> Geographic Information Systems (GIS) Expert Daniel Parr estimates that about five sixths of that is wasted due to

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<sup>18</sup> GPS Demonstration, Presentation by Francis Charles, Port of Spain, Trinidad and Tobago, Aug. 17 & 18, 1995.

<sup>19</sup> Stewart, L. & Hendrix, S. "Proceedings from the Planning Retreat for the Deeds Registry in Guyana: September 5-6, 1995, Georgetown, Guyana," 1995, p. 8.

<sup>20</sup> Id.

<sup>21</sup> Schwendener, H.R., Leica Corporation, Jan. 17, 1996.

<sup>22</sup> Dale, P & McLaughlin, J.D. Land Information Management (1990) p. 2.

<sup>23</sup> Tosta, N. Presentation at the FIG Meetings, New Brunswick, Canada (Oct. 12, 1994).

inefficiencies and failures in the system and system design.<sup>24</sup> Dale and McLaughlin add: "For Third World countries, the potential for spending and wasting enormous sums of money on the development of their own systems is limited only by their lack of available funds... Such countries can least afford to waste resources and are most in need of the benefits of orderly land development."<sup>25</sup>

2.4 Daniel Parr adds no developed world city with a population of over 100,000 could function today without some automated GIS in order to not only manage land, but urban planning, emergency services, utilities and other applications. Debate over whether to have GIS and its related cost-benefit function really ended in the 1970s. Information has become necessary for doing business. People need access to data about spatial relationships, since land, water, air, buildings are all finite. Today the GIS issue is not "whether" but "how." Land administration is part of the necessary informatic infrastructure for development. In global terms, the trend has been toward putting the "public" in the information loop, since GIS allows a great democratization of information via broad public access to information.<sup>26</sup>

2.5 The Inter-American Development Bank's new rural development strategy defines the problem of rural poverty in Latin America. The very first lines of that definition notes: "One-third of the rural poor of Latin America consists of landless workers and ethnic communities that often do not have well-recognized land rights. The other two-thirds are small producers with little access to land and other productive resources... The productive potential of poor small farmers is limited by lack of security in land tenure, as well as lack of access to land and water resources."<sup>27</sup> Tenure security, poverty alleviation, and land regularization all contribute to a strategy of providing land access and making land markets work for the poor. Clearly, land regularization, land markets and land information systems are topics of hemispheric importance.

### 3. SUCCESSFUL REGIONAL APPROACHES TO REGISTRY AND CADASTRAL REFORM.

3.1 Registry and cadastral reform is often considered a means to address deficit reduction to allow for increased social sector investments. More specifically, Governments generally seek to promote:

Transaction transparency: the rule of law requires that property transactions be carried out in a transparent system free from corruption. The market requires transparency to get the prices right.

Private Sector Participation: in the provision of traditionally public sector survey services. There is nothing more basic to the development process than participation.<sup>28</sup>

Decentralization: to empower local government and provide local access to public information.

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<sup>24</sup> Parr, D. "Introduction to GIS" Lecture, URISA Conference, Atlanta, Georgia, July 25, 1995.

<sup>25</sup> Dale & McLaughlin, op cit., pp. 2-3.

<sup>26</sup> Parr, D. op cit.

<sup>27</sup> Inter-American Development Bank, "Confronting Rural Poverty in Latin America and the Caribbean: A Renewed Approach to Rural Development," Nov. 1993, p. 1-2.

<sup>28</sup> U.S. Agency for International Development, Making Markets Work for the Rural Poor (1994) p. 15.

Reduced Transaction Costs through the use of new technologies: To allow the poor to participate in the registry process. Further, greater efficiency in government, with leaner, smaller budgets, while demanding greater service, means the Registry must rethink its approach to information management.

