Research Paper

A COMPARATIVE EVALUATION FRAMEWORK
FOR CADASTRE-BASED LAND INFORMATION SYSTEMS (CLIS)
IN DEVELOPING COUNTRIES

by

Grenville Barnes

LAND
TENURE
CENTER

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LIST OF ACRONYMS AND ABBREVIATIONS

ACSM	American Congress on Surveying and Mapping
ASPRS	American Society for Photogrammetry and Remote Sensing
CASLE	Commonwealth Association of Surveyors and Land Economists
CLIS	Cadastre-Based Land Information System
CMS	Comprehensive Marketing Systems
CPM	Critical Path Management
DAI	Development Associates Incorporated
DBMS	Database Management System
DCA	Development Control Authority (St. Lucia)
DCLRP	Dane County Land Records Project (Wisconsin)
DEC	National Cadastral Office (Honduras)
DINAC	National Office of Assessment and Cadastre (Ecuador)
EDM	Electronic Distance Measurer
ESRI	Environmental Systems Research Institute
FAO	Food and Agricultural Organization (United Nations)
FGCC	Federal Geodetic Control Committee
FIG	International Federation of Surveyors
GIS	Geographic Information System
GOE	Government of Ecuador
GOH	Government of Honduras
GOSL	Government of St. Lucia
GPS	Global Positioning System
HMSO	Her Majesty's Stationery Office
IADB	Inter-American Development Bank
IERAC	Institute for Agrarian Reform and Colonization (Ecuador)
IES	Institute for Environmental Studies (University of Wisconsin-Madison)
IGIS	International GIS Convention (Virginia)
IGM	Military Geographic Institute (Ecuador)
ILI	Institute for Land Information
INA	National Agrarian Institute (Honduras)
LIS	Land Information System
LMIS	Land Management Information System

LRC	Land Reform Committee (St. Lucia)
LRDB	Land Registry Database (St. Lucia)
LRTP	Land Registration and Titling Project (St. Lucia)
LTC	Land Tenure Center (University of Wisconsin-Madison)
MPC	Multipurpose Cadastre
MPLIS	Multipurpose Land Information System
MUCIA	Midwest Universities Consortium for International Activities
NRC	National Research Council
OAS	Organization of American States
OUP	Oxford University Press
PCN	National Cadastral Program (Honduras)
PID	Parcel Identifier
PIU	Project Implementation Unit (Ecuador)
PPMS	Physical Planning Management System (St. Lucia)
PROLETIERRA	Legalization of Land Tenure Project (Ecuador)
PTT	Land Titling Project (Honduras)
RCS & RP	Regional Cadastral Survey and Registration Project (Antigua)
TM	Team Month
UAF	Family Unit Title (Honduras)
UAM	United Aerial Mapping (San Antonio)
UN	United Nations
URISA	Urban and Regional Information Systems
URPIS	Urban and Regional Planning Information Systems (Australia)
USAID	United States Agency for International Development
UTM	Universal Transverse Mercator (projection)
UW	University of Wisconsin-Madison
WLRC	Wisconsin Land Records Committee
WSLS	Wisconsin Society of Land Surveyors

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1. INTRODUCTION

1.1 Problem Statement

While land and other natural resources diminish through use or erosion, populations in developing countries continue to rise to unprecedented levels. The question of long-term sustainability is but one of many crucial questions that are being raised as a result of this increased pressure on the land. Poverty levels among the small-farmer sector, low agricultural yields, tenure insecurity, and the disorganization of public land administration and management institutions are some of the more specific concerns related to the issue of sustainability.

Strategies to combat these problems have varied from the formation of small-farmer cooperatives to the application of technologies that are often more appropriate to developed countries than the resource-scarce environments of developing countries. More recently, a policy of enhancing land tenure security through the provision of mortgageable titles which strengthen the landholders' land rights has been adopted. This was clearly spelled out in a U.S. Agency for International Development (USAID) policy paper on food and agricultural development:

> Clarity of ownership and title is critical to stimulating increased capital investment (and therefore production) at the level of the individual farmer. Consequently, AID will give favorable consideration to requests for assistance in the form of feasible projects and programs that establish wider access to agricultural assets, including land, and in providing more secure tenure arrangements (USAID 1982, p. 9).

In an attempt to address these land tenure-related problems, many developing countries, with the assistance of development agencies such as USAID and the World Bank, have embarked on projects to develop systems that record land interests and provide land information for the more effective management and administration of land. Although these systems are often called "cadastres," "land registration systems," "multipurpose cadastres," "titling systems," and a host of other terms, they are defined as "cadastre-based land information systems," or CLIS, in this paper.

A CLIS, and therefore the environment of this study, is defined as a <u>resource</u> that comprises (1) the institutions created to handle land tenure issues, policies, and information; (2) an information base describing the formal (legal) land tenure situation in a given area; (3) the technology used to collect, manipulate, analyze, archive, and disseminate land tenure data and information; and (4) the procedures, standards, and protocols observed by institutions in carrying out their land tenure-related functions.

Land tenure in this paper refers to a set of relationships com- prising three primary dimensions, namely,

1) a person-person relationship (the spatial dimension of a social system),

2) a person-land relationship (means of correlating people with the physical environment),

3) a concept of land (or folk geography) (Bohannan 1963, p. 103).

Person-land relationships are usually encapsulated or formalized in such terms as "leasehold" or "freehold." The CLIS focuses on the data and information required to support person-land relationships (see Barnes 1986 for more detail), and tenures are divided into (1) formal tenures (those that are legally recognized and registerable), and (2) informal tenures (those that are not officially registerable but nevertheless exist outside the legal system).

In 1987, World Bank investment in projects related to the development or enhancement of CLIS in developing countries was estimated to be in the region of a billion dollars.[1] The challenging physical environment and the severe shortages of resources such as capital and skilled personnel in these countries have led to a need for techniques and approaches that are less costly, more efficient, and simpler than those traditionally adopted in the resource-rich developed nations. Alternative approaches using aerial photography, orthophotography, and other graphical products are gaining increased attention as a means of delineating and recording property boundaries. The rapid progress in computer-based technologies is also offering new opportunities for the development and management of CLIS, especially in the context of process automation and data integration.

Although many new approaches are emerging for the development of cost-efficient and simple CLIS, very little attention has been paid to the evaluation of these options. The need for more effective evaluation techniques has been identified as one of the major areas of research in the general field of LIS. This need was summarized as follows:

> Current techniques for evaluating the effectiveness of different LIS are unsatisfactory. This lack of valid assessment tools has clouded the focus of LIS research. . . . Comparative studies should be used to isolate those LIS elements or characteristics by which significant improvement to the system may be introduced. The end product of this suggested research is the development of valid methods for quantifying the success of any LIS. Comparative studies appear to be the most logical means for achieving this very much needed end product (Onsrud et al. 1985, p. 14).

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1. Personal communication with Lynn Holstein of the World Bank.

Evaluation efforts have been frustrated by problems related to the inappropriate documentation of existing systems and the absence of effective evaluation models. In many cases systems are documented in a fashion which makes them extremely difficult to examine in a comparative context. This research is aimed at addressing these two issues.

Given the large investment of resources, both human and financial, and the urgent need to address land tenure, agricultural production, and land management concerns through upgrading CLIS, it is essential that current efforts be evaluated in order to assess their effectiveness.

1.2 Objectives

The primary objective of this study is to provide a tool for evaluating alternative approaches to the formalization of land tenure data and information in a CLIS. A first step toward this objective is the development of a generic CLIS model that is used as a common structure or skeleton for organizing data and information about the systems to be evaluated. The second objective is to develop a broad evaluation framework that reflects the inner strengths and weaknesses of a system. The idea is to identify the effectiveness of a system within a particular developing country's environment, not merely to suggest an ideal model. The final objective is to validate the CLIS model and evaluation framework by applying it to CLIS in three developing countries: Honduras, Ecuador, and St. Lucia.

1.3 Approach

The approach used in this research is: (1) to identify and define the CLIS concept within the broader LIS environment; (2) to review previous evaluation efforts and devise an evaluation framework that is appropriate for CLIS within the context of Third World countries; (3) to document the CLIS in Honduras, Ecuador, and St. Lucia; and (4) to evaluate these systems using the evaluation framework developed earlier.

The CLIS concept has its roots in the early fiscal cadastres of England and Europe, and today is regarded as a single node within a broad multipurpose LIS network. A basic information systems model is used as a framework for the CLIS model, thereby paving the way for an investigation of the broader information-related issues of the CLIS. One of the practical problems that arises with such a broad approach is that it becomes extremely difficult to restrict the analysis to a single topic while still doing justice to the inherent breadth of the subject. The large and diverse body of literature that has at least some relevance continually challenges the research focus, making it difficult to stay within the bounds of the selected topic.

The CLIS model is made up of four major functional components, viz. input, conversion mechanism, output, feedback. By using this systems approach, it is possible to concentrate on issues related to land information management instead of the simple documentation or recording of land rights and parcels.

Honduras, Ecuador, and St. Lucia were selected for this study as major titling projects either have just been completed in the country or are in the process of being implemented. In addition, they represent several new approaches to the implementation of CLIS.

In order to gather data for this study, both Honduras and Ecuador were visited. A period of six weeks (February-March 1987) was spent in Honduras, part of which was spent with the delineation teams in the departments of Cortés and Yoro. Although no adjudication teams were in operation at the time of this visit, team members kindly simulated the process with the author as the potential beneficiary. Further data were obtained through interviews with project staff at the central offices of both government agencies [National Agrarian Institute (Instituto Nacional Agrario, INA) and National Cadastral Office (Dirección Ejecutiva del Catastro, DEC)] involved in the project as well as with USAID representatives. The extensive documentation on this project also provided a valuable source of information.

The author also spent a month (July 1987) in the sierra region of Ecuador studying the Legalization of Land Tenure project (Proyecto de Legalización de Tenencia de la Tierra, PROLETIERRA). Part of this period was devoted to attending a five-day training course for new field personnel and observing field teams in action. Additional data were acquired through interviews with the personnel at the Institute for Agrarian Reform and Colonization (Instituto Ecuatoriano de Reforma Agraria y Colonización, IERAC) offices in Quito and Cayambe. The USAID project coordinator proved to be an extremely valuable source of information and also directed the author toward relevant documentation.

Unfortunately, visa problems prevented a visit to St. Lucia and data on this system were obtained primarily from existing literature and Land Tenure Center (LTC) consultants as well as from personal communication with the Chief Surveyor and Registrar of the country.

The data collected for the three countries are organized according to the CLIS model, thereby placing them in a common structure that facilitates evaluation. An evaluation framework is developed by identifying criteria or characteristics that are critical to the effective functioning of a CLIS. This framework is composed of the following set of criteria: (1) efficiency, (2) maintainability, (3) cost, (4) quality, (5) complexity, and (6) utility. Each system is evaluated according to these criteria in order to identify its relative strengths and weaknesses. From these evaluations it is possible to identify certain factors that have a major influence on each criterion.

1.4 Organization

The paper is organized into eight major sections. The first two provide an introduction to the CLIS concept by reviewing the evolution of this concept within the broader LIS environment. Section 2 also explains the information systems approach that is followed and describes the development of the CLIS model. The rationale behind the enormous investment (by developing countries and development agencies) in CLIS designed to strengthen land tenure security is outlined in the latter sections of this section.

Section 3 reviews previous LIS evaluation efforts in both developed and developing countries and constructs the evaluation framework for the analyses that follow in the next four sections.

Sections 4, 5, and 6 describe and evaluate the CLIS in Honduras, Ecuador, and St. Lucia. Each section includes brief sections on the geographical setting, historical background, institutional structure, and land tenure arrangements within the country. This information acts as a description of the institutional environment in which the CLIS operates. The sections on the three systems describe the procedures and techniques used for the collection of spatial and textual land tenure data, cadastral and parcel mapping, deed/title registration, information output (maps, titles), and feedback mechanisms. The latter part of each of these sections contains an evaluation in terms of the framework developed in Section 3.

The comparative evaluation in Section 7 is essentially an abstract from the individual evaluations contained in the previous three sections. However, by drawing this information together into one part, a more direct comparison may be made between the three systems.

The final section of the paper summarizes the conclusions that can be drawn from this study and provides a list of factors to be considered in an evaluation of this nature. Finally, certain recommendations are offered for the improvement of future evaluation efforts in this field.

2. THE CADASTRE-BASED LAND INFORMATION SYSTEM CONCEPT

2.1 Evolution of the Modern Cadastre and LIS Concepts

Several distinct phases can be identified in the evolution of the modern cadastre and LIS concepts, reflecting to some extent the transformation from an agrarian to an industrial society and more recently to an information society. Although many important cadastral developments occurred prior to the eleventh century, the Domesday Book is regarded as the origin of the modern cadastre concept.

In order to trace the origins of the modern cadastre, it is necessary to re-examine the efforts of William the Conqueror in England and the development of Napoleon's cadastre (**l'ancien cadastre**) in France during the nineteenth century. All of the early cadastral initiatives in England and France were undertaken as a means of supporting and extending the land taxation system (Dowson and Sheppard 1952). In England, the Domesday Book, compiled in the remarkable period of one year (1085-86), consisted of a textual record containing a comprehensive inventory of the real and personal property of each landholder (Simpson 1976, p. 113). This information was "spatially referenced" to a local administrative/tenure unit known as a "hundred." The boundaries of this unit were identifiable on the ground but, since the necessary technology was not available, no accurate spatial representation (map) existed.

It was only toward the end of the sixteenth century that surveying and mapping technology developed to the point at which maps could be used to support the textual fiscal records. The English parish maps, compiled for the assessment of tithes (taxes) at the parish level (Simpson 1976, p. 115), were some of the first maps to be used for this purpose. Subsequent development of the cadastre in England was retarded by the feudal system which enabled the state to deal only with the landlords of large estates or manors (Dowson and Sheppard 1952). Detailed information on the smaller tenant farmers was of interest only to the local landlords who were responsible for extracting rents, taxes, and labor from them. The landlords thus acted as agents for the state, making it unnecessary for the state to require a spatial framework with a resolution higher than that of the large manors. It is therefore necessary to look toward Europe and the efforts of Napoleon I for the further evolution of the cadastre.

In eighteenth century continental Europe, it was not possible to adopt the feudal approach used in England as most of the land was owned by relatively independent smallholders who had to be dealt with directly. Dowson and Sheppard (1952, p. 48) remarked that the European situation "necessitated more exact, intimate and detailed knowledge of the individual land parcels and of their holders." In France, all feudal institutions were abolished in 1789 and legislation was passed calling for the registration of all deeds of purchase and mortgage in a public deeds register. This recognition of the need to record tenure changes systematically can be attributed partly to the change from

an agrarian to an industrial society which resulted in the proliferation of densely populated urban areas and a loosening of the person-land bond. With industry replacing land as society's primary source of occupation, land became more of a transferable commodity and new demands began to be made on the cadastre.

In 1807, Napoleon I ordered a survey of some 100 million parcels with the express purpose of systematically referencing fiscal data to individual holdings. Spatial data were acquired by plane table survey and portrayed on sectional (units of 200-400 hectares) cadastral plans as well as on index maps at a scale of 1:5,000. Textual data relating to owners, nature of tenure, area, tax, and land use were compiled in a person-based (one folio per owner) fiscal record known as a **matrice**. It required more than four decades for the French to extend this cadastre to the entire country, a goal that was finally reached in 1850.

Napoleon's imperialistic and cadastral endeavors in Europe meant that the French cadastre strongly influenced the early development of many cadastres on the continent, including those in Belgium, Holland, Italy, Austria, and Luxemburg (Lawrance 1984; Dowson and Sheppard 1952).

Although an admirable achievement, Napoleon's cadastre suffered from some fundamental weaknesses that were to negate many of its potential benefits. For instance, the deeds register was not linked directly to the "cadastral" maps (index map and cadastral plans) and these maps played no role in the legal description of property. Furthermore, no mechanism was provided for the maintenance of the maps. In view of these limitations, the maps perhaps should be regarded more as "fiscal" maps than cadastral maps. The matrice (textual fiscal record), on the other hand, was updated regularly through lists of transactions obtained annually from the registrar of deeds (Dowson and Sheppard 1952, p. 51). Over time these maps became increasingly out-of-date and the absence of a reliable spatial record of holdings began to cause serious problems by the end of the nineteenth century. Litigation related to boundary disputes proliferated and eventually reached an average of 4,600 cases (7 percent of total landholdings) per year (ibid., p. 52).

In 1891, a commission was appointed to investigate the state of the cadaster and to consider the introduction of a registration of title (ROT) system. The latter was never implemented in France, but this enquiry did lead to the establishment of an improved registration of deeds (ROD) system and a new phase in the evolution of the cadastre concept.

Improved ROD systems currently operate in France, South Africa, Brazil, and several other countries (Holstein 1985). Although there are differences between the various "improved" systems, it is possible to identify certain common characteristics and trends. Where a ROD system may be regarded as simply a storage house for documents that convey land rights, an improved ROD system is more of an "information system" designed to store and provide all information relevant to the nature, extent, and possession of land rights. Registration of all documents affecting the ownership of land is insured by the priority given to registered over unregistered documents. In South Africa, for example, this principle is applied to the extreme, so unregistered documents lose not only priority but all legal status as well.

The precise survey and spatial definition of all legal parcels have also become a part of these improved systems. To do this, linkages have been forged between the deeds registry and the agency responsible for maintaining the cadastral maps. The integration of the ROD system with the cadastral map has caused a change in emphasis from the tax parcel to the ownership unit, although in some cases the only difference between the two will be the precision with which the parcel boundaries are required to be defined. The integrity of the system is generally raised by restricting the framing of deeds and cadastral surveys to highly qualified professionals and introducing a process of document examination and approval by designated public officials (such as the registrar and surveyor-general). Other improvements include: (1) the introduction of a parcel-based or tract index with references to all instruments affecting the tenure status of individual parcels, and (2) measures to circumvent time-consuming, retrospective title searches.

The South African system, for instance, has effectively eliminated the need to conduct "chain of title" searches by maintaining a register which reflects all registered (legal) rights to the parcel and by carrying through the effect of all previous documents to the last registered deed. In many ways the so-called ROD system in South Africa resembles a registration of title (ROT) system, and Simpson (1976, p. 107) asserts that "we should be more correct to regard it as the kind of system which, basically, Torrens aimed at introducing in South Australia in 1858." However, the importance of the deed, as opposed to the register, in providing prima facie evidence of title remains a principal difference between this improved ROD system and the Torrens ROT system. It is more accurate to look at the South African system as a blend of Torrens-type concepts and the European concepts introduced by the early Dutch settlers. Similarly, other "improved" systems should be viewed as being on a continuum between a rudimentary ROD system, on the one pole, and a parcel-based ROT system, on the other.