#### 4. WHERE ARE WE TODAY? COMMON REGIONAL ISSUES

4.1 Currently, only the more economically-sophisticated can manipulate the byzantine registry and cadastral systems often found in the region. Information is often power and the current system offers key economic information only to the few. When this is combined with market liberalization, we might expect economic growth to be even more exclusionary if the registry issue is not confronted. Guyanese attorney Leon Rockcliffe asserts "The registry is the basis of social stability, beyond mere economic stability. (Without addressing registry reform) the country is flirting with anarchy. People with economic power can run through the system when things are in disarray." While even the more sophisticated have difficulty manipulating the registry system due to the lack of administrative and technological efficiency, the poor are often entirely excluded.

4.2 Inefficiencies and lack of comprehensiveness and transparency in registries and cadastres mean that the poor usually do not have access to what is for them perhaps one of the most important institutions of the justice system. *The poor are effectively denied the benefits of citizenship in democratic society.* Similarly, they escape any responsibility of citizenship, i.e. property taxation. In other words, responsibility of citizenship means payment of taxes.

4.3 Other ailments of the current systems include:

Lack of information in project design about other experiences: what has worked elsewhere and what has failed. Continuous need to "reinvent the wheel." This is evident in Venezuela's current program.

Extremely poor cost-benefit analysis, as in modernization proposals from Venezuela, El Salvador or Ecuador.

Slow, expensive processes that ignore new technologies available to reduce transaction costs, as in Guatemala, Guyana, Ecuador or the Dominican Republic.

Land administration systems are generally highly centralized, as in Guatemala, Costa Rica and Panama.

No conceptualization of value-added projects, despite having very important and highly valuable information. Value-added products have the potential to contribute vast profits to government far beyond its investment in the registry. Lack of thought to these products means lost income for regional cash-strapped governments. This is true in Peru, Ecuador, Bolivia, Guyana, Nicaragua, Honduras and other jurisdictions.

Little participation by the private sector, as in Peru, Nicaragua, the Dominican Republic and Ecuador.

Lack of capital for investing in the system (ex. Peru, Venezuela, Ecuador, Honduras), even though the system could be designed to be self-financing in the longer term, and indeed generate massive amounts of money for local and central governments.

Perceived insecurity of ownership (examples: Nicaragua, Guatemala, Venezuela) or at least confusion of ownership (examples: Peru, Dominican Republic, Guyana, Bolivia).

Demands by Indigenous Groups and Small Farmers for titles: the public sector is not responding to the demand in an efficient, responsible, timely manner, as in Ecuador, Bolivia, Panama, Nicaragua, Peru and Mexico.



Competitiveness: as the developed world moves from the industrial to the information age, the third world will fall further behind. Countries that do not get moving with information management strategies will continue to be non-competitive and will never "graduate" from foreign assistance style economies.

## 5. A WAY FORWARD: COMMON APPROACHES FOR LAND RECORDS MANAGEMENT

### 5.1 Cadastral Surveying

5.1.1 Given the importance of land records, how can new technologies and methods help in the measurement of parcels and determination of parcel size? In years past, traditional survey methods were all that were available. But more and more, global positioning systems (GPS) are now being considered. In the 1980s, surveyors began to use GPS, which was found to reduce the costs of land surveying, the most expensive aspect of land titling.

5.1.2 GPS consists of 24 satellites: 21 operational satellites and three spares. The satellites are placed in a high altitude, geostationary orbit, and are maintained by the U.S. Department of Defense. They can be used world wide. Radio signals are sent continuously from the satellites. A person using a GPS receiver on the ground can read these 24 hours a day. In its most simplistic form, the GPS receiver calculates its position based on the equations: Distance = Velocity X Time. Both the satellite and the receiver have very accurate, synchronized, internal clocks. To calculate an accurate coordinate, four satellites should be read by the receiver. The coordinate is then calculated using triangulation, based on these readings.<sup>29</sup>

### 5.2 Options and In-field Variation

5.2.1 Until a few years ago, geodetic GPS, accurate to a less than a centimeter, was expensive, required up to half an hour to fix a single point, using two base stations and a rover. Single receiver GPS, without any base station, could fix a point in seconds, but allowed margins of error of up to 100 meters. This was excellent for navigation, but lousy for mapping. In March 1994, the Land Tenure Center experimented with using differential GPS to carry out parcel mapping. It was found that using high quality GPS receivers, it is possible to obtain meter level accuracy in just 30 seconds per point.<sup>30</sup> Differential GPS uses just one base station and one rover unit. This provided a quick, inexpensive alternative for GPS survey. In all three categories, never before have the costs been lower, and benefits higher.<sup>31</sup>

5.2.2 Before jumping on the GPS wagon, we should first ask what are developing countries' survey needs. Grenville Barnes notes that first and foremost, surveying should be affordable and efficient. Any new approach must

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<sup>29</sup> I must apologize for being brief here about the technical background for GPS, as the focus of this paper is on the policy rationale for land administration rather than GPS itself. Also, as the technology is in a state of constant change, and I am not a surveyor, I apologize for any errors in presentation. For greater detail and specificity on GPS technology itself, see B. Hofmann-Wellenhof, H. Lichtenegger & J. Collins. Global Positioning System: Theory and Practice (Springer-Verlag, Wien, New York, 1994).

<sup>30</sup> Barnes, G., Sartori, Michael & Chaplan, Bruce. "A GPS Methodology for Survey and Mapping Cadastral Parcels in Albania," ACSM/ASPRS Annual Conv. and Expos. Technical Papers, Charlotte, NC, Feb. 27-March 2, 1995, Vol. 1, pp. 111-120.

<sup>31</sup> It is possible we are coming to a point in time where the instruments are so precise that the primary errors in accuracy now come from errors in relocating the exact position at which original points were taken in non-monumented situations. See Leininger, Joel M. "The Case Against Positional Tolerance," Prof. Surv. (Jan./Feb. 1996) pp. 17-18.

perform better than traditional methods, which are usually considered expensive. In the 1980s, survey costs in Latin America and the Caribbean were about US\$40 to US\$100 per hectare, or US\$5 to US\$50 per parcel. Efficiency also means short occupation times for defining a single point. We should not wait 10 minutes at a point. Instead, 30 to 60 seconds would be ideal, dependent on parcel size and accessibility. We may decide to spend more time if parcels take a long time to get to. Conversely, a shorter time may be justified for less accessible parcels.<sup>32</sup>

Comparison of the "Wisconsin Model" in Albania vs. traditional land regularization models <sup>33</sup>				
Jurisdiction	Timeframe	No. of Parcels	Cost per parcel for Survey	Cost per parcel for inscription
Albania	11/94 to 7/95 (10 months)	approx. 72,000	US\$3 to US\$5	US\$1
Honduras	9/83 to 10/87 (49 months)	94,028	US\$120	US\$35.20
Ecuador	4/87 to 10/87 (6 months)	74,972	US\$50	US\$167
St. Lucia	12/84 to 4/87 (29 months)	approx. 52,000	US\$96	US\$39

5.2.3 Second, surveying should permit long baselines. Traditional approaches require a line of sight for survey. This means not only short distances, but also clearing the land. Ideally, baselines should extend to at least 100 kilometers. This distance would decrease costs by eliminating the need to densify and maintain additional control points.<sup>34</sup>

5.2.4 Third, parcels should fit together into a national grid, convertible to the world wide network. This requires georeferencing of the parcels, so that one parcel's boundary description corresponds with its neighbor's description of that same boundary. Historically, parcels boundaries were described as distances and angles, or leaps and bounds, without corresponding to other boundary descriptions. Parcels were floating around on the earth! This produced gaps and overlaps in parcels, and consequently a great deal of insecurity. This can be eliminated through use of coordinants which can give absolute positioning using geodetic control.<sup>35</sup>

5.2.5 Four, developing economies need realistic accuracy level. This is perhaps the most difficult aspect of project design, since it implies a cost-benefit analysis. Designers should question how accurate the clients need the measurements. Historically, technology dictated the requirements: surveyors simply gave what was best. Today, that

<sup>32</sup> GPS Demonstration, Presentation by Grenville Barnes (University of Florida), Port of Spain, Trinidad, Aug. 17 & 18, 1995.