Sir Robert Torrens is commonly regarded as the "father" of the ROT system, even though similar systems were developed independently in England and parts of Europe. While serving in the colonial service as Registrar General of South Australia, Torrens, fueled by a hearty dislike for the legal profession and equipped with a practical knowledge of the system used to register ships, designed and implemented his land registration system. The Torrens system is often described as being founded on three basic principles (Simpson 1976): (1) mirror principle--the title register should reflect the current legal status of all parcels; (2) curtain principle--title should not be retrospective; and (3) insurance principle--the state should guarantee the legality (indefeasibility) of title as portrayed on the register and should compensate any person who suffers a loss due to a flaw in the register. In addition, Torrens emphasized the need to define parcels by means of ground surveys, compulsory registration, and the retention of the original certificate of title in the registry (Torrens 1885). Attempts have been made to implement so-called Torrens systems in countries such as the United States, but in many cases these have failed because one or more of these central prin- ciples has been overlooked (Barnes 1985a).

In a Torrens system, a certificate of title replaced the deed of the ROD system and also formed the folio for the register since one certificate is

created for each parcel. The certificate also contains a parcel map showing the parcel dimensions. All information relevant to the tenure status of a parcel is simply obtained by inspecting the register. The advantages of this system over that of an ROD or "improved" ROD are primarily in increased efficiency and simplicity and in the reduction of operation and maintenance costs.

Torrens did not, however, appreciate the need to integrate individual parcel surveys with the cadastral mapping system and, in fact, vehemently opposed such a move on the grounds that it would be too costly and difficult to maintain the maps (Torrens 1885, p. 13). As a result, the Australian Torrens system developed, until recently, without the benefit of a comprehensive cadastral map. Dale (1976, p. 203) has described the Australian system as a system that "developed on the basis of individual surveys of individual parcels by individual surveyors for the benefit of individual clients." Although this did not have a detrimental effect on the conveyancing system, it has tended to reduce the utility of the system for other purposes such as land management and planning (Williamson 1983), which require property information on a more regional scale. To examine the integration of the ROT system, cadastral map, and fiscal system, it is once again necessary to return to Europe.

In 1900, a registration of title (ROT) system was introduced throughout Germany (Simpson 1976). The central component of this ROT system is the **grundbuch**, or land register. Unlike the Torrens register, it is created through inscription (that is, the abstraction of specific details from the document of conveyance) and comprises four distinct sections relating to property description, property owner(s) and nature of tenure, secondary rights (easements, leases, and the like), and charges (mortgages, liens, and so on) against the parcel (Simpson 1976; Reinemann 1987). The **grundbuch** is linked to an accurate set of cadastral maps through a unique parcel identifier. These maps, together with related surveying information, define the current parcel boundary status and can, therefore, be regarded as the legal descriptions of the parcels.

Some regions in Germany have had the benefit of high-quality cadastral maps for more than a century (Bavaria, for example, had a complete cadastral map by 1860), and they used these to establish an integrated and precisely defined fiscal/legal cadastre. Using this as a foundation, they subsequently added soils information (1934) and land-use information (1974) (Reinemann 1987). They thus moved from a dual-purpose legal/fiscal system to a more multipurpose system, incorporating natural resource information that was referenced to the property parcel.

By the mid-1970s, the concept of a multipurpose cadastre (MPC) had become the dominant cadastral model (see, for example, McLaughlin 1975; Blachut 1975; Philips 1975). Countries that currently operate an MPC include Germany, Switzerland (Williamson 1981), and Sweden (Larsson 1975). The fundamental components of the MPC are shown in Figure 2.1.

When the MPC concept was first conceived, it was believed that all land information, including natural resource and other environmental information, could be supported by a system based on cadastral parcels (McLaughlin 1975; NRC 1980), but, by 1983, it was realized that this belief was overambitious.

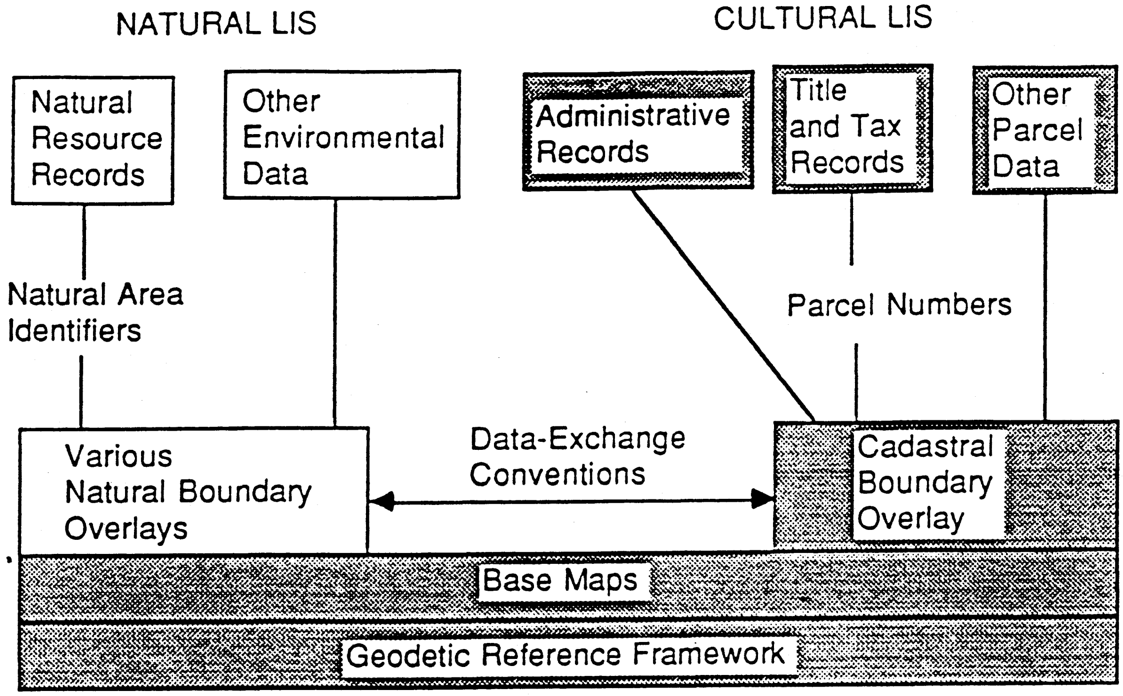


FIGURE 2.1

Fundamental Components of a Multipurpose Cadastre (MPC)

Source: National Research Council, Need for a Multipurpose Cadastre (Washington, DC: National Academy Press, 1980), p. 16.

The 1983 NRC Report, entitled Procedures and Standards for a Multipurpose Cadastre, recognized that certain natural resource information could not effectively be collected or represented as attributes to the cadastral parcel and should be handled by a nonparcel-based "natural" (or environmental) LIS linked to the MPC.

The increased need for the systematic collection, processing, storage, and dissemination of land-related data and information has given rise to the concept of a land information system (LIS). This need has stemmed, in part, from the demand for land information as a primary resource for management and other activities related to the land.

An LIS is regarded as a resource for the management, planning, administration, development, and stewardship of the land and its attributes (see Subsection 2.2 for a more detailed definition). LIS may be divided into four general categories based on the type of information contained in the system: (1) environmental, (2) infrastructural, (3) legal/fiscal (cadastre-based), and (4) socioeconomic.

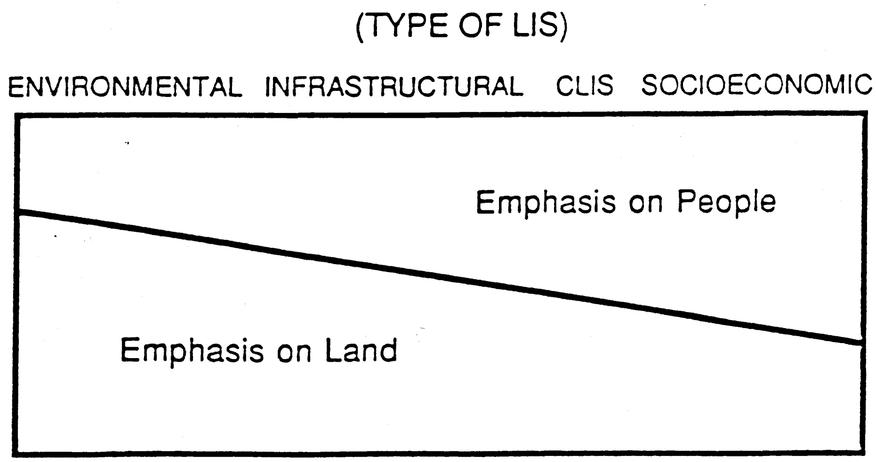


FIGURE 2.2

Land/People Emphases of Different LIS

Source: Adapted from D. Palmer, A Land Information Network, Technical Report no. 111 (Fredericton: Department of Surveying Engineering, University of New Brunswick, Canada, 1984), p. 13.

In comparing the characteristics of these systems, Palmer (1984) examined their relative land/people emphasis as well as their method of spatial reference. LIS may be arranged on a land/people continuum (see Figure 2.2) with environmental LIS giving higher priority to the land and socioeconomic LIS emphasizing people. A CLIS lies at the center of this continuum as it is concerned with people-land relationships (land tenure) which involve people and land on a more or less equal basis.

The four categories of LIS may also be characterized to some extent by their mode of spatial reference. CLIS make use of the property parcel as a basic organizational unit for referencing land tenure data and information. The other LIS rely predominantly on points and polygons for spatial referencing but may also include parcel-referenced information. The relative dependence of each type of LIS on these spatial elements is represented in Figure 2.3.

The drawback to an approach that uses separate LIS to address land-related problems and issues is that in many cases the effective management or administration of land requires information from more than one system. For example, property rights, traditionally served by cadastre-based LIS, are being affected by rights that are spatially expressed according to the polygonal area of a particular natural resource (for example, soils, as opposed to the

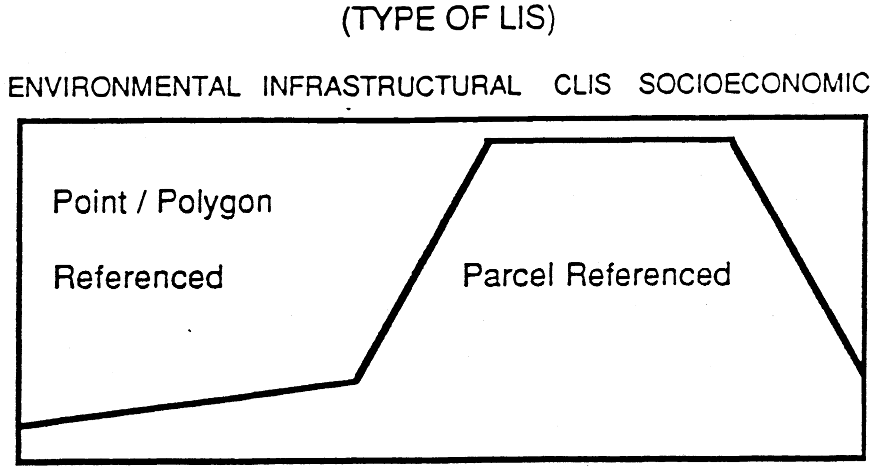


FIGURE 2.3

Spatial Referencing Characteristics of Different LIS

Source: Adapted from D. Palmer, A Land Information Network, Technical Report no. 111 (Fredericton: Department of Surveying Engineering, University of New Brunswick, Canada, 1984), p. 13.

property parcel. Chrisman and Niemann (1985) cite the following examples in this regard: floodplain zoning, farmland preservation and protection, soil erosion control, regulation of water pollution, shoreland zoning, and the preservation of wetlands. They conclude (p. 6) that "environmental information is absolutely crucial to describe the actual interests in land." Clearly, there is a need for "systems" that facilitate the integration and cooperation of individual LIS in order to address these kinds of issues. This need has resulted in the 0mergence of a network concept.

The concept of an LIS network has been described by Palmer (1984, p. 44) as "a confederation of individual [land information] systems . . . . While a LIS may be regarded as an attempt to improve the effective flow of information within an organization, a network may be viewed as an attempt to improve the effective flow of information between organizations."

A network approach has been adopted in the South Australian "Total LIS" (Sedunary 1984). This concept was described as follows by Ralph (1987, p. 1):

> The Land Information System in South Australia has developed in accordance with a "nodal approach" which is based on the incremental development of individual systems as "nodes" in the overall LIS framework. This approach allows these "nodes" to be developed either

in sequence or in parallel, subject to need and separate cost justification. It also allows the choice of the most suitable hardware/ software for the data management needs of the particular function. Each individual development must, however, accord with a published development policy to insure compatibility and the required level of data integration.

The South Australian model currently comprises four interrelated nodes: (1) legal/fiscal--supporting legal, registration, and taxation functions; (2) environmental--supporting natural resource and environmental functions; (3) geographic--supporting surveying and mapping functions; and (4) socioeconomic--supporting demographic, socioeconomic, and statistical functions (South Australia 1987). Each of these primary nodes is linked to "secondary peripheral databases" that serve specific applications which may not require any interaction with other parts of the network. The South Australian model is illustrated in Figure 2.4.

The legal/fiscal node has been in operation since 1979, and by November 1987, the geographic node had been completed for 75 percent of the state. A feasibility study has also been carried out for the development of the socioeconomic node. Several parts of the environmental node are in place and others are under development (Ralph 1987, p. 1). There is also an effort under way to establish a facilities or infrastructural LIS, but it is not yet clear whether this will constitute a primary node.

The South Australian model is very similar to the multipurpose LIS (MPLIS) concept that has been advanced by Niemann and others at the University of Wisconsin (see, for example, Chrisman and Niemann 1987). The MPLIS model focuses on the functional aspects of a network system and, in particular, on how different information layers can be integrated through a common geodetic reference system. This concept is illustrated in Figure 2.5. Both the MPLIS and the "nodal" model attempt to strike a balance between a centralized and a decentralized approach.

The South Australian model can be regarded as the most advanced concept to be developed in the field of LIS. The legal/fiscal node, or land ownership and tenure system (LOTS), for example, provides on-line service to over 300 terminals throughout the state and can process as many as 7,000 inquiries in a single day (Sedunary 1984, p. 76). It also offers a practical approach to the integration of land information within institutional structures which were originally created to focus the scope of institutions to special narrowly defined tasks.

In examining the evolution of the modern cadastre concept into an LIS network, the following trends become apparent:

1) increased spatial referencing of land data and information--a geodetic reference framework is commonly recognized as the only means of accurately integrating different types of land information;

2) increased abstraction as people-land relationships become less tangible;

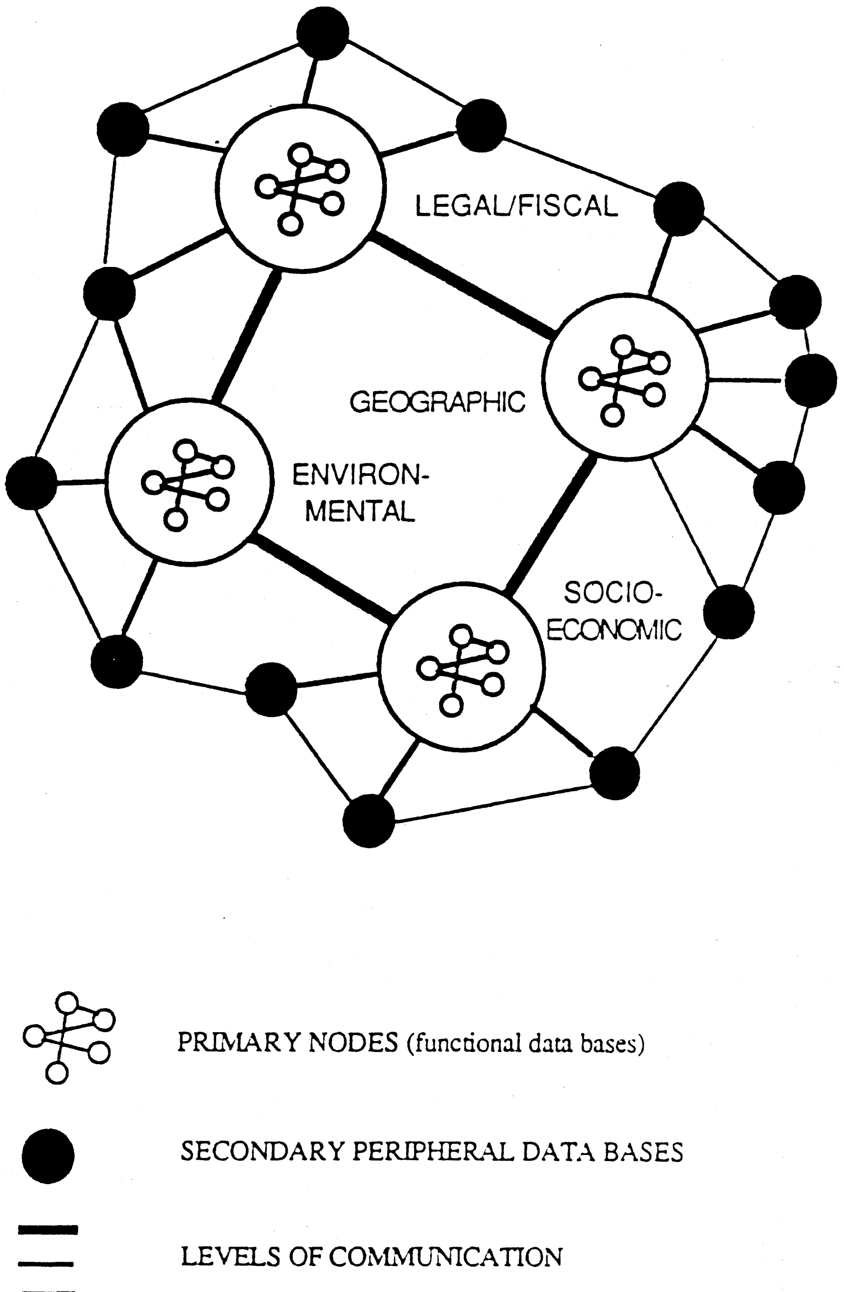
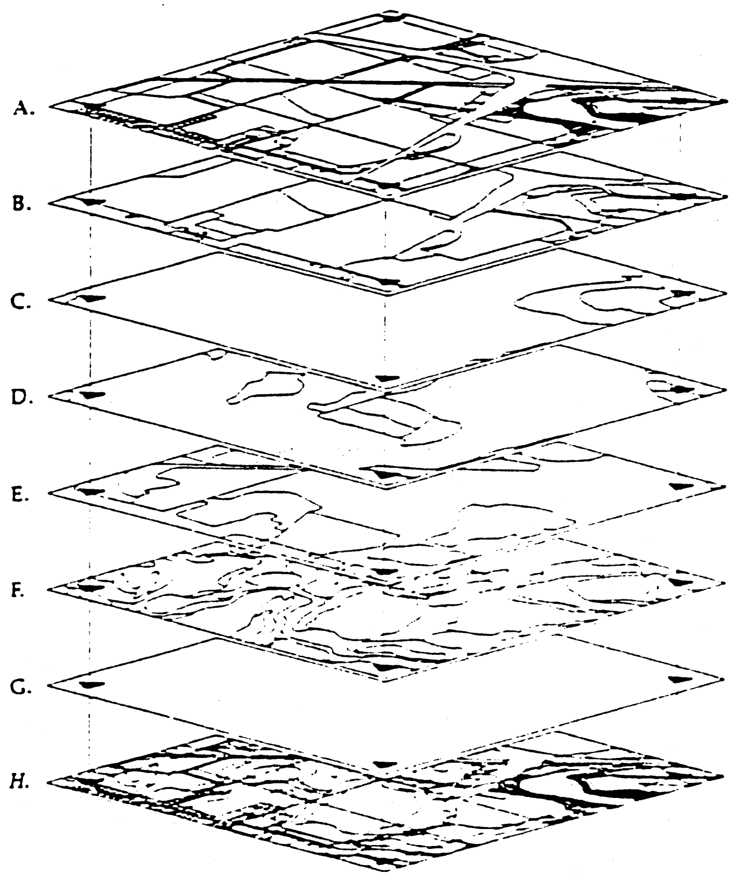


FIGURE 2.4

The South Australian LIS Network

Source: M.E. Sedunary, "LOTS, and the Nodal Approach to a Total LIS," in The Decision Maker and LIS: Proceedings of the FIG Symposium, Edmonton, Alberta, October 15-19, 1984, ed. A.H. Hamilton and I.P. Williamson (n.p.: International Congress of Surveyors, 1984), pp. 69-79.



Concept for a Multipurpose Land Information System

Section 22, T8N, R9E, Town of Westport, Dane County, Wisconsin

Data Layers:	Responsible Agency:
A. Parcels	Surveyor, Dane County Land Regulation and Records Department.
B. Zoning	Zoning Administrator, Dane County Land Regulation and Records Department.
C. Floodplains	Zoning Administrator, Dane County Land Regulation and Records Department.
D. Wetlands	Wisconsin Department of Natural Resources.
E. Land Cover	Dane County Land Conservation Committee.
F. Soils	United States Department of Agriculture, Soil Conservation Service.
G. Reference Framework	Public Land Survey System corners with geodetic coordinates.
H. Composite Overlay	*Layers integrated as needed, example shows parcels, soils and reference framework.*

FIGURE 2.5

The Multipurpose LIS (MPLIS)

Source: Land Information and Computer Graphics Facility, School of Natural Resources, College of Agricultural and Life Sciences, University of Wisconsin-Madison.

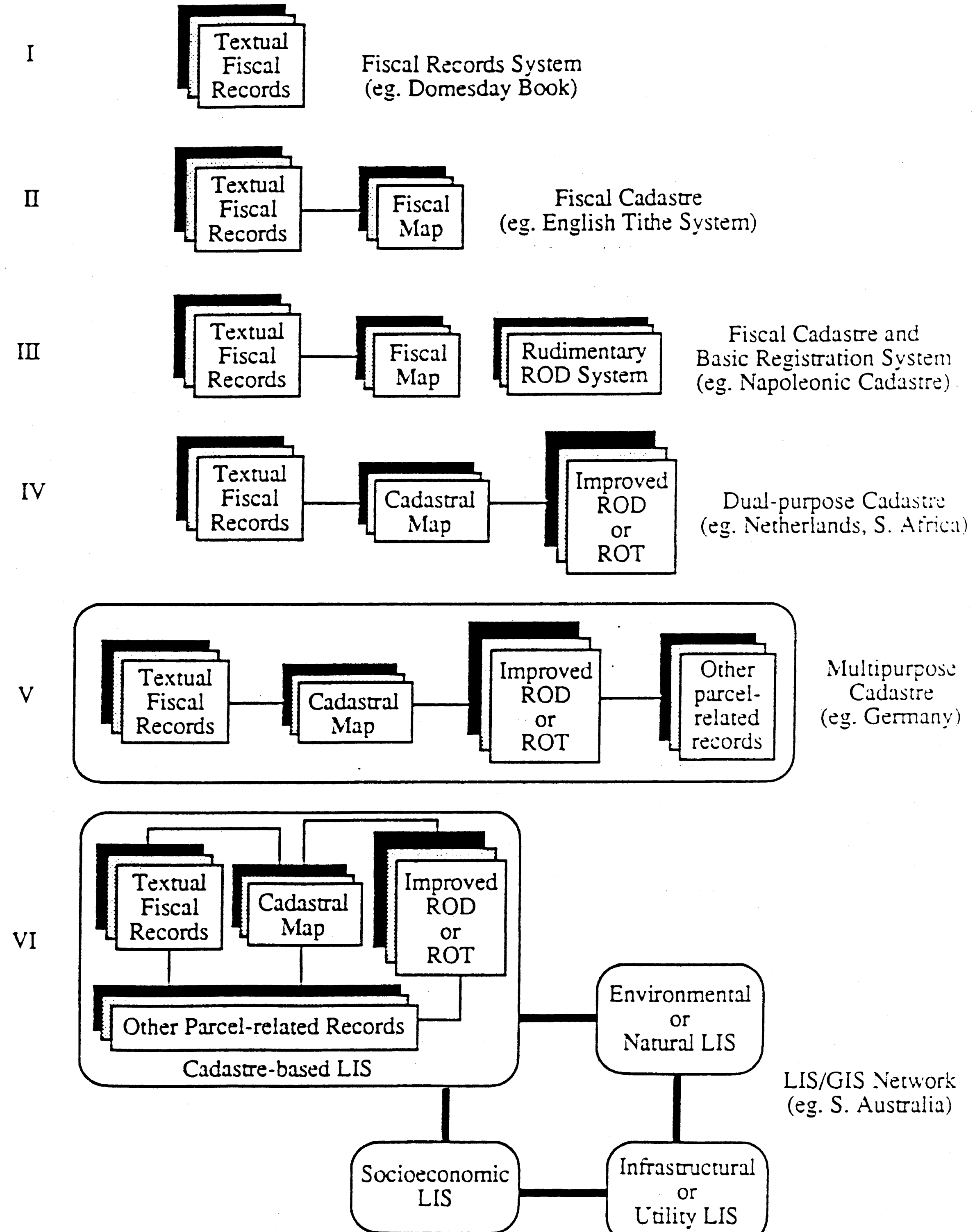


FIGURE 2.6

Summary of Cadastre and LIS Evolution

3) increased sophistication in supporting technologies, in particular, positioning, mapping, and information systems technologies;

4) integration of a wider variety of data, from fiscal to legal to environmental data;

5) increased concern with environmental data and information for land management purposes--protection of valuable resources such as soil, farmland, wetlands, and forests;

6) increased perception of the value of information as a resource, from data processing systems to information systems;

7) a wider range of users, from single-purpose to dual-purpose to multipurpose systems;

8) emergence of LIS networks where different institutions maintain their own LIS but have the capability to communicate and share information with other LIS in the network.

A summary of the evolution of the modern cadastre and LIS concepts as described in this section is shown in Figure 2.6.

The continuing conceptualization and modeling of cadastres and LIS are crucial elements of systems development. Such work provides direction, insures compatibility, accounts for technological advancements, and also facilitates the phased development of the system (Williamson 1983; Sedunary 1981). By reexamining the historical evolution of the cadastre concept, we can both learn from the mistakes of others and gain a broader understanding of the complexities and challenges underlying the cadastral and LIS concepts.

2.2 An Information Systems Approach

Over the past two decades, many of the more developed nations have moved from an industry-based society to one that is centered around the production, management, distribution, and use of information. They have been transformed from industrial societies, concerned with the production of goods, to information societies, whose primary "product" is information. This transformation has been popularized by several best sellers, including The Third Wave (Toffler 1981) and Megatrends (Naisbitt 1982).

One of the most astonishing impacts of this transformation has been the rise in the perceived value of information to the extent that it is now regarded as one of the three basic resources. Encyclopedia Britannica (1988, p. 244A) currently defines information as "a new basic resource that supplements the familiar natural resources of matter and energy" (emphasis added). Somavia (1977, p. 143), in discussing the inequitable flow of information between "industrialized" and "Third World" countries, asserts that the demand for information is "a basic need, both for individuals and societies, and one of the fundamental human rights."

The "information revolution" that is occurring in many parts of the world is causing a major shift in the work force, with the more traditional

production and manufacturing jobs making way for work involving information collection, storage, retrieval, and dissemination. In discussing the situation in the United States, Naisbitt (1982, p. 4) notes that in 1950, "only about 17 percent of us worked in information jobs [but] now more than 65 percent work with information as programmers, teachers, clerks . . . ."

It would be naive to single out two or three factors to which the information revolution can be attributed, but technology, or rather, the assimilation and use of technology, has certainly played a major role in steering society in this direction. The automation of many tedious tasks has freed a large percentage of the labor force from the industrial and agricultural sectors and provided the human resources to fuel an expanding service and information sector. Information has become the essential resource in this sector as it constitutes one of the main ingredients in planning, management, and administration.

The need to improve our capabilities in these fields and the focus on information as a resource have raised the question as to whether better information leads to better decisions (Wellar 1981; Humphries 1985; Zwart 1986a; Niemann 1987). Niemann (1987) concludes that there is "no question about it" and draws on three cases in the United States to prove his assertion. Regardless of the answer to this fundamental question, there is certainly no doubt that modern technology is opening up new integration and communication opportunities, and the synergism to be gained from broader, more integrated LIS will offer new perspectives and resources for dealing with land-related issues.

Analysis and debate on the cadastre have traditionally been approached from an administrative or task-oriented perspective. Because of the different skills involved and the separation of these skills into different administrative units of government, tasks such as cadastral surveying, mapping, and land registration have typically been treated as separate and independent entities (see, for example, Simpson 1976; Dowson and Sheppard 1952; Fortescue-Brickdale 1914; Brown 1969, Hogg 1920). Little attention has been devoted to an overview of the role and place of these elements in the broader land-tenure *system* environment. In this study, a systems approach, incorporating all the elements required to support the formal land-tenure system, is adopted. The relevance and advantages of such an approach have been spelled out as follows:

> Although recent emphasis has been on computerized LIS, . . . the important development over the last few years has been in the *application of systems logic* to the collection, storage, handling and dissemination of land information. This has led not just to the possibility of improvement, rationalization and extension of existing land records systems but to fundamental investigation of the real nature of land information, the actual needs for such information and the cost benefits of all kinds of LIS (Furmston and Logan 1987, pp. 131-32).

The rapid progress in the development of computer and satellite technologies during the 1960s and early 1970s significantly improved data collection and storage capabilities. This gave rise to what might be termed a "data bank

period" during which the emphasis was placed on the construction of large centralized data banks or inventories (Cook and Kennedy 1967; Konecny 1969; Philips 1975) rather than on the conversion of this data into useful information. In extreme cases, this preoccupation with data, as opposed to information, has resulted in a condition sometimes described as "information constipation" (Humphries 1985, p. 322).

The increasing demands made on these data banks and the corresponding improvement in data processing, networking, and information dissemination technologies have drawn us into an "information systems period." Information is now recognized as the major output of these systems, as evidenced by the replacement of the term "land *data* system" by "land *information* system," and new demands are being made on the integration of different types of information.

Since the processes in these systems are designed to convert data into information with the express purpose of increasing the knowledge of the user, it is important to understand the differences between *data*, *information*, and *knowledge*.

Data may be regarded as a set of unstructured elements which have no intrinsic value, such as numbers, lines, or letters. Information can be derived from such data by formatting it and placing it in a recognized context. *Information* is thus "a structured and organized set of data" (Sharkas et al. 1981, p. 20) which has, in the most literal sense, the potential to inform. When this potential is realized, that is, when a user's knowledge structure is modified by the information, the information is transformed into *knowledge* (Brookes 1979, p. 13). Although a map may contain a significant amount of information, it will not convey any knowledge to a person who is map illiterate. Thus, the final impact of the structured data, or information, depends to a large extent on the user and his/her knowledge structure. This is one of the major reasons why the technological environment of an LIS cannot be divorced from its social realm.

Depending on the level of the user and the application, the same piece of information may be regarded as data *or* information. The length of a boundary line, for example, constitutes valuable information for the land surveyor who is performing a boundary relocation survey, whereas it is merely data for the cartographer whose objective is to draw a parcel map. The aim of an LIS should therefore be to maximize the information content of its output and disseminate the resulting information in a manner that optimizes the knowledge transfer to the user. In other words, systems should be designed primarily as means of improving the knowledge base of the local users, not merely as devices for capturing and storing data.

A system may be defined as "a collection of interacting entities, or . . . a collection of parts, together with statements on the relationships, of some kind, between these parts" (Dale 1972, p. 231). It can be resolved into four fundamental parts, entities, or components: inputs, conversion mechanism, outputs, and a feedback component. Inputs and outputs may, for example, be in the form of energy, matter, data, or information. In an information system, inputs will be in the form of data, and outputs will consist of information. The conversion mechanism will consist of one or more processes that transform

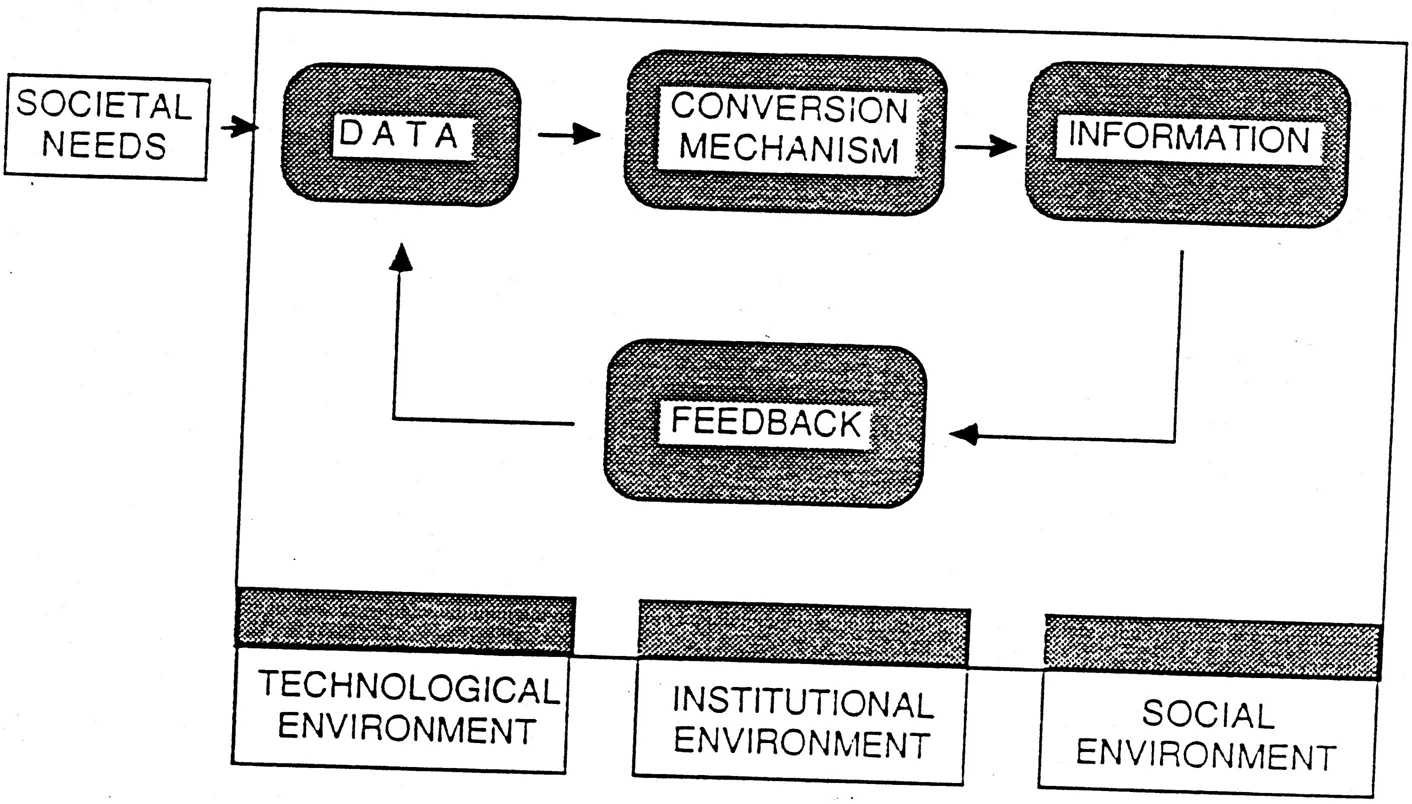


FIGURE 2.7

Basic Components of an Information System

Source: Adapted from J.D. McLaughlin "Notes and Materials on Land Information Management," prepared for seminar series at the University of Natal, South Africa, 1981, p. 11.

the raw data into usable information, a process which some information scientists call "infology" (Langefors 1981). These processes may include abstraction, generalization, formatting, indexing, storage, computation, and retrieval. Once the system is in place, the feedback component becomes an essential link between the system and the objects it describes as well as providing a mechanism to update and refine the system. This basic model of an information system is shown in Figure 2.7.

Information systems may be categorized according to their functional objectives (for example, management), type of information (land, water),

technological characteristics (manual, computerized), primary presentation medium (graphic, numeric), user community (medical, legal), or nature of information (spatial, nonspatial). Further discussion on classification schema can be found in McLaughlin (1981, 1983), NRC (1983), and McLaughlin and Nichols (1987).

The dynamics of the LIS field of study and its relative immaturity make it difficult to define this concept in a precise manner while still retaining the extreme breadth inherent to such a system. Initially, while this concept was gaining in popularity and coming into its own, it was probably undesirable to attempt to confine LIS to a narrow definition, but with so many people claiming to be LIS (land information system) or GIS (geographic information system) specialists, it is time to begin narrowing the existing all-encompassing definitions of these terms. It should be possible to form an objective definition that ignores traditional disciplinary "turfs" and incorporates the truly multidisciplinary nature of these subjects.

The Fédération Internationale des Géomètres (FIG) have attempted to address the problem of defining an LIS ever since they accepted the LIS concept in 1971. But thirteen years later at one of their international symposiums, they were still struggling to come up with a definition that satisfied multiple disciplines (Hamilton and Williamson 1984b). In 1981, FIG approved a definition that regarded an LIS as "a <u>tool</u> for legal, administrative and economic decision-making and an aid for planning and development." In a "critique" of this definition, Hamilton and Williamson (1984a) rightfully pointed out that an LIS is not a tool as it cannot be bought or sold like any other tool and that it is "misleading" to regard an LIS as a "hardware/software" combination. They suggest that the term "resource" would be a more accurate word for describing an LIS.