<sup>33</sup> Sources: For Albania: J.D. Stanfield, Update on 7/14/95 for Albania; For Honduras, Ecuador and St. Lucia: Barnes, G., "A Comparative Evaluation Framework for Cadastre-Based Land Information Systems (CLIS) in Developing Countries" (Land Tenure Center Research Paper 102, 1990). Caveat: Prices include labor, transportation, per diems, and other variables beyond just the GPS costs. This may affect the absolute costs. However, GPS will dramatically reduce costs, and these figures are illustrative of what might be expected.

<sup>34</sup> Id.

<sup>35</sup> Id.

approach is too expensive. As an alternative, a user needs approach has been advanced: what does the client need? Unfortunately, clients (governments or donors) seldom have a criteria for making such decisions. Perhaps one way to approach this is really a function of the coordinates themselves. Measurements should be at least good enough to:

relocate monuments or even relocate missing points or coordinates,

to replace coordinates, or

to describe points.<sup>36</sup>

5.2.6 Differential GPS is usually sufficient for these purposes. However, a final decision may depend on the parcel size, parcel value, capability of getting better measurements, neighborhood relationships, and other factors.<sup>37</sup>

5.2.7 Five, emerging markets need a realistic level of technology. We cannot advocate a technology so advanced it requires highly trained people that do not exist in country. Governments should consider the technology level, the existing skill base and training requirements. In this regard, GPS technology is very easy to use and adaptable to developing world environments.<sup>38</sup>

### 5.3 GPS Methodology for Producing Maps for Titling

5.3.1 With geodetic GPS, a minimum of two base stations are used as control points. Independent "rover" units managed by survey teams then take measurements of individual parcels. Teams membership varies by country, but often consists of a GPS operator, a data collector who knows the boundaries, and a sketchmaster.<sup>39</sup>

5.3.2 Controlled tests in Albania and at the University of Florida indicate that differential GPS with very precise receivers can yield submeter accuracy with a baseline up to 135 kilometers. Accurate readings result in just 15 seconds. In Albania, in terms of productivity, traditional methods can survey 10 hectares per day, or 6 to 12 parcels. GPS was at least three times more productive, allowing for 37 hectares per day, or 76 parcels. Further, GPS cut adjudication time cut even more due to digitalization.<sup>40</sup>

5.3.3 In March 1995, a workshop was held at the University of Wisconsin to assess the use of GIS, GPS and other technologies to various settings.<sup>41</sup> In August 1995, a GPS workshop was held in Port of Spain, Trinidad and Tobago, to demonstrate the "Albania Model" with new GPS technology along with land administration practices to governments of the English-speaking Caribbean. Based on that workshop and other consultations, the Governments of

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<sup>36</sup> Id.

<sup>37</sup> Id.

<sup>38</sup> Id.

<sup>39</sup> Barnes presentation, op cit.

<sup>40</sup> Id.

<sup>41</sup> Gage, J., Leisz, S. & Kranz, R. The Use of Geographical Information Systems and Remote Sensing Technologies in Analyzing Land and Natural Resource Tenure Issues: Possibilities and Prospects (Research Planning Workshop, March 1995).

Trinidad and Tobago, and Belize announced plans to take advantage of the new approaches. Similar initiatives are being considered in Jamaica, Guyana, Barbados, the Dominican Republic, Panama, Nicaragua, El Salvador and elsewhere.

## 6. PRIVATE SECTOR PARTICIPATION

6.1 One option mapping agencies may consider is to establish a permanent GPS base station in a central location or various locations. This base could be set to permanently download the information needed for differential GPS. If private surveyors invest in GPS receivers that can be used as rovers, they could then buy the information needed to differentially correct the position locations that they collect with their rovers. This would make GPS surveying much more accessible to the average surveyor, and could also speed up the surveying process (and potentially lower costs) in the country as a whole. It would also allow the mapping agency to recover some of the costs of the GPS base station.