A definition that takes into account these two points was in fact offered at a FIG conference the previous year (McLaughlin 1983, p. 701.4/2): "A LIS may be simply defined as a combination of <u>human</u> and <u>technical</u> <u>resources</u>, together with some set of organizing <u>procedures</u>, which provides certain <u>information</u> products (for example, maps) and services (for example, technical advice) related to the <u>land</u>" (emphasis added).

The underscored sections of the above definition suggest that an LIS comprises four broad dimensions: (1) a human or institutional element, (2) technology (for example, hardware/software), (3) a set of organizing procedures, and (4) an information base (McLaughlin and Nichols 1987).

In the field of LIS research, attention is being focused on (1) the conceptual design of LIS (Williamson 1983; McLaughlin 1985; Sedunary 1984; Chrisman and Niemann 1985); (2) data quality issues (Chrisman and Moellering 1983; McLaughlin 1983; Vonderohe and Chrisman 1985; Wilcox 1984); (3) integration of information derived from different sources (Anderson 1985; Dahlberg 1986; Frank 1986); (4) institutional, social, and political issues (Ayers 1984; Felstehausen 1984; Jacobs 1985; Portner and Niemann 1983; Robinette 1984; Sullivan et al. 1985); (5) user requirements (Scoggins et al. 1985; Zwart 1986b; Green 1987); (6) geographic information systems (GIS) (Burrough 1986; see also papers presented at GIS 1987 in San Francisco and the 1987 IGIS

conference in Virginia); and (7) the evaluation of existing and proposed systems (see Chapter 4). For a more general view of emerging research issues from a surveying, mapping, and LIS perspective, the reader is referred to Onsrud et al. (1985).

In this paper, an LIS is regarded as a land management, planning, and administration "resource" that utilizes technology (not necessarily computerized) to create an information base and disseminate land information but which is ultimately controlled by the surrounding institutional and social framework. The success of the system can be measured by the level of integration and cooperation between various land information users, and this is, in turn, dependent on effective organizing procedures and protocols.

"Parachuting" modern computerized LIS technology into developing countries without due consideration for the people, culture, and institutional fabric is essentially disregarding three out of the four primary dimensions of an LIS. The notion of developing nations utilizing modern technology to "leapfrog" into the future, thereby avoiding the pains of industrialization, is in many instances a technocrat's pipe dream (Barnes 1985b). Although modernization in an incremental manner is often desirable, this should be undertaken with due regard to the skills, values, and customs of the host culture (Barnes 1985c). While the introduction of technologies such as orthophotography can provide significant benefits to a society, a "leap" to satellite or computer-based technologies can lead to their rejection as a result of the unfamiliar approaches and logic inherent to these technologies (see Bhatia et al. 1978 for more detail).

Since the term GIS is currently favored in North America, it is important to distinguish between these systems and an LIS. A comparison of the titles and contents of papers presented at major GIS/LIS/mapping/cadastre conferences in North America [for example, ACSM-ASPRS (American Congress on Surveying and Mapping/American Society for Photogrammetry and Remote Sensing) annual conventions] shows the inconsistency in the definitions of GIS, LIS, and various other terms. There appear to be two significantly different ideas of what constitutes a GIS. Proponents in the one camp define GIS as a broad spatial information system while an LIS is but one of many subsystems or subsets (McLaughlin and Nichols 1987). The second camp regards a GIS as a "tool kit" for the "input, storage, and retrieval; manipulation and analysis; and output of spatial data" (Marble 1984, p. 35). It is composed of the following: (1) data input component for collecting and processing spatial data; (2) data storage and retrieval component which organizes the data so that it can be efficiently retrieved and updated; (3) data manipulation and analysis component which reformats (generalizes, aggregates, and the like) data for specific purposes; and (4) data-reporting component for displaying data in a tabular (textual) or map form.

Marble (1984, p. 37) explained that the definition of a GIS does not depend on scale or content. Other definitions given by leading GIS specialists include:

> a powerful set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world (Burrough 1986);

> computer-assisted systems for the capture, storage, retrieval, analysis and display of spatial data (Clark 1986);
>
> [the] ability to both automatically synthesize existing layers of geographical data and update a database of spatial entities is the key to a functional definition of a GIS (Cowen 1987);
>
> internally referenced, automated, spatial information system (Berry 1986).

A GIS can therefore be regarded as a tool or "set of tools," that is, it can be bought and sold. It is possible, for instance, to go out and buy an Arc/Info or Intergraph GIS. Although the institutional or user dimension is included in some definitions of GIS (see, for example, ESRI 1987), this generally arises only in the application of the GIS tool. Whereas the institutional dimension is an inherent part of an LIS, in a GIS environment it arises only when the tool is applied to some problem outside a research laboratory.

Although a GIS is a software/hardware/database combination that manipulates and analyzes spatial data and information, this does not mean that all mapping and database-management systems can be classified as GIS. A GIS refers only to those computer tools, such as Arc Info, that have the capability to analyze data that is spatially referenced. GIS can also be distinguished from other systems by the fact that one can generally obtain more information from the system than is entered into it (Burrough 1986). This means that a GIS should be regarded as a powerful analytical tool that can enhance information in a manner that has not previously been possible.

The next section defines the particular type of LIS that is dealt with throughout the remainder of this paper.

2.3 Cadastre-Based Land Information Systems (CLIS)

A CLIS is a parcel-based system which deals with data and information concerned with land tenure. It is the means by which society officially delineates, records, and gives public notice of the nature and extent of rights to land.

An information systems taxonomy, showing the CLIS with respect to other spatial and land information systems, is displayed in Figure 2.8.

A CLIS forms part of a larger "Legal/Fiscal LIS" which incorporates legal tenure information as well as fiscal information relating to valuation and taxation. The combination of legal and fiscal information in one LIS is a logical approach, as the cadastral parcel can serve as a spatial framework for the textual component of both information bases. This is also consistent with the historical evolution of cadastres in Europe as described in Subsection 2.1. In this study, the focus is on the legal component of CLIS, with little attention given to fiscal issues and problems. This stems from the fact that LIS initiatives in most developing countries are not motivated by a need for a better land taxation system, though this would undoubtedly constitute an additional benefit. The important goals in developing countries are

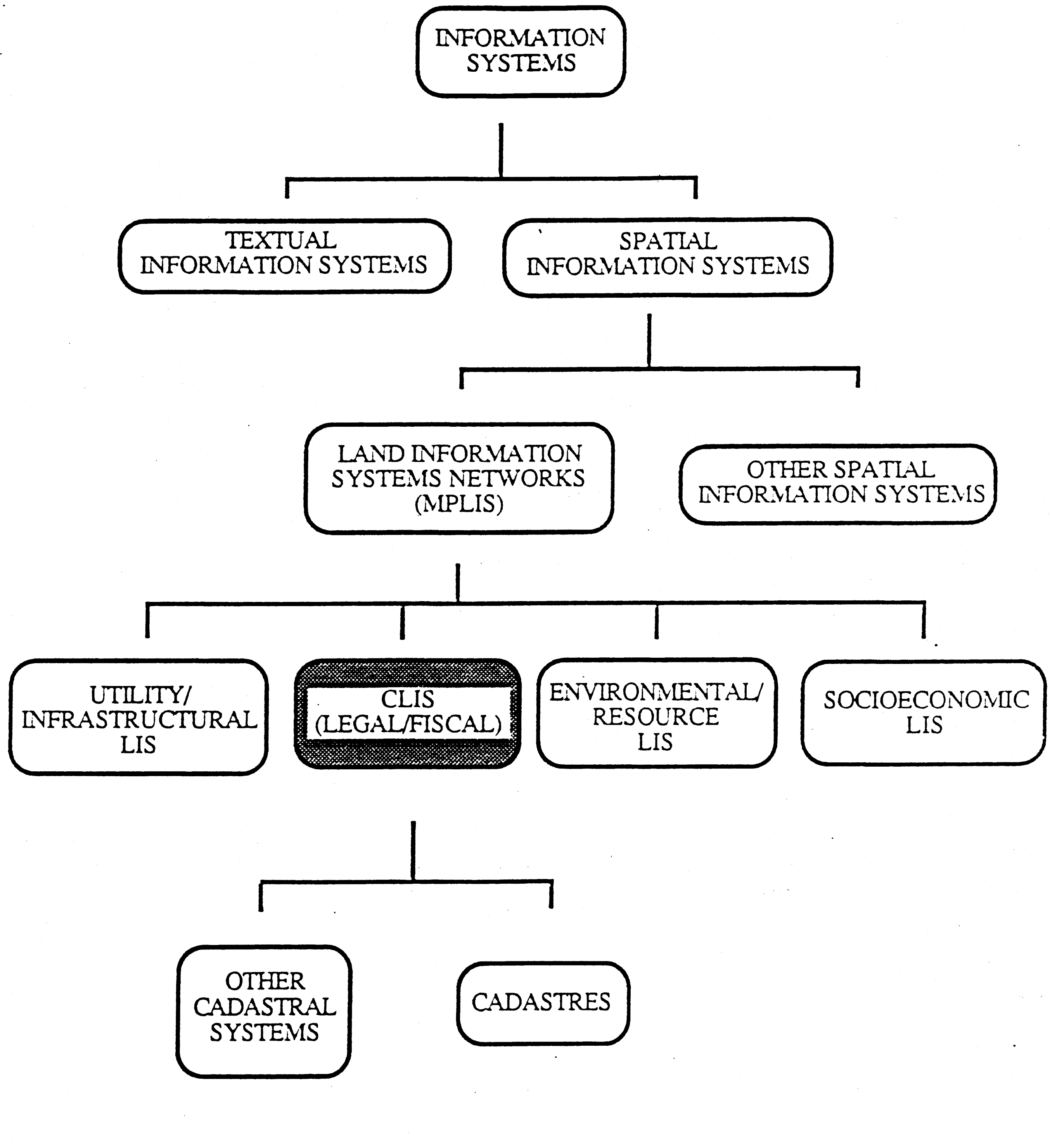


FIGURE 2.8

An Information Systems Taxonomy

enhancing tenure security, raising agricultural yields, and promoting better resource management (see Subsection 2.4). In countries such as Honduras, many small farmers cannot be taxed because they simply do not have the financial resources.

Where Europe passed through a phase of developing fiscal cadastres and then converting these into legal cadastres, developing countries are forced to develop legal cadastres without the benefit of the fiscal base. Although a CLIS may resemble what is often called a "legal cadastre," the former may be distinguished by (1) the holistic or systems approach, and (2) treating it as an information system.

The spatial inputs in a CLIS relate to the location (state/province, district, block, coordinates), size (area), and shape (length of sides, angles, azimuths, bearings) of the tenure or cadastral parcels. The nonspatial or textual input is concerned with the nature of the tenure rights (privileges, restrictions, obligations) and the identification of those who hold them. Spatial data on the parcel boundaries can be collected directly through a conventional field survey, or remotely by means of aerial photography, or through some combination of these methods.

The identification of right-holders and the nature of their tenure generally require some form of adjudication or legal investigation. Where titles have previously been issued to only some of the primary right-holders, there will be two categories of landholders--de jure holders, those with legal documentation of their rights, and de facto holders, those who occupy and use the land but have insufficient or no legal documentation to support their claims.

The transformation mechanism in a CLIS consists of all the processes that are applied to the spatial and textual input data. These include abstracting, archiving, and indexing required for the management of recorded information as well as those processes involved in the production of system outputs. More specifically, these processes relate to cadastral and parcel mapping in the case of spatial information and to a deed or title registration system in the case of textual information. The cadastral map is generally used for indexing the various cadastral parcels in a jurisdiction while a title register or tract index is used to manage the textual tenure information.

The outputs of the system are generally represented in terms of certain information products. A cadastral map is used to portray the general location and distribution of cadastral parcels as well as linkages, such as parcel identifiers, to related textual records. Individual parcel maps may contain information relating to the exact location, size, and shape of the parcels, but, in some instances, the cadastral map may be the only record containing spatial information about cadastral parcels. A deed or title is the product containing information on the nature of the tenure and the identity of the landholder. This textual information may also be combined with certain spatial information at the individual parcel level to form a single document, such as the certificate of title in the Australian Torrens system.

The feedback component of the system comprises the mechanisms necessary to capture new data that are required to keep the system current. In the CLIS, this consists of data arising from the [illegible] of new cadastral boundaries

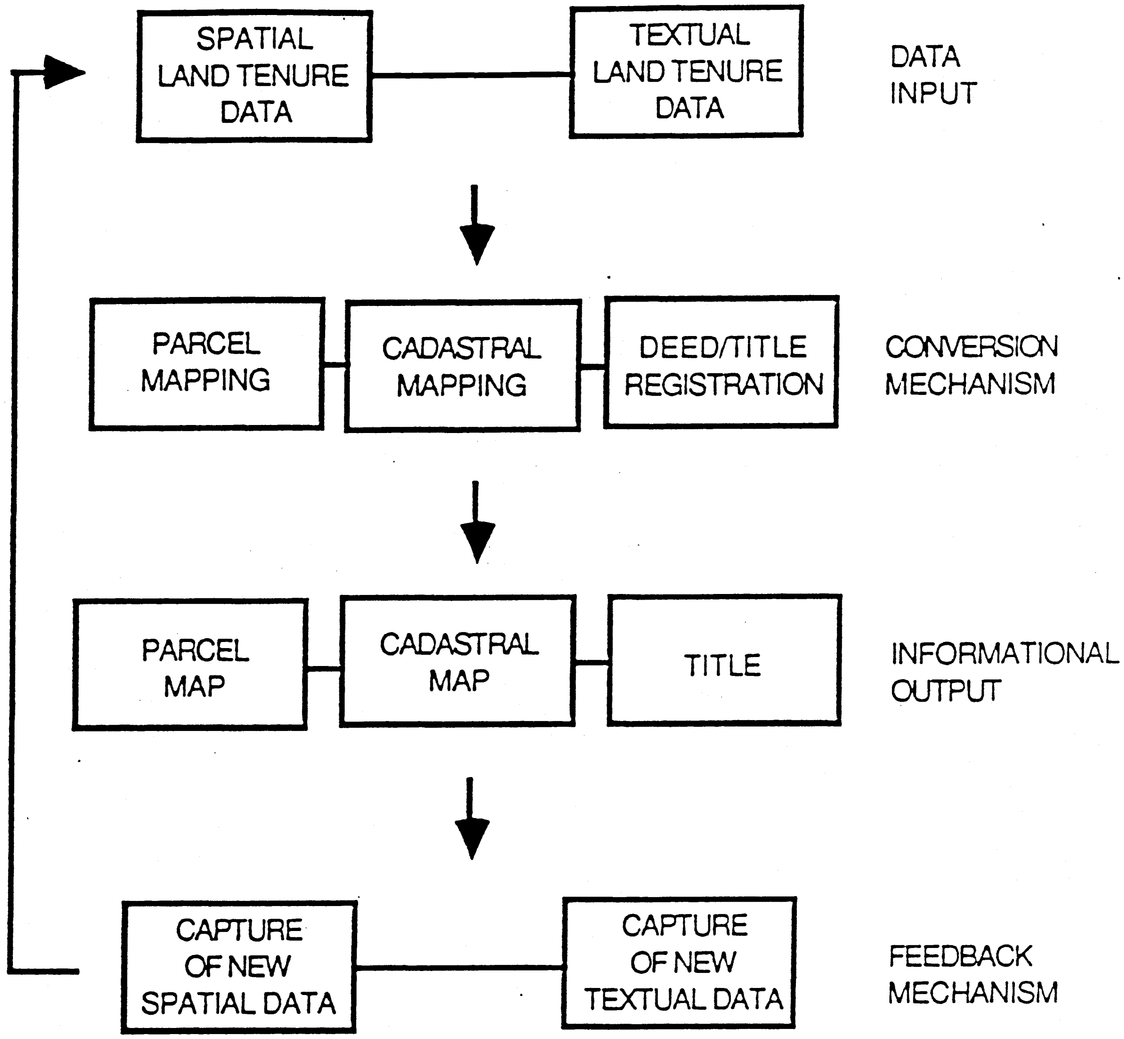


FIGURE 2.9

Structure of a CLIS

(through subdivision, consolidation, or resurvey) and from the conveyance (sales, inheritances, donations, foreclosures, and so on) of rights to land. This component may also contain data relating to the system performance and thus provide the stimulus to make adjustments or refinements to the system. Land tenure is dynamic, and it is imperative for a CLIS to recognize this and to incorporate effective mechanisms for the acquisition of new data. If not, the system will become a snapshot of a brief moment in a country's tenurial history with little real relevance to current informational needs or demands. Figure 2.9 illustrates the structure of a CLIS in terms of its spatial and textual components.

2.4 Relevance of the CLIS to Developing Countries

It was estimated that in 1987 upwards of a billion dollars was being spent by the World Bank on cadastre-related projects.[1] The disappointing results of the land reform efforts of the 1950s and 1960s (Dorner 1971) have caused many development agencies and governments to shift their focus from a reform-oriented policy to one aimed at strengthening existing land rights. Land reform programs have, as a result, been replaced in many countries by land titling projects targeted at small farmers who hold land but who have no long-term tenure security.

Although most countries have some operating titling system, the use of these systems has often been restricted to those with sufficient money, knowledge, time, and confidence in the system to acquire an official title. This has left a large section of the rural land-holding population without any official protection over their land rights. Titling projects are designed to address this problem by improving accessibility to title and by offering farmers a title which is both inexpensive and mortgageable and whose acquisition is not subject to long delays. To achieve this, it has been necessary to develop efficient titling systems (CLIS) where initial registration relies on the action of the state as opposed to the initiative of individual landholders. In this way, an attempt is made not only to answer private tenure and production needs but also to set up a system that contributes to the overall land administration and public planning capability of a country. The potential private and public benefits available from this strategy are outlined in Subsections 2.4.1 and 2.4.2, and Subsection 2.4.3 is devoted to a brief summary of the potential disadvantages of such an approach.

2.4.1 Private Sector Benefits

One of the key assumptions behind a titling project is that a title will impart tenure security to the recipient. Tenure <u>in</u>security generally arises when there is a shortage of land and traditional security mechanisms, where rights to land may be protected by membership in a social grouping and long established customary laws have been eroded. Other factors that may have a detrimental effect on security are: (1) the growth of land and produce markets, (2) improved communication networks, (3) use of new technology and methods, (4) emergence of alternative forms of land use, (5) increased tenure individualization, and (6) boundary uncertainties (Cross 1980; Feder and Noronha 1987; Lemel 1985; Thome 1971).

Tenure security in the context of this chapter should be interpreted as the ability to mortgage and dispose of land rights as well as a spiritual peace of mind with regard to the long-term rights of possession and usufruct--the "assurance that you will be able to reap where you have sown" (Raup 1967). A legally recognized title is commonly regarded as the most rational and effective means of providing tenure security to a landholder (Goody 1980; Koehn 1983; McLarney 1984).

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1. Personal communication with Lynn Holstein of the World Bank.

The proponents of titling argue that a title, or, more precisely, the security associated with title, will provide farmers with the incentive to increase their resource investment (labor, capital) in the land (Salas et al. 1970). Studies in Thailand (Feder et al. 1986; Stifel 1976), Costa Rica (Seligson 1982), and St. Lucia (Laville 1978) have shown that title, through the added security it provides to formal moneylenders, expands the availability of cheaper and longer-term credit. This will result in an increased use of formal credit by individual farmers, leading to greater investment in the land (IADB 1986; Feder et al. 1986; Villamizar 1984; Seligson 1982).

Increased investment in agricultural inputs (labor, fertilizer, technology, and the like) will in turn lead to better production rates and a corresponding improvement in rural incomes (Feder et al. 1986; Seligson 1982, 1984). In Costa Rica, the USAID-supported Agrarian Law Project (Salas et al. 1970, pp. 22-23) concluded that:

> When some of the indexes of farm performance . . . are analyzed in terms of tenure security, it is evident that the presence of tenure security, particularly a full title to land, substantially accounts for higher farm performance . . . . Among all the different factors which provide a positive influence to increased agricultural performance, evidence shows that full, legal title to the land is one of the most important if not the most important.

In advancing the case for titling projects, as distinct from projects restricted to improving credit facilities, a study undertaken in Brazil maintained that "an occupant without credit would be expected to double production if he became an owner, whereas credit alone would only raise his output about 20 percent" (Barbosa and Strasma 1984, p. 13). This study further asserted that: "[it would] . . . be reasonable to project increases on the order of 200% for family incomes, when titles are distributed to persons presently operating as tenants or occupants" (ibid., p. 17).

Research in Ecuador revealed that total farm income for titled landholders was 2.7 times higher than that for untitled holders (USAID 1985, p. 9). In a follow-up study of a land titling project in Costa Rica, two-thirds (66.3 percent) of the title beneficiaries reported that their "economic situation" had improved since receiving title (Seligson 1982, pp. 50-51).

A further benefit of strengthening tenure security and credit availability is that it will improve the "marketability" of land, thus facilitating the transfer of land to more productive farmers and the landless (Stanfield 1986; Stringer 1986). Titling projects also directly address problems stemming from land and boundary disputes. Conflicts of this nature can challenge the stability of a community and result in lengthy lawsuits which drain the limited resources of the small farmer even further (Thome 1971).

Individual tenure security can also lead to better stewardship by individual farmers. For instance, in many developing countries it is necessary to clear a piece of land completely in order to express possession and discourage others from laying claim to the same land. McLarney (1984, p. 21) quips rather

sardonically that in Costa Rica, a farmer "who claimed a piece of land and napalmed it would be making a good investment in security." Titling can prevent such destructive behavior by publicly sanctioning land claims and providing a protection which promotes stewardship.

Although other factors play a major role in improving agricultural production and reducing rural poverty, evidence from a range of countries demonstrates that titling has the potential to provide substantial benefits to the private sector. Nevertheless, titling should not be viewed as a universal panacea, but must form part of a broader, more integrated rural development plan that includes land reform, technical assistance, and other measures that address the inequities commonly found in developing countries.[2]

A simple flow chart, summarizing the arguments presented in this section, is given in Figure 2.10.

2.4.2 Public Sector Benefits

The public benefits offered by titling systems (CLIS) can perhaps provide a more convincing argument for the implementation of these kinds of systems in developing countries.

If one takes a longer-term view that supports the conservation of nonrenewable resources and an improvement in the management of renewable resources so as to promote land stewardship, then the public benefits (protection of the public good) of a CLIS certainly outweigh the more individualistic and potentially exploitative private benefits. González (1975, p. 373) explains the importance of LIS as follows:

> In a nation striving to improve its economic situation, it is of prime importance to know its resources in order to measure the potential of development projects, especially when it is known that these resources are scarce, and their utilization will require careful planning in order to successfully conclude social-economic programs.

Public sector benefits are centered around improvements in the land administration, public planning, and development capabilities of a government. By providing an up-to-date inventory of land rights, state land may be located and allocated to landless farmers or developed for public purposes. Such an inventory facilitates the stewardship of state-owned resources by making available information on the nature and extent of these resources. This is particularly important in ecologically sensitive areas, such as water catchment areas, where it is essential to protect the long-term public good. Given the extreme demands made on governments in developing countries for the development of rural and urban services, it is not surprising that one of the prime public

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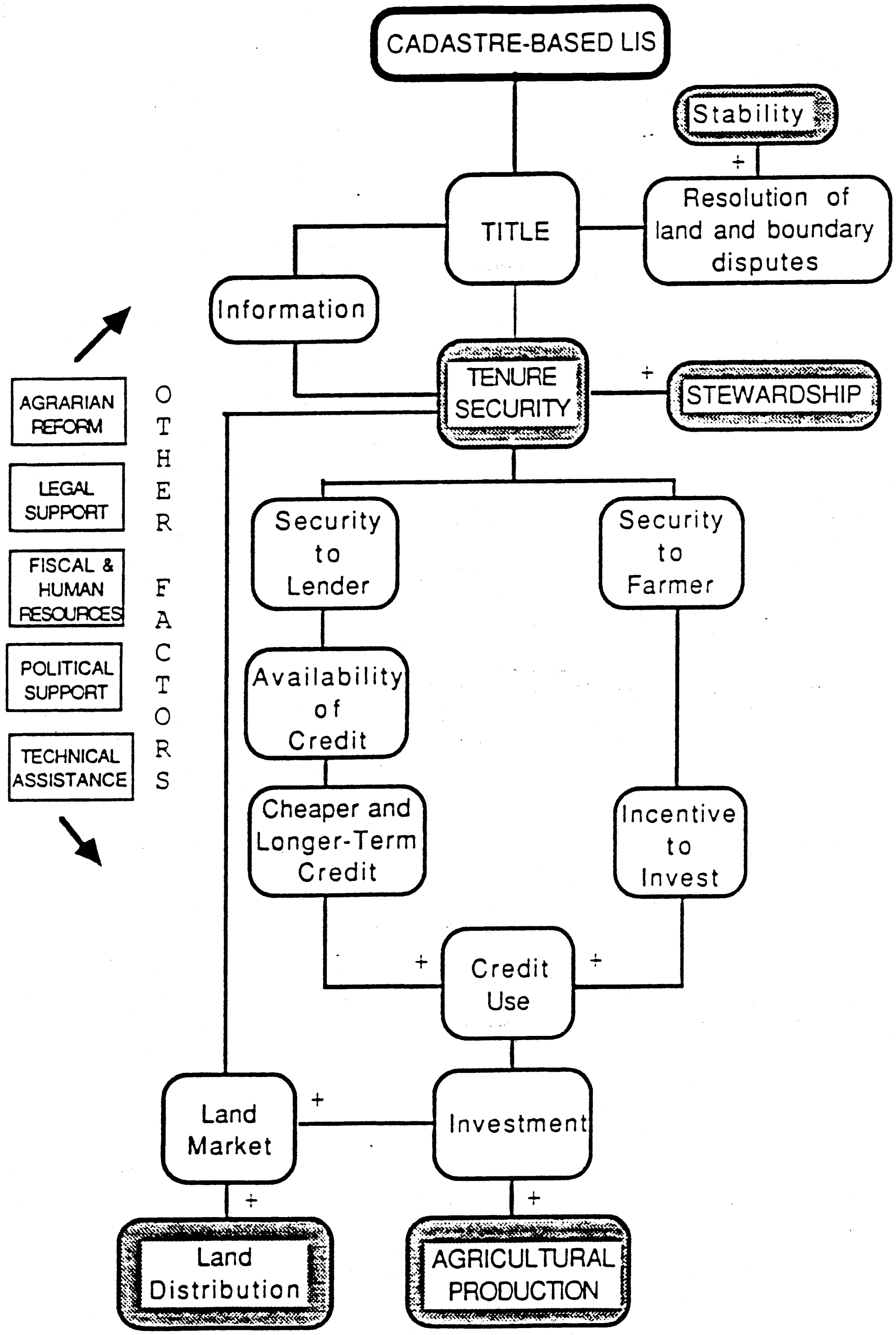
2. For a more comprehensive overview of these issues, the reader is referred to two excellent papers by Feder and Noronha (1987) and Stanfield (1986).



(+ positive influence)

FIGURE 2.10

Private Sector Benefits of a CLIS

motivations for a CLIS is the establishment of a more comprehensive land taxation system that will boost public revenue (Strasma and Ahene 1986). As mentioned earlier, one of the fundamental differences between early cadastral developments in Europe and current initiatives in developing countries is that the fiscal or taxation systems provided the foundation for the modern European cadastres, whereas in the latter, a "legal" CLIS is seen as a mechanism for creating a more effective and equitable land taxation system.

Other potential benefits include: (1) improvements in the land valuation capability; (2) simplifying and facilitating land acquisition for public projects; (3) improvements in public planning by establishing the basis for more effective land-use controls (zoning, and the like) and collection of socioeconomic (census) data; (4) reduction in corruption owing to tighter controls and checks; (5) greater system efficiency leading to increased use; and (6) decreased cost resulting from more efficient procedures and less duplication of effort.

Most of the above-mentioned benefits can contribute directly to the development process. Increased public revenue and the availability of reliable land tenure, socioeconomic, and other planning information can promote rural development through infrastructural development, land reform, and land consolidation. The ultimate goals of the CLIS are to promote long-term land stewardship and the rational development of land resources--precisely the same long-term goals as were envisaged in the private sector (see previous subsection). Figure 2.11 illustrates the benefits of a CLIS from a public sector standpoint.

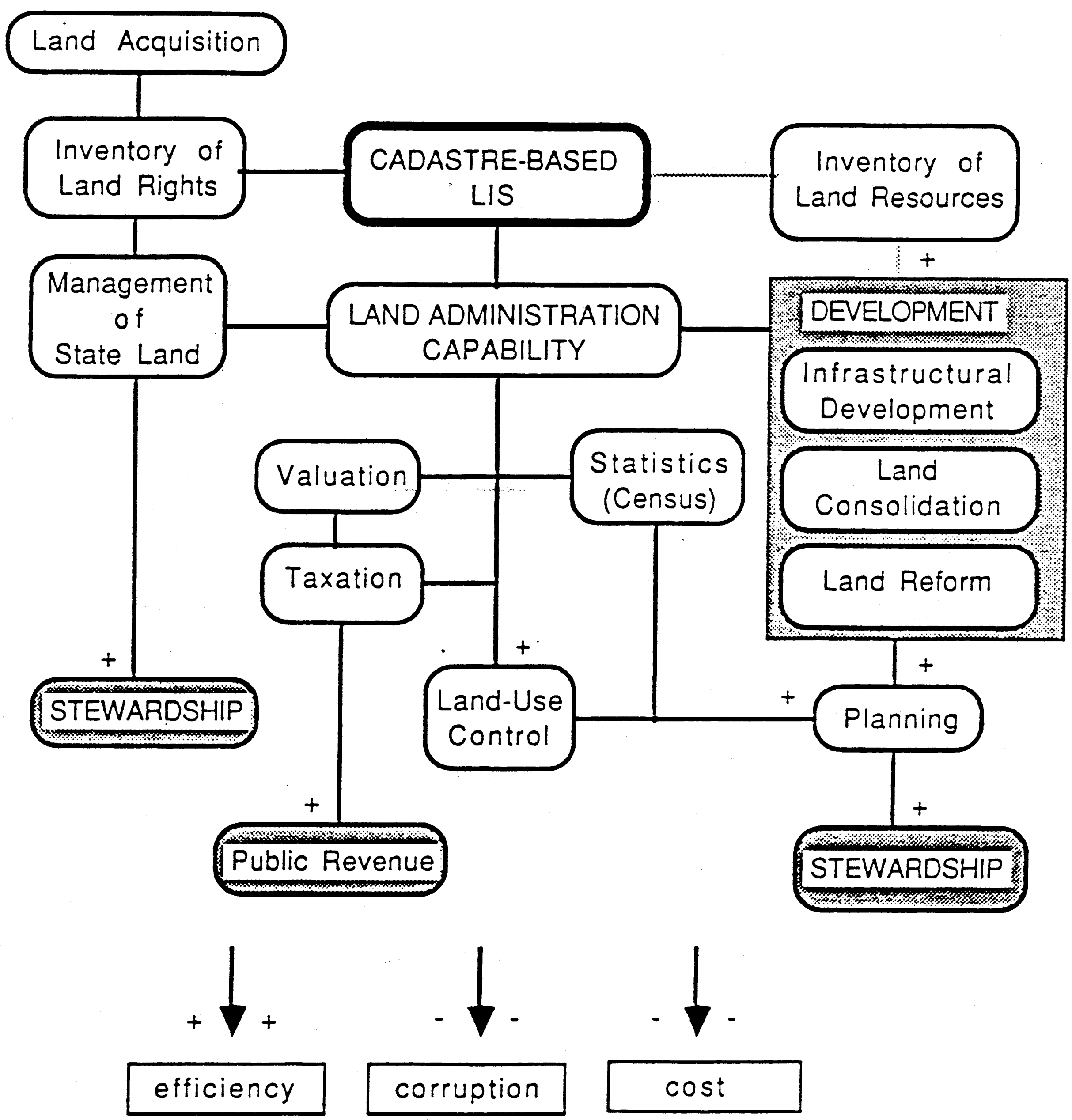
It is important to point out that this evaluation of the CLIS does <u>not</u> examine the broader social and economic factors discussed above. The focus is on the system itself and it is assumed that the implementation of an <u>appropriate</u> and <u>effective</u> CLIS would be beneficial to a country. Most previous evaluation work has been directed toward the socioeconomic implications of title possession and the benefits described above. But little attention has been paid to an assessment of the system that is producing the information on which these benefits depend.

Tenure security--and potential agricultural production gains associated with this condition--is closely related to the system that provides titles and the information required to support land interests. The value of a title fades when, for instance, the supporting system fails to maintain its information base or does not operate in an effective manner. One need only look at the case studies in this research to observe the effect of old titling systems that have become ineffective. The failure of these old systems to provide the kinds of benefits discussed in the first part of this section is in fact the major reason for the development of improved CLIS.

While recognizing the socioeconomic benefits of a CLIS, this study is based on the belief that the effective operation of these systems is a prerequisite to attaining those benefits.

2.4.3 <u>Potential Disadvantages</u>

While reasoning presented in the previous two subsections provides adequate justification (as witnessed by current investments) for the development



(+ positive contribution)

(- negative contribution)

FIGURE 2.11

Public Sector Benefits of a CLIS

of CLIS, there are certain shortfalls and hazards to this approach. Per- haps the most important fact with regard to CLIS and rural development is that a title, no matter how secure, and a CLIS, no matter how efficient or inexpensive, cannot help the poor small farmer unless they are accompanied by similar efforts in infrastructural development, the supply of credit, education, agricultural extension, and land redistribution (reform).

The provision of title to small farmers and the promotion of a land market may, instead of relieving landlessness, actually contribute to further dispossession. In Schickele's (1962) often-quoted phrase: "the surest way to deprive a peasant of his land is to give him a secure title and make it freely negotiable." It is essential, therefore, to protect the rights of small farmers from speculation and land grabbing even if this runs contrary to free market principles.

In Latin America, the subdivision and titling of ejidal and communally held land has in many cases benefited the larger landholders and contributed to the insecurity of smallholders. In a paper entitled "Are Titling Programs always Good?," Thome (1984) argues that titling is not necessarily (and seldom) beneficial to everyone. This argument becomes clearer if titling is perceived as a public sanctioning of rights (positive rights) as well as an extinction or exclusion of rights (negative) (Stanfield 1984). Particular care should thus be exercised to insure that unrepresented, or under-represented, right-holder groups, such as women, secondary right-holders, and absentee holders, are not excluded from the titling process.

Titling projects that introduce concepts, technologies, and procedures which are completely foreign to the culture of the "beneficiaries" also run the risk of exacerbating tenure insecurity. Any titling or CLIS system, regardless of local peculiarities, must prove acceptable to and gain the confidence of the local populace (by offering positive incentives) if it is to remain active and offer the benefits it is designed to provide. Therefore, it is important to be aware of both public- and private-sector user needs.

The simple truth in many developing countries is that the large majority of farmers are forced to farm land which is marginal at best and which has been fragmented to the extent that the holding no longer constitutes an economically viable land unit. In contrast, the large farms, owned by a privileged elite or multinational enterprise, contain the most fertile and productive land which in many instances is exploited in a manner that is contrary to the principles of stewardship. CLIS are important mechanisms for development and stewardship, but they are no substitute for land reform and should therefore be viewed as part of a larger and broader development strategy.

3. EVALUATION FRAMEWORK

3.1 Review of Previous Evaluation Work

A review of the literature on the evaluation of LIS shows a predominant focus on aspects related to cost. Some works deal with benefits associated with the implementation of LIS and a small minority cover evaluation on a broader scale than cost/benefit analyses.

Numerous efforts have been made to quantify the cost of implementing an LIS, or certain components of an LIS, in the United States and Canada. One of the most noteworthy contributions to the field of cost analysis has come from Professor Angus Hamilton and his colleagues at the University of New Brunswick. They have concentrated on developing "unit cost principles" which have been applied to both property mapping (Kenny and Hamilton 1985) and topographic mapping (Laroche and Hamilton 1986; Hamilton et al. 1985). These principles are as follows:

1) unit costs are divided into initial production costs and maintenance costs;

2) unit costs must be referenced to a single currency at a particular base year;

3) unit costs should be expressed in terms of person-hours;

4) person-hours must take into account different skill levels.

In advancing the case for land records modernization in the United States, Larsen and others studied the annual cost involved in maintaining the existing land records system. They estimated that in the state of Wisconsin, this cost was in the region of $80 million, or $17 per capita (Larsen et al. 1978). A subsequent study in Wisconsin, the Dane County Land Records Project (DCLRP), analyzed the relative costs of a manual versus an automated approach to land records modernization. More specifically, this project produced detailed costs for (1) manual digitizing versus scanning, (2) field surveying versus the use of the global positioning system (GPS), and (3) the creation of digital data layers for soil erosion planning (Moyer et al. 1988; Wunderlich and Moyer 1988; Green and Moyer 1985). Moyer et al. (1988, p. 200) concluded: "To be successfully implemented, multipurpose LIS such as the one developed in the DCLRP must meet at least three criteria--technical feasibility, institutional practicality, and economic cost effectiveness."