6.2 Other opportunities for private sector collaboration within the land management system include: organizational consulting; training; capacity building; storage of maps, photos and data; and data conversion, among other services.

## 7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Trade integration will have a negative fiscal effect on customs revenue, which accounts for up to half of all public revenues in many Latin American and Caribbean jurisdictions. Facing huge public deficits, governments will be looking to cut costs while increase revenues from other sources. With the increasing need for public investment in the social sector, particularly in basic education and health care at the local level, property taxation is becoming increasingly important as a future revenue producer. However, land taxation implies accurate, agile, up-to-date data on parcel size, value and ownership. This basic informatic infrastructure is not readily available in most of Latin America.

7.2 Finance Ministries of various individual governments will have to assess the extent to which FTAA will reduce government revenue. Next, they will have to assess what cuts can be made in existing programs, and what revenue deficit will need to be replaced. Then revenue potential from property taxation should be closely examined. Once a decision to move forward with a property taxation strategy has been reached, the technological issues of GPS/GIS can be addressed in the context of registry and cadastral reform.

7.3 Given this reality, governments will look to increase the efficiency of their land administration programs. The most direct impact will be more public revenue for programs such as education and health care. But reform will also have a direct impact on land administration itself: reorganizing and streamlining mapping and titling agencies, making them more client-driven. They will also be better able to absorb budget cuts while generating more revenue.

7.4 Land administration reform will have many other collateral benefits besides simply fiscal revenue generation for education and health programs. Investors will need accurate and above board land administration as a prerequisite to the massive regional investment anticipated by FTAA, which in turn is a prerequisite to the hoped for job creation for the middle class. Environmental initiatives, democratization efforts and anti-corruption campaigns will also benefit, making those countries which pursue this policy the most competitive in the new international market.

7.4 Historically, land administration projects have been financial black holes for donors, which pumped in millions and saw little in return. However, we no longer look for agrarian reform titling or increased agricultural productivity as the main means for testing the "success" of initiatives. Further, we have advanced light years beyond the old, traditional survey methods and communications methods. In short, land administration efforts today can yield many more benefits at a fraction of the cost: the Region will have to throw out yesterday's notions of "land titling"

and think much more broadly about tomorrow's possibilities. As the region faces a fiscal crunch on social programs as a result of slashed import duties and fiscal deficits, these advances could not have come at a better time.

7.5 GPS, first used in Albania, and now in places like Trinidad and Costa Rica, is paving the way to dramatically reduced cost, greater speed, and broader opportunities for private sector participation. When combined with decentralization efforts and greater transparency, these efforts will play a very dramatic role in the future economic recovery of the Region.

7.6 GPS implementation will involve overcoming hurdles: (a) there has been a general lack of experience by developing world surveyors with any system other than traditional surveying equipment; (b) there is sometimes a "fear" to use new GPS equipment; (c) there is sometimes a hesitancy to keep records and evaluate the costs associated with terrestrial surveying techniques; and (d) access to data is sometimes difficult.<sup>42</sup> To address these concerns, governments should look for a strategic plan for using the new technologies and methods, and develop plans for retraining of employees. As costs plummet, the latest technology is now available to all developing countries, even the poorest. Similarly, as GPS methodology is fairly simple, North American experience will be readily applicable in Latin America and the Caribbean.

7.7 Private sector competitiveness, sub-meter accuracy, and new low-cost software, hardware and scanners are translating into great savings and efficiencies through their integration, and through the creation of multi-purpose land information systems.

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<sup>42</sup> Moyer, D. "The Land Tenure Center's work with Land Information Systems in Albania," in Gage, J., Leisz, S. & Kranz, R. The Use of Geographical Information Systems and Remote Sensing Technologies in Analyzing Land and Natural Resource Tenure Issues: Possibilities and Prospects (Research Planning Workshop, March 1995) pp. D.