The World Bank recently undertook a general survey of cost models and actual costs of projects carried out in several developing countries, including Brazil, Philippines, Thailand, Malawi, and Cameroon (Bernstein 1985, 1987). Bernstein (1987, p. 45) summarized the problems associated with costs as follows:

Currently, there is no consensus among the professionals and government officials on the costs to be anticipated in collecting land-related data, producing maps, and introducing and maintaining the various systems that process, store and administer them. Most of the component costs vary according to such factors as the level of accuracy required, local land conditions and the availability of pre-existing information, equipment and expertise.

Since cadastral surveys and boundary demarcation form such a large proportion of the total expense involved in implementing a CLIS, most of the pressure for cost reduction has been directed toward these two activities (see West 1971, for example). It has been suggested that the accuracy and precision standards of rural cadastral surveys in developing countries are unrealistically high, leading to unnecessary and inflated costs. One of the problems in this regard is that accuracy (and precision) and cost do not share a linear relationship. For example, a cadastral survey using tacheometric methods would produce less accurate (and precise) results than a conventional theodolite/electronic distance measurer (EDM) survey but would not necessarily reduce the cost and time required for the survey. Dale (1976, p. 16) raises the very relevant question, "Where is the cut-off point at which the investment in cadastral surveys ceases to produce any further benefits to justify higher expenditure?" Clearly this should be a function of the needs and demands of the society that the survey is serving and the cutoff point will, therefore, vary from one situation to the next.

Several researchers have attempted to examine the economics of land information in an effort to design effective cost/benefit models for evaluating LIS. The difficulties in quantifying both the costs and the benefits of land information or related products make it difficult to adopt a traditional supply/demand approach (see Wunderlich and Moyer 1984, for example). In many cases (for example, maps), the market price does not reflect the cost to the producer.

Epstein and Duchesneau (1984) developed an "avoided costs" model in order to identify the benefits of a geodetic reference network. By using this approach, they estimated that the cost/benefit ratio with respect to such a network is of the order of 4.5/1.7.

Blaine and Randall (1987) asserted that the "avoided costs" approach as applied to evaluating LIS improvements greatly underestimates the true benefits flowing from such changes. They pointed out that this approach disregards significant increases in demand resulting from the lower (avoided) costs. It therefore overlooks the substantial benefits that are derived from an increase in demand.

Luzar (1987) suggested that the use of "learning theory" can be used to complement the more traditional approaches toward estimating the economic value of land information and LIS. She argued that modern computerized LIS provide an opportunity to enhance certain dimensions (accuracy, completeness, precision, and the like) of information which in turn increase the value and supply of information. Decision-makers utilizing land information are regarded as being in a position on a learning curve where, initially, the precision and

amount of information required to support a decision are unknown. But as they observe the results of using certain information, decision-makers gain more experience at gauging the information required to support particular decisions.

Wunderlich and Moyer (1984) have examined the economics of LIS from a more traditional standpoint by using accepted production, demand, and supply functions. They experienced problems with this approach because (1) the information market is highly imperfect, (2) units of information (production) are ill-defined, and (3) there is a dearth of knowledge on the behavior of supply and demand curves and the production curve related to land information. These authors have recently expanded on this work by including cost and efficiency data from the DCLRP (Wunderlich and Moyer 1988). They observed that technological changes, such as the use of scanning (as opposed to manual digitizing technology), cause shifts in the production function which can lead to substantial gains in efficiency. Data from the DCLRP showed that production could be enhanced by a factor of 13 through the use of scanning technology. They also found that the many hidden demands which cannot be anticipated at the outset of a project continued to complicate the measurement or estimation of demand.

The Wisconsin Land Records Committee (WLRC) has also examined benefit/cost issues related to land records modernization and recently published a subcommittee report on this subject (WLRC 1986, p. ii). They noted that many of the benefits in the field of LIS are "soft" and "intangible," making it difficult to measure this part of the benefit/cost ratio. The committee did, however, list ten factors that could influence this ratio, including enhanced efficiency, fiscal savings, more accurate and reliable information, and more effective communication (ibid., p. 5).

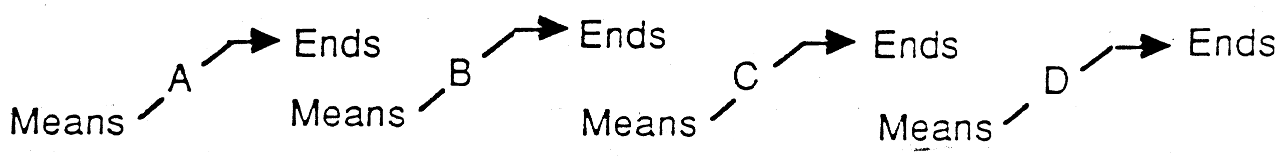
Regardless of the difficulties of quantifying future benefits and examining other qualitative aspects of LIS, it is essential that broad evaluation models be developed which can examine the various dimensions and attributes of an LIS and allow us to gain a better understanding of the issues surrounding the implementation of these systems. In this respect, Gurda et al. (1987, p. 12) recommended the use of longitudinal studies, the assessment of the impact of emerging and prospective technologies, and the development of a theory and models that will expand traditional cost/benefit approaches to LIS evaluation.

Borrowing from a model developed for evaluating public expenditures in the Canadian federal government (Jordan and Sutherland 1979), Clapp et al. (1985) developed a "means-end" model for the evaluation of LIS. The model is comprised of several different evaluation "levels" as illustrated in Figure 3.1. Each particular level assumes that the preceding level is a means for attaining the goals of the level in question. The model focuses on the efficiency and effectiveness achieved by a multipurpose LIS in moving from one level to the next. The evaluation criteria consist of (1) operational efficiency and effectiveness, (2) program effectiveness, and (3) contributions to the well-being of society.

The Illinois State Geological Survey has used this model to evaluate the relative merits of a manual information system versus a GIS for the management of coal mines (Treworgy et al. 1988). In order to refine the model for this

EVALUATION OF A MULTIPURPOSE LAND INFORMATION SYSTEM
(A Means-Ends Hierarchy)

INPUTS	OPERATIONAL OUTPUTS	PROGRAM OUTPUTS	PROGRAM EFFECTS	SOCIETAL BENEFITS/ COSTS
Data & Labor & Capital & Material	Interactive Cartographic Capability & Products	Information Availability & Public and Private Understanding	Enhanced Decision Making & Timely Problem Recognition	Integrity & Justice & Wealth & Fulfillment



A. Operational Efficiency

B Operational Effectiveness

C. Program Effectiveness

D. Contribution to Well-Being

FIGURE 3.1

Means-End Evaluation Model

Source: J. Clapp, J.D. McLaughlin, J. Sullivan, and A.P. Vonderohe, "Toward a Method for the Evaluation of Multipurpose Land Information Systems," in Proceedings of URISA Conference, Ottawa (n.p.: Urban and Regional Information Systems, 1985), p. 4.

particular application, several measurable indicators were identified for each evaluation level. For measuring operational efficiency (A), they looked at initial investment, maintenance costs, and production costs. Operational effectiveness (B) was evaluated through an examination of resolution, precision and timeliness, scale of output, digital output, readability, and new opportunities. Improvements in the decision-making process were used to indicate program effectiveness (C), and public health and safety were mentioned as areas where the well-being of society (D) could be enhanced by the implementation of more effective information systems. D was not adequately addressed as the effects on society generally require a longer period of time to identify and isolate. Nevertheless, the model proved to be successful and demonstrated that the automated GIS approach was not only more efficient for data management but more effective at all levels of evaluation.

Dueker and Kjerne (1987) attempted to apply this "means-end" model to the evaluation of different "implementation paths" followed by local government agencies in the creation of a cadastral layer for an MPLIS. In surveying nine such agencies, they focused on three different dimensions of the implementation path, that is, (1) the spatial knowledge (ability to answer spatial questions) of the cadastral layer, (2) the method used to construct the cadastral layer (digitization, coordinate geometry, and the like), and (3) the content (spatial referencing) of the base layer. Although this study raised some important questions relating to the use of different implementation paths, the evaluation was severely restricted by the absence of a "mature" baseline system and difficulties experienced in applying the "means-end" model. These problems highlight the need to consider "the dynamic nature of system development and its effect on the implementation of the cadastral layer" (ibid., p. 19). Any evaluation model should therefore be flexible enough to accommodate these dynamics.

3.2 Identification of Evaluation Criteria

The "means-end" model was not found to be appropriate for the purposes of this study as it does not directly address certain criteria, such as system maintainability and complexity, that are crucial to the design and implementation of CLIS in developing countries. In addition, the evaluation model required for a CLIS needs to concentrate more on the dimensions and attributes of the system itself rather than, for example, on the socioeconomic effects of titling unregistered landholders.

The approach used to develop an evaluation model is to identify the system attributes most critical to the successful implementation and maintenance of LIS in developing nations. This was achieved by examining the relevant literature, interviewing project implementers and professionals in the field, and drawing on the author's own experiences in Southern Africa and Latin America.

Specialists at the World Bank offered the following advice with regard to the design of LIS for developing nations: (1) the system must be <u>simple</u>, <u>labor-intensive</u>, and <u>easily</u> <u>understood</u> by landowners and other users; (2) <u>low</u> <u>cost</u> solutions need to be found; (3) a more <u>integrated</u> approach is required; (4) greater <u>flexibility</u> is needed in both the standards of precision and the comprehensiveness of information (Bernstein 1985; Dunkerley 1985).

In a 1985 issue of Urban Edge, a World Bank publication, the lead article, entitled "Developing Cadastral Systems," suggested that, "The design for a cadastral system should be kept simple and easily understood . . . . A system can be progressively upgraded with new elements and more sophisticated technology added at a later stage" (Urban Edge 1985).

Fortescue-Brickdale (1913, p. 2), in arguing the case for title registration in England in the early part of this century, asserted that a land registration system should exhibit properties of security, simplicity, accuracy, expedition (efficiency), and cheapness. Dowson and Sheppard (1956), West (1971), and Dale (1986) echoed these views and added completeness of record and suitability to local conditions to this list of desirable properties. Binns (1953, p. 37) maintained that "the success or failure of a system of registration will depend on the completeness and promptness with which mistakes are reported" and also advanced the importance of simplicity.

Holstein (1987) highlighted the importance of completeness of coverage, continuous updating of both mapping and registration subsystems, and the use, in a manual system, of methods that will allow for future computerization efforts. Furmston and Logan (1987) warned against implementing improved LIS in situations where user departments do not have the required skills, efficiency, or finances actually to make use of the information. There is a shortage of skilled professionals and technicians in most developing countries, and they pointed out that, "Labour-intensive methods of data collection for LIS and for LIS maintenance may not be appropriate or popular in the developed countries, but they may be sensible in developing countries" (Furmston and Logan 1987, p. 138). They recommended the use of manual systems but did not rule out the future use of computer-based technologies.

In discussing cadastres in Latin America, Rosholt (1986) emphasized the need to design cadastres so that they take into account the multiple users and their needs. He asserted that, "The ultimate success of the cadastre, and the maintenance of the cadastre, may well depend upon the success of intra-agency co-operation to develop a functional cadastral administration system and not on law which cannot . . . be enforced or carried out in the absence of such a system" (ibid., p. 6).

González (1975) consolidated Rosholt's view by pointing to the El Salvador experience, which suffered because of "institutional problems arising from lack of effective co-ordination" (p. 388). He referred specifically to the lack of integration between the titling project and the property registry.

Williamson (1982) highlighted the necessity for flexibility and suggested that an alternative, cheaper system, based on graphical methods, be offered to communities where the existing system proves to be too expensive for landholders.

Many other authors have offered their opinion on this subject, but generally they simply consolidate the views expressed above. Drawing on this pool of experience, an evaluation model comprising six criteria is constructed. This set of criteria is designed to reflect the inner strengths and weaknesses of any CLIS. The criteria are:

1) maintainability,
2) efficiency,
3) quality,
4) cost,
5) utility,
6) complexity.

In evaluating an existing or proposed CLIS, this framework facilitates a broad examination of system alternatives and highlights the major factors that are being played off against one another. The model recognizes that there is no "ideal" system but, instead, attempts to act as an evaluation tool and aid in selecting the most appropriate or expeditious system that provides the best balance within a given environment. It assumes that different societies and localities will have different constraints and needs and will, therefore, place different priorities on such criteria as cost, efficiency, and complexity.

3.2.1 Maintainability

Maintainability is defined as the effectiveness of the institutions and procedures in maintaining the CLIS, acquiring information on system performance, and adapting to changing needs and demands. The currency of the information base is indicated by the extent to which it reflects the situation on the ground.

The maintenance of a system is viewed as an essential prerequisite for the achievement of the long-term socioeconomic goals that underpin most cadastral and titling projects in developing countries. In highlighting the importance of maintainability, Blackie (1975, p. 31) declared that: "The whole design of a cadastral system therefore has to be based on reflecting the current state of a changing situation. Updating is therefore the most critical element in the design of a system."

Indicators that are examined with regard to maintainability include: (1) availability of equipment maintenance services, (2) currency of the information base, and (3) mechanisms provided for the capture of new land tenure data and the extent to which these are used.

3.2.2 Efficiency

Efficiency is the rate of production or the average number of informational "units" (delineated parcels, maps, titles, and so forth) processed per field-team month. These informational units may be divided into three categories: (1) delineated parcels, (2) mapped parcels, and (3) registered parcels.

Whenever possible, these categories are quantified in terms of the number of units as well as the geographical area (hectares) covered by the units. This criterion does not examine cost or cost efficiencies since cost is dealt with as a separate and independent criterion (see below).

3.2.3 Quality

Quality relates to the accuracy, precision, and completeness of the land tenure information in the system. This includes an examination of quality

control measures and the problems exposed by these measures. Other indicators that are investigated include: the nature of parcel boundaries (fixed, general), the boundary delineation methods (graphical, numeric), and the extent and type of land specifically excluded from the system.

3.2.4 Cost

This criterion refers to the cost of producing a single information unit, such as a cadastral map sheet or title. Unit costs are examined at various levels, beginning from a consideration of gross project costs to a consideration of recurring costs for a specific activity in a particular year. The degree of specificity within any one case is highly dependent on the cost data available, but an attempt is made to compute unit costs for (1) delineation (cost per parcel and hectare), (2) cadastral mapping (cost per map sheet), and (3) titling (cost per title, parcel, and hectare). All costs and unit costs are reduced to 1987 U.S. dollars in order to facilitate comparisons.

3.2.5 Utility

In a field such as LIS, the success of a particular system can often be measured by the breadth of the user community and the extent to which this community interacts with the system. A department that develops an LIS in isolation will generally ignore the special needs of other agencies and will therefore be biased toward its own specific needs. This not only decreases the utility of the system but also ignores the synergistic benefits to be gained through a cooperative approach which promotes the sharing of costs, data, and information. In this study, an attempt was made to identify the actual <u>and</u> potential users of the CLIS as a means of measuring the utility of the system.

3.2.6 Complexity

Given the severe financial, technological, and personnel constraints in developing countries, it is not surprising that many LIS specialists recommend the need for simplicity and low cost solutions to land-related problems. Although it addresses the same issues, the term "complexity" is preferred to "simplicity" as the latter term tends to mask the complex institutional, environmental, and tenurial circumstances in most developing countries. Certain experts have observed that in several developing countries, the measures, if any, that have been taken so far to fill this need [for the establishment or improvement of cadastral systems as a prerequisite for accelerated development] are inadequate or have failed mainly because of lack of insight into the complexity of the problem (UN Economic and Social Council 1973, p. 21).

Factors that are examined in this regard include: the level of the LIS technology used or proposed, education and training required to run and maintain the system, expertise used to create the system, procedures and techniques employed for the demarcation, delineation, mapping, and titling of land rights.

4. THE CADASTRE-BASED LIS IN HONDURAS

4.1 Introduction

Honduras is the second largest country in Central America, covering an area of 11.2 million hectares (approximately the size of the state of Ohio). The current population is estimated to be just over 4 million, with 90 percent mestizos (mixed race) and the remainder made up of small numbers of whites, blacks, and Indians. The north coast experiences a hot tropical climate while the more mountainous interior (above 2,000 feet) has a temperate climate. Corn, beans, and rice are the primary domestic consumption crops, and coffee, bananas, and sugar constitute the chief export crops.

The country is divided into eighteen departments (states) which are subdivided into municipalities (**municipios**). These are, in turn, divided into smaller units known as **aldeas** (villages or hamlets). The Honduran land titling project (Proyecto de Titulación de Tierras, PTT) is being implemented on a department-by-department basis and will eventually cover six departments.

4.2 Historical Background

The Spanish conquest signaled the beginning of a colonial era which significantly altered the system of land tenure in the region. The **repartimiento** and **encomienda** systems were introduced as a means of consolidating their authority and organizing slave labor to work their newly claimed lands. **Repartimiento** was a system of dividing and allocating groups of Indians among the colonists. The **encomienda** system gave the colonists the right to exact a certain amount of labor from Indian communities and in return the colonists would see to their "well-being." It is estimated that by 1547, the Indian population had been reduced to 7 percent of its original size (Blutstein et al., p. 11).

The size of a private land grant during the colonial period was generally dependent on the social class of the recipient. Those from the upper classes (knights, captains, squires) received parcels that were hundreds of times larger than those granted to the Spanish peons and soldiers, thus laying the groundwork for a highly inequitable distribution of land (Ponce 1977). The **repartimiento** and **encomienda** systems were gradually replaced by a private property system with most of the land being held by the aristocracy. This dualistic land distribution pattern was typical of many Central American states and was one of the primary reasons for the land reform efforts that ensued in Honduras and many other countries during the 1960s.

Stringer has identified four distinct periods in the history of Honduran land reform (Stringer 1984, pp. 38-50). The first period, from 1898 to 1961, consisted of legislative action and projects designed to settle or colonize unused public lands with the objective of increasing government tax revenue

and developing the agricultural sector. The second period, from 1962 to 1972, was spurred by the Alliance for Progress, a 1961 agreement that required Latin American countries to initiate land reform programs before they could qualify for U.S. foreign aid. Many Latin American countries complied with this condition simply by passing land reform laws without any serious commitment to the enforcement of these laws. Honduras responded by passing the Agrarian Reform Law of 1962 (Decree no. 2), which, inter alia, created the Instituto Nacional Agrario (INA) to implement the reform. The third period, from 1972 to 1975, was characterized by extensive land redistribution. This can be attributed to the INA directorship's commitment to reform and an increase in political pressure from campesino organizations. The fourth and final period, from 1976 to the present, saw the passing of the current Agrarian Reform Law (Decree no. 170 of 1975) and a marked slowing in land reform activity owing to a change in the directorship of INA and a conservative backlash from the large landholders.

Although these agrarian reform efforts have had some impact on the distribution of land, the situation remains inequitable. The 1974 Agricultural Census showed that 64 percent of the total number of farms were under 5 hectares in size, but that, together, these farms covered only 9 percent of the total area of the country. On the other hand, 4 percent of the total number of farms (including those greater than 20 hectares in size) covered approximately 56 percent of the total area. The agrarian structure in Honduras has been described as "a marked underutilization of the lands on the one hand, and on the other, an excessive overutilization of the land area of the smaller farms, in which the man-land ratio is much higher, with obvious implications on the conservation of the country's resources" (Ponce 1977, p. 5).

4.3 Land Tenure Situation

4.3.1 Formal Tenures

Land in Honduras may be arranged along a private/public continuum containing the five broad tenure categories shown in Figure 4.1.

PRIVATE PUBLIC

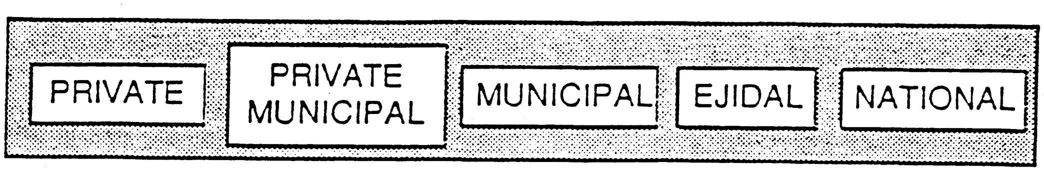


FIGURE 4.1

Formal Land Tenure Situation in Honduras

Private tenure pertains to land that has been passed from the state or Spanish crown to an individual through some legally recognized transaction which is evidenced by a publicly registered document. Generally this document is a fee-simple title or **dominio pleno**. It is estimated that there are approximately 3,737 fully titled private holdings (1 percent of the total number of holdings) in rural Honduras, some dating back to the start of the colonial era (USAID 1982, p. 11).

Private municipal tenure relates to private land that has been acquired by a municipality through purchase or donation. This can be distinguished from land under municipal tenure, which the municipality administers as a public branch of the state. The municipality no longer owns this land since all nonprivate land belonging to decentralized state bodies was transferred to the state with the passing of the 1975 Agrarian Reform Law (Article 21).

The ejido system of land tenure gained legal recognition in Honduras in 1836, some 79 years before the more publicized ejidal system in Mexico (Stokes 1947, p. 153). Ejidal land was generally an area (of approximately 3,000 hectares) surrounding a municipality or pueblo which was "conceded" to this local unit of government for its use. This concession generally involved the transfer of usufructuary (the right to use and take the fruits of this use) and administrative rights only (Reglamento de Afectación, Art. 2.h), so that ejidal land became a form of commonage. Usufructuary rights to these ejidal lands have in some cases been formally allocated to individuals through a document known as **dominio util**. Many of the holders of these documents believed that these documents gave them the full bundle of property rights and not merely usufructuary rights.

Prior to the passing of the Agrarian Reform Law of 1975, national land comprised all that land not formally transferred to an individual or group. The 1975 Law (Art. 21) transferred all agricultural land held by decentralized state institutions (such as municipalities) to INA, thus adding substantial areas to the pool of national land.

The formal land-tenure distribution in three departments, St. Bárbara, Comayagua, and Copán, is shown in Table 4.1.

4.3.2 Informal Tenures

The formal or juridical situation outlined above has been complicated by the emergence of a number of informal tenures resulting from persons' simply moving onto the land or through their "purchase" of parcels on national and ejidal land. This was partly a result of Decree no. 8 of 1973, which encouraged peasants to occupy and use the land in order to alleviate the severe land shortages among the campesinos. These informal tenures may be identified as squatting, possession, and occupation.

Squatting occurs when a farmer moves onto private land and begins using it for his/her own purposes. While squatting is not recognized by state law, many campesinos feel that this action is justifiable as they are simply reclaiming (**recuperando**) what is rightfully theirs (Alvarado 1987). This tenure issue is certainly one of the most important challenges faced by Honduras.

TABLE 4.1

Distribution of Formal Tenures
(percentage of total number of parcels delineated)

DEPARTMENT	EJIDAL	NATIONAL	MUNICIPAL PRIVATE
St. Bárbara	81.6	16.2	0.01
Comayagua	67.9	22.1	0.34
Copán	72.9	25.1	0.02
Average	74.2	21.1	0.12

Source: Dirección Ejecutiva del Catastro (DEC). The data were gathered as part of the Proyecto de Titulación de Tierras.

Possession rights are acquired through some formally documented transaction, whereas occupation rights accrue solely through the physical occupation of the parcel, without any formal, supporting documentation. Both of these tenures apply only on rural parcels of land that is officially defined as ejidal or national land.

Occupation and possession have developed along with the use of national or ejidal land so that many campesinos now feel that they own the full bundle of rights attached to the land. They are understandably confused when told by INA that they have never owned the land but only the improvements constructed thereon and therefore will have to pay INA to gain full property rights to their holdings. Many campesinos find it difficult to perceive, and accept, the separation of ownership rights from the various other rights (such as use rights) attached to land. Farmers who have purchased parcels on nonprivate land have always assumed that this transaction included rights to the land. Further confusion is caused by the fact that registered title to private land and the Civil Code both define real property as the land and its improvements (LTC 1986). To clarify the situation, INA promoters explain that the costs of purchasing the land from INA are minimal and that, in return, farmers will not be charged for processing the titles (including the cost of delineation and mapping). The success of this argument will become clearer as payments for the land become due (see Section 4.7).

In addition to the above tenures, there are also a small number of renters and beneficiaries from previous titling efforts and a significant number of parcels (11 percent) that cannot be categorized because no tenure information was available when the field investigation was carried out.

TABLE 4.2

Distribution of Informal Tenures

DEPARTMENT	OCCUPATION		POSSESSION	
	No. Parcels	% Parcels[a]	No. Parcels	% Parcels[a]
St. Bárbara	8,679	40.8	8,392	39.4
Comayagua	20,273	59.7	7,556	22.2
Copán	10,391	45.8	10,044	44.3
Average	13,114	48.7	8,664	35.3

Source: Dirección Ejecutiva del Catastro (DEC).

a. Percentage of all delineated parcels.

It is estimated that over 75 percent of all farms in Honduras are occupied by small farmers who have only informal tenure to their parcel of land (USAID 1982, p. 1). In the first three departments delineated under the titling project, approximately 84 percent of the parcels were found to be held under informal tenure (occupation and possession). The relative distribution of parcels held under possession and occupation for three departments is shown in Table 4.2.

The Proyecto de Titulción de Tierras (PTT) will convey full private title to farmers in this sector in an effort to improve tenure security and standards of living in rural Honduras. The rationale behind this private property approach was clearly spelled out in a 1982 policy statement by the Suaro administration: "But to deliver land to a man is not everything, he also has to be the owner of it. Because only in this way will he really want it, work it securely, defend it, and care for it as something of his own. In this way will the principles of private property be fortified . . ." (USAID 1982, p. 7).

4.4 PTT: La Tierra Es Patria[3]

The short-term objective of the PTT is "to establish a functioning mechanism for the granting of fee simple titles to farmers in Honduras" (USAID 1982,

3. "The land is my country" is the general motto of the Honduran Land Titling Project.

p. 13). The strategy of the project is to extend the benefits of private property, particularly the ability to obtain credit by using the land as collateral, to small farmers with the intent of increasing agricultural production, employment, and income in rural Honduras. The underlying rationale behind this strategy is that improved tenure security will not only give the small farmer sector greater access to credit but will also encourage these farmers to expand their investments in the land (see Section 2.4). The coffee-growing sector, in particular, is in need of capital to enable its entrepreneurs to modernize their operations in order to counteract a blight of coffee rust.

The project is restricted to rural parcels on national and ejidal lands in six departments (St. Bárbara, Comayagua, Cortés, Copán, Yoro, and La Paz) covering an area (including private land) of 3,238,000 hectares. These areas were selected as priority areas because of their "importance to coffee production, concentration of producers and availability of Cadastre data" (USAID 1982, p. 16). The goal of the PTT is to issue 71,628 titles to holdings between 5 hectares and 50 hectares in size (or 0.1 hectare and 50 hectares for coffee parcels) over a period of five years. Landless peasants and **minifundistas** (except those growing coffee) are specifically exempt from receiving title under this project as these groups received the primary benefit of nearly all previous land reform efforts (USAID 1982, p. 11). Regardless of their size, all parcels on national and ejidal land in the six departments will be delineated and mapped under the PTT.

Funding for this $16.7 million project is being furnished by the Government of Honduras (GOH) through a $4.2 million grant and by USAID through a $2.5 million grant and a $10 million loan. The revenue from land sales will be set aside for the extension of titling activities to areas outside the project area and to the ultimate realization of a national cadastre.

Four distinct phases can be identified in the PTT: (1) project promotion and identification of potential beneficiaries, (2) parcel delineation and mapping, (3) processing and registering title, and (4) project evaluation.

With fieldwork beginning in January 1983 in the Department of St. Bárbara, at the time of this study (February 1987), delineation work had been completed in the departments of St. Bárbara, Comayagua, Copán, and Cortés (excluding quality-control checks) and was under way in Yoro. Titling had been completed in St. Bárbara and Comayagua and was partially completed in Copán. No titling work was being carried out by INA field teams at the time of the author's visit to Honduras as a large number of the work force had been laid off as part of an institutional "reconstruction" effort.

4.5 Institutional Framework

The overall responsibility for processing and issuing land titles under the PTT is in the hands of INA, the Honduran Agrarian Reform Agency which was set up in 1962 to implement the Agrarian Reform Law. INA is a semi-autonomous institution which reports directly to the president. The Transfer and Legalization Division (División de Afectación y Adjudicación) and the Agrarian Debt Control Section (Administration Division) carry out the bulk of the PTT-related

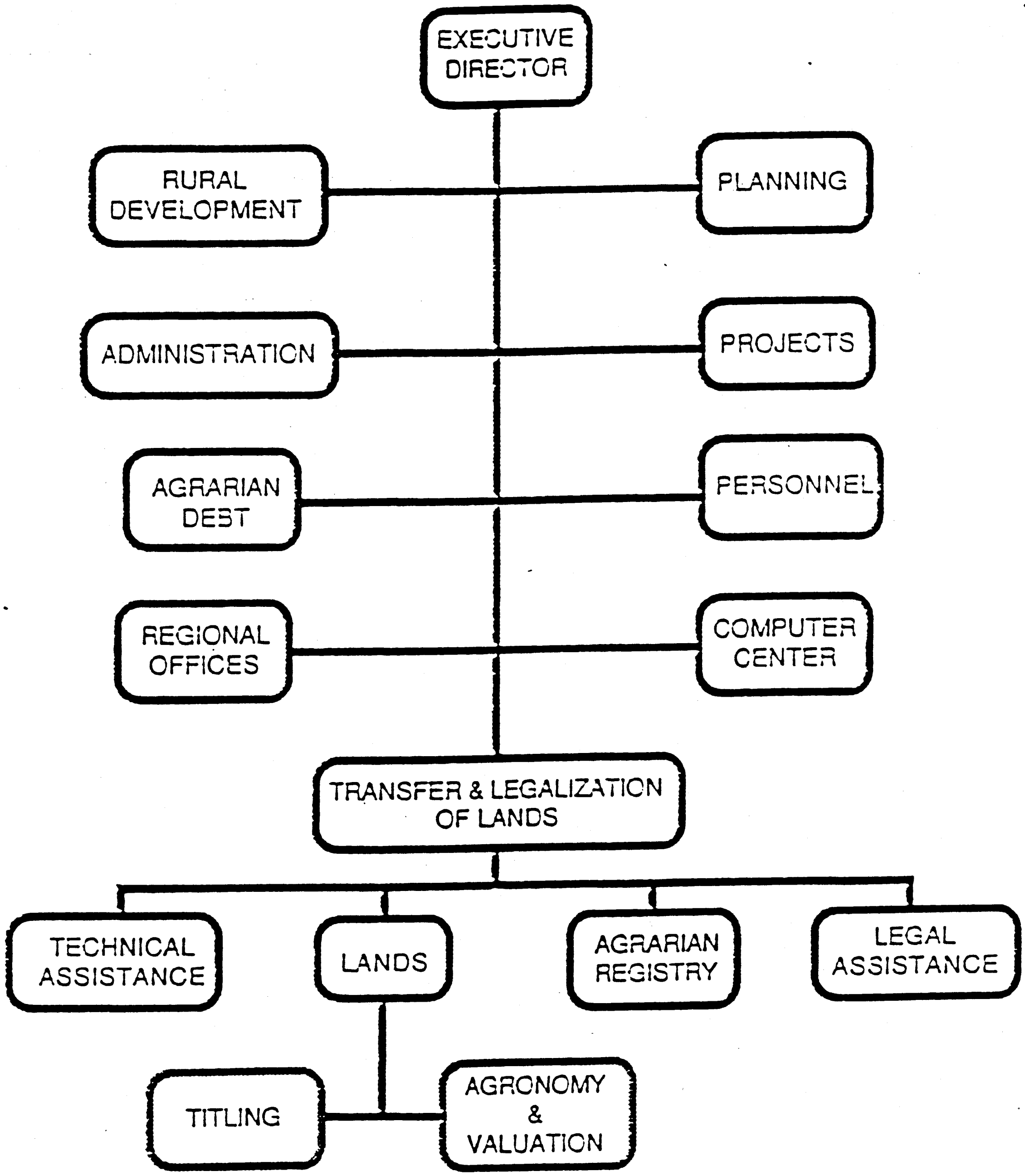


FIGURE 4.2

General Structure of INA

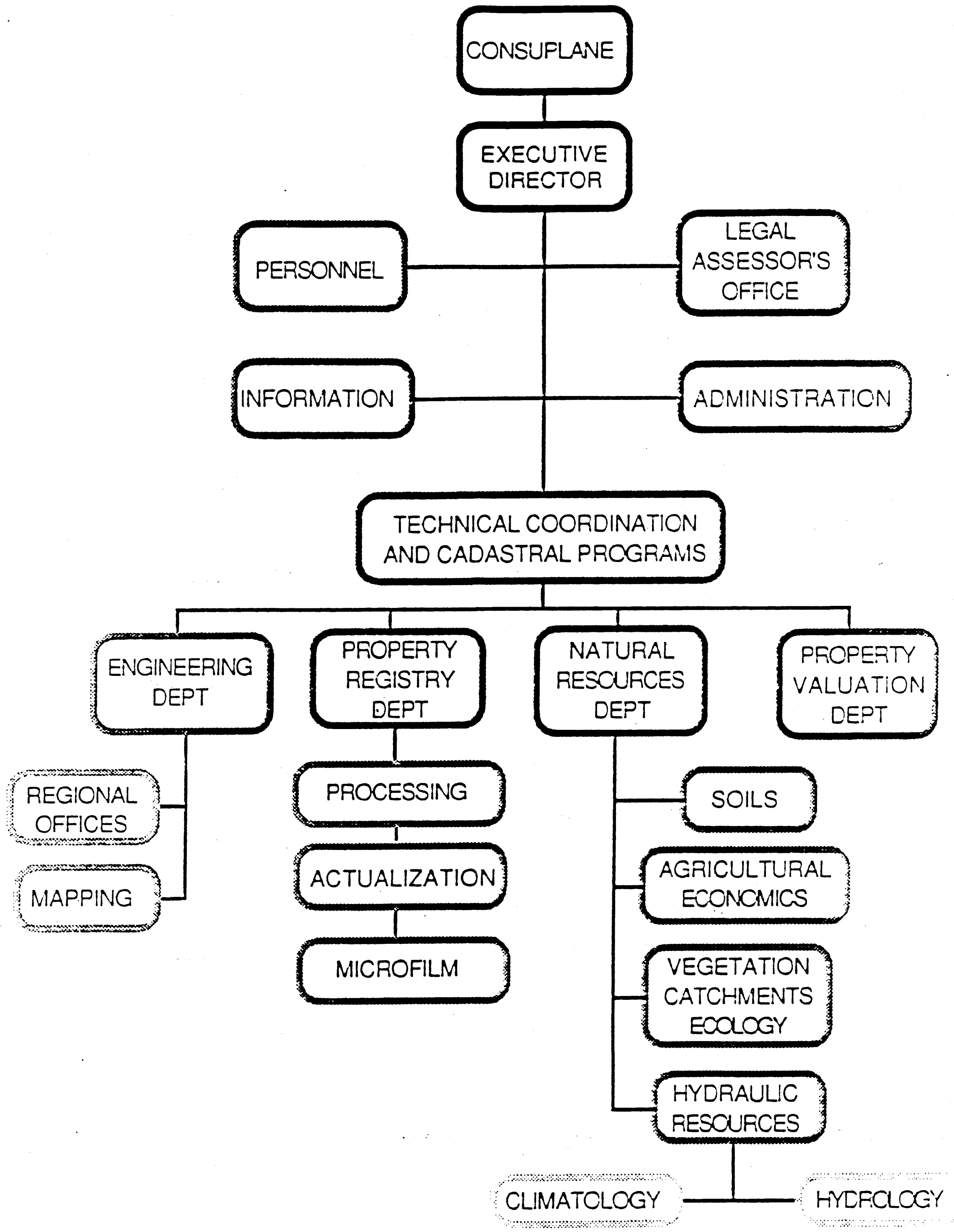


FIGURE 4.3

Institutional Structure of DEC

work within INA. The position of these divisions within the general structure of INA is shown in Figure 4.2.

Although INA has its own field surveying capability, all of the delineation and mapping work on the project (except for La Paz) has been contracted to DEC, the national cadastral office. The origins of DEC can be traced to the cadastral demonstration project (Proyecto Catastro Demostrativo) which began in 1972 in the departments of Choluteca and Valle. In 1975, this project was extended to other departments and became known as the Programa de Catastro Nacional (PCN). The aim of this program was to create a "general inventory of the immovable assets of the country for juridical, fiscal, economical, social and administrative purposes" (DEC 1983, p. 9). DEC was created in 1980 (Decree no. 933) to consolidate the various cadastral operations in Honduras with a view to developing a multipurpose cadastre for the whole country.

DEC has modernized its mapping and information-processing equipment to the extent that it is regarded by some as possessing the most technically advanced facilities in Latin America (USAID 1982, p. 24). The institutional structure of DEC is shown in Figure 4.3.

4.6 Components of Honduran Cadastre-Based LIS

4.6.1 Input

Spatial Land Tenure Data. Honduras makes use of a general boundaries approach similar to that used in England but with additional flexibility for situations where boundaries are not physically defined by features (such as fences or trees) that are visible on aerial photography. A general boundary consists of a physical feature such as a fence, ditch, hedge, or row of trees where the feature itself is recognized as the legal boundary. Most rural landholders in Honduras fence their properties by planting trees along the boundary line and attaching wire strands to the growing trees. These trees not only provide good durable fence posts but are also clearly visible on aerial photography. This means that it is possible to utilize aerial photographs to define and record the spatial dimensions of property boundaries.

Wherever possible a general boundaries approach is used, but in situations where boundaries are uncertain, or where there are no physical features on the ground, an approximate position is accepted (and shown as such on the cadastral map). While such an approximation would be taboo in many countries, there does not appear to be any justification in Honduras for the expense involved in precisely defining a boundary which in reality is imprecise. No monuments are placed in the ground, but the corner fence posts are regarded as corner markers. These posts are certainly more permanent and easier to relocate than a metal peg in the ground and can, therefore, be regarded as corner monuments.

The base materials--aerial photos, orthophotos, maps, and so forth--required for the delineation work are acquired by the DEC Engineering Department (central office) and transmitted to their regional offices, which in turn distribute the materials to the field teams. The average number of DEC field personnel in each of the four task forces is: for administrative boundary

delineation, 11 persons; for quality control on administrative boundary delineation, 2 persons; for property boundary delineation, 75 persons; and for quality control on property boundary delineation, 10 persons.

A promotional campaign is supposed to begin in the titling area at least three months prior to the arrival of the delineation teams. Efforts in this regard appear to have declined significantly since the start of the project and currently the promotion is limited to a few radio "spots." Further promotion is carried out after delineation and immediately prior to the collection of textual land-tenure data by the INA field teams (see following subsection).

The delineation work comprises two distinct parts: (1) the delineation of administrative boundaries, including the boundaries of national and ejidal lands, and (2) the property boundary delineation. The administrative boundary teams are required to delineate the boundaries of departments, municipalities, **sitios** (local tenure units or estates), urban areas, and private land. This work is necessary to define the bounds of the project, which is restricted to rural parcels on national and ejidal lands. Topographic maps, at a scale of 1:50,000, are used extensively for the initial planning of the fieldwork, for navigational purposes, and to determine the general location of the boundaries. Further information pertaining to the location of administrative boundaries is acquired from the national archives, INA archives, and municipal offices. Many department and municipal boundaries are defined by monuments (**mojones**) which were placed in the last century. Wherever possible, these points are relocated and marked on aerial photos with the help of a pocket stereoscope. If no monument was placed or the original marker was destroyed, the position is determined by considering all documentary and other evidence relating to the boundary corner. The administrative boundaries are subsequently transferred from the aerial photos onto 1:10,000 orthophotos which are sent back to the DEC central office for digitization and inclusion in the final cadastral map.

The property-boundary delineation generally starts three months after the commencement of the administrative boundary work. A parcel-delineation group consists of a delineator, an assistant, and a supervisor who is responsible for at least four groups. The delineater and his assistant perambulate the boundaries of each holding with the landholder and identify, on 1:40,000 aerial photos, the property corners as pointed out by the landholder. Photo-identification is done stereoscopically, and the corner points are marked by means of a pinhole on one of the photos that constitute the stereopair. When the corner cannot be located on the photograph, measurements are taken to nearby photo-identifiable features (**accidentes**) so that the position can be "scaled" onto the photo. These features may be trees or buildings or even places where there is a sharp change of elevation.

While in the field, the delineator also collects other spatial data which is collated on a cadastral card (**ficha catastral**). This includes data on the jurisdictional location of the parcel, the landholder's estimate of the parcel area, and data relating to land use. The landholder also signs a declaration stating that he/she personally pointed out the boundaries that were delineated. An additional certificate of agreement of boundaries (**acta de conformidad de linderos**) is signed by landholders to document their mutual agreement to the delineated parcel boundaries.

The delineated data are later transferred from the aerial photos onto the 1:10,000 orthophotos which are kept at the field group's local base camp. Once the delineators have completed their work, the delineated orthophotos are passed on to the quality-control groups for verification. The quality controllers direct their efforts toward the most problematical areas, which may be areas that have changed significantly since the date (1976-77) of the aerial photography or parcels with unclear boundaries. This usually involves a resurvey of between 20 and 40 percent of the parcels on each orthophoto. When the quality-control groups are satisfied with the parcel delineation, the orthophotos, **fichas**, and aerial photos are sent back to the DEC Engineering Department in Tegucigalpa, where the final cadastral map is compiled.

Textual Land Tenure Data. The DEC delineation teams are also responsible for the collection of a substantial amount of nonspatial or textual land tenure data, such as the identification of the holder and the basis for his/her claim. Claimants are categorized into one of the following classes of beneficiaries: (1) individual, (2) **comunero** (two or more joint owners or possessors), (3) society (legally constituted), (4) campesino group (authorized by INA), (5) original benefactor (holder of INA provisional title), or (6) legitimate heir (with documentary evidence) (DEC/INA 1985). All of these data are recorded on the cadastral card or **ficha**.

Once INA receives the cadastral maps and lists of holders and parcel areas from DEC, INA field teams are sent out to collect additional data on the title applicants and their holdings. The 31-person field unit is composed of the following members: 6 promoters, 6 agronomists, 6 legal assistants, 2 supervisors, 3 quality controllers, and 8 drivers.

The cadastral maps and area measurements are used to eliminate those parcels that are below the legal titling limit and therefore not eligible for title. Each individual field-team consists of a promoter, an agronomist, a legal assistant, and a driver. The promoter advises and assists applicants with the claiming procedures and collects socioeconomic data on the nuclear family members (sex, age, education, marital status, occupation, annual income) as well as detailing the types of crops grown, consumed, and sold. All of these data are recorded on a socioeconomic data card (**incuesta socioeconómico**). The promoter also negotiates the terms of payment for the land being transferred.

The legal assistant procures the signatures of neighbors who testify to the validity of the applicant's claim and the period of time which the applicant and his predecessor have occupied the land. The agronomist is responsible for the collection of data relating to the physical characteristics of the parcel--slope, soil type, soil texture and depth, permeability, erosion--and access to the parcel. These data are collated on a technical valuation report card (**informe técnico de valorización**). The data assembled by the promoter and agronomist are used to determine a per-hectare land value on which the selling price of individual parcels is based.

4.6.2 Conversion Mechanism

Cadastral Mapping. The concept of a cadastral map is new to Honduras but was recognized as essential for the development of an efficient CLIS for

supporting conveyancing, land taxation, and various other functions at the parcel level. Prior to the PTT, the majority of rural parcels were described by metes and bounds with no consideration given to a comprehensive record of the distribution of parcels in a jurisdiction. Cadastral mapping is now a major part of the surveying operation under the PTT. The process is described below.

The central DEC Engineering Department receives the following data from its regional offices: (1) aerial photos, with pinholes marking property corners; (2) annotated orthophotos showing delineated property boundaries; (3) annotated orthophotos showing delineated administrative boundaries; (4) cadastral cards (**fichas**); (5) description of monuments demarcating administrative boundaries; (6) certificates of agreement to administrative boundaries (**actas de conformidad de linderos**); and (7) list of owners organized by parcel number indicating the department, municipality, **sitio**, and category of land (national or private). This department transfers the delineated data from the two sets of orthophotos (points 2 and 3 above) to a new, clean orthophoto. The new orthophoto and cadastral card, together with details on land use for each parcel, are then forwarded to the DEC Computer Center for digitization.

The Computer Center manually digitizes the data delineated on the orthophoto and inserts all symbology and text required for the final cadastral map. This is done via two intergraph workstations connected to a VAX 11/730 and also through two graphic editing stations (digitizer and graphics terminal) connected to a PDP 11/34 computer. Data captured by the latter may be converted into a format that is compatible with the VAX. The alphanumeric data associated with the parcels are entered separately through two standard terminals and comprise the names of owners and the areas and locations (administrative district) of parcels.

The final cadastral map is plotted on an HP 7585B plotter in DEC and sent across to the INA Technical Assistance Section for a final quality-control check. This entails visiting the field and physically checking approximately 3 percent of the parcels on each orthophoto. DEC also supplies INA with a list of all parcels (arranged by parcel number) showing the approximate centroid coordinates of individual parcels, parcel location, area, details on owners, and type of document supporting the claim (private, public, no document). A list of the areas and type of land use for all delineated parcels is also sent to INA.

<u>Parcel Mapping</u>. Once the cadastral map has been digitized and stored, the generation of individual parcel maps becomes a relatively simple task. The digital data for each individual parcel are isolated and stored in separate data files. A hard copy of the parcel map is produced very simply by recalling the appropriate file and plotting the map on a Tektronix 4631 Hard Copy Unit. This plotter can accommodate one screenful of data but is limited to a plot size approximately equivalent to a standard letter-size (A4) sheet of paper. No coordinates, distances, or bearings relating to parcel boundaries are currently included on the parcel map, but project personnel did indicate that this might be done in the future.

Parcel maps for all delineated parcels are sent to INA where the names of adjoiners are added from the cadastral cards. The parcel map and card,

together with all other data collected on the property parcel, are collated in a dossier known as an **expediente**.

Title Registration. The application for title and supporting documentation--agronomist's report, socioeconomic survey, copy of the cadastral card, promissory note--are sent by the INA regional office to the Agrarian Registry Department at the INA central office in Tegucigalpa. The field data are checked in this office and then passed on to the INA Lands Department, which consists of an agronomy and valuation section and a titling section. The former section checks the field data, verifies the per-hectare value determined in the field, and prepares the final documentation relating to financial arrangements. Records of all repayments are kept on file in the INA central computer system and receipts are issued by this office. The Titling Section verifies the results of the legal investigation and prepares a title, which is sent to the INA director for final endorsement.

The title is subsequently passed on to the Agrarian Registry where it is microfilmed and stored for future reference. A copy of the final title is added to the supporting documentation in the **expediente** and sent to the archives of INA's Legal Assistance Section for storage.

The title and financial documents are forwarded to the INA regional office for the landholder's final acceptance of the repayment plan and the subsequent issuance of title. Details of the accepted repayment plan are sent to the Office of Agrarian Debt Control, which in turn transmits the information to participating banks. The regional office also sends a copy of the title to the national Property Registry (**Registro de la Propiedad**).

The Property Registry operates as a conventional deeds registry by providing a public storage house for all registered documents affecting land tenure within a particular department. Three registers are kept for this purpose: **registros de la propiedad raíz** (real property), **hipotecas** (mortgages), and **sentencias** (judgments). The **registro de la propiedad raíz** contains all documents that "recognize, transfer, modify or cancel" land rights relating to possession, occupation, use, inheritance, rent, or servitudes (Mass 1980, p. 13). The **registro de hipotecas** provides information on formal mortgages, and the **registro de sentencias** records changes in the civil status of individuals through such actions as marriage, death, or divorce.

The linking of the property deed or title to a comprehensive cadastral map will significantly improve the quality of information related to the location and extent of land rights. In the past a metes-and-bounds description has been used to define a parcel spatially on the title. An example of this type of description in Honduras is the following.

> A rural property consisting of a parcel of land called Baja Mar, situated in the municipal jurisdiction of Puerto Rico, covering an area of 510,006 hectares, 8 areas and 40 centiareas, limited: to the north by the Caribbean Sea; to the south by Chambers Canal; to the east by Juan R. Lopez' lot; and to the west by the Caribbean Sea (Property Registry, San Pedro Sula).

In the absence of a reliable and comprehensive cadastral map, the use of adjoiners' names for identifying parcels is probably the most rational approach. However, in a situation where reliable cadastral or parcel maps exist, the most rational approach is to use those records to define the spatial dimensions of tenure and to link them with the registry system through the use of an appropriate parcel identifier or by recording spatial and textual tenure information onto one document, such as the Torrens certificate of title.

To facilitate the cross-referencing of spatial and textual information, it is necessary to maintain a parcel index at the Property Registry to permit the efficient retrieval of information relating to (1) the current tenure status (identification of right-holders and the nature of their rights) of a parcel, (2) the location of all registered documents affecting the tenure status of a particular parcel, and (3) the identification of the record defining the spatial dimensions of all rights.

At present, the registration system in Honduras makes use of a grantee/grantor index, which is arranged alphabetically and connects the owner's name with the volume and folio containing the relevant deed. The index is arranged as follows:

INDEX

BUYER'S NAME	SELLER'S NAME	OBJECT	NO/VOL
Acosta Mina, Rosa	Aguirre, Mercedes	Transaction	47/797

Source: Property Registry, San Pedro Sula.

This name index is useful for locating documents when the owner's name is the only information available. However, name and parcel indices, together with a unique parcel identifier, can provide a more effective linkage between the spatial and textual elements of a CLIS, as illustrated in Figure 4.4.

Although efforts are being made in Honduras to extend the links between the registration subsystem and the cadastral mapping subsystem, it is only those deeds that have been processed through the PTT that currently contain a reference to the spatial information base.

4.6.3 Output

Cadastral Map. The final cadastral map (see Appendix A) is stored digitally in a number of separate information "layers" or "coverages" which may be recalled separately or merged together to form the complete cadastral map. The map is composed of the following layers: (1) property boundaries and related symbology; (2) administrative boundaries; (3) parcel identifiers (numbers); (4) **sitio** identifiers and areas; (5) urban areas; (6) rivers, paths, roads, utility lines; (7) map frame, grid, and grid values (UTM); (8) text; (9) footnotes.

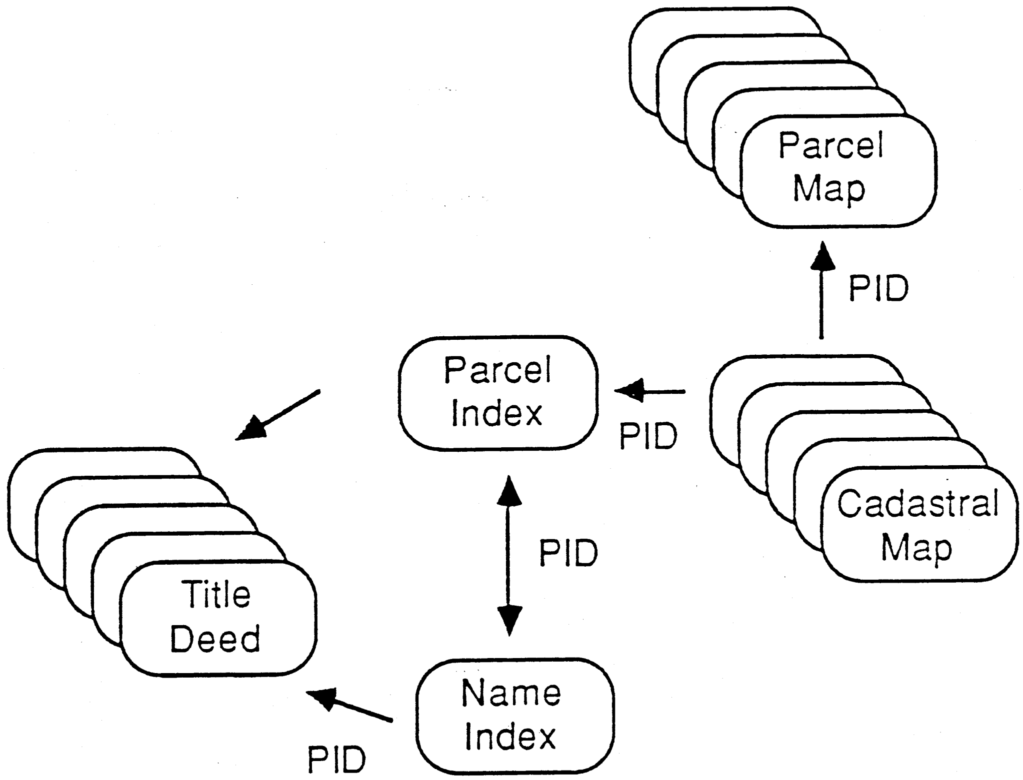


FIGURE 4.4

PID Linkages to Spatial and Textual Information

A hard copy of the cadastral map, showing the above information, is generally plotted at 1:10,000, but the digital database allows the regeneration of this information at almost any scale.

The primary function of the cadastral map is perceived to be the provision of a graphic inventory (DEC 1987a, p. 72) which will act as a spatial framework for the collection, indexing, and dissemination of land tenure, fiscal, economic, social, administrative, and various other information.

The legal weight of the cadastral map is not clearly defined in any statute but is treated simply as one element in a package of cadastral documents which consists of aerial photos, orthophotos, survey plans, parcel and owner indices, cadastral certificates and cards (Decree 933, Art. 36). Although titles issued through the PTT include a reference to the relevant cadastral

map (for example, HK-23), the adjoiners' names and parcel areas appear to be given a higher priority than the precise location, shape, and dimensions (as portrayed on the cadastral map) of individual parcels. This implies that the cadastral map is treated more as a general parcel index than as a portrayal of valuable boundary evidence. If the conclusion that the cadastral map is only an index map is, in fact, true, then the use of a less precise and less accurate (as well as less expensive) mapping technique, such as the use of unrectified or semi-rectified aerial photos, would appear to be a more rational approach.

The alphanumeric cadastral map number (for example, CN-41) is one of the four elements that form the unique parcel identifier. This identifier is comprised of eleven characters arranged in the following order.

DEPARTMENT	MUNICIPALITY	MAP	PARCEL
00	00	AA00	000

Parcel Map. Parcel maps are plotted at scales varying from 1:4,000 to 1:250,000 depending on the size of the parcel. These maps form part of the cadastral file (**expediente**) maintained by INA but do not play a role in describing the parcel for legal or registration purposes.

The primary information displayed on the maps is the number, shape, dimensions, area, adjoiners, and jurisdictional location of the parcel. The data relating to shape and dimensions are portrayed in graphic form only, that is, no numeric data are given relating to sides, angles, or azimuths. The usefulness of these maps is questionable since most of the information portrayed is included in other parts of the cadastral file. The only additional information that it furnishes is a more accurate graphic illustration of the shape and dimensions of the individual parcel. Given the absence of any numerical data (other than area) on the parcel map, the less accurate parcel sketch (**croquis**) on the cadastral card (**ficha**) or the smaller-scale cadastral map should meet most demands for spatial information at the parcel level.

Title. Two distinct types of title are issued by INA through the PTT: full title (**dominio pleno**), and family title (**unidad agrícola familiar**, UAF). Full title is limited to those farmers with holdings between 17 and 50 hectares in size, and UAF title, to farmers with holdings between 5 and 17 hectares (or between 0.1 and 17 hectares--theoretically no lower limit--for coffee parcels) (Decree 78, Art. 3). Both of these titles, properly registered, are evidence of a conveyance of land (excluding improvements) from the state (INA) to the titleholder.

The 1975 Agrarian Reform Law (Decree 170) authorized the granting of provisional titles to all beneficiaries until such time as they had paid INA for the land (Arts. 93-95). These titles could, however, be used to secure loans from state credit institutions (Art. 43). This principle of issuing provisional title was subsequently changed by the titling project agreement (Decree 89 of 1982, Sec. B.3), which authorized the granting of full and unencumbered

title in return for full payment for the land or a promissory note (**pagare**) formally documenting the payment conditions. The implications of this change in policy are described in the midterm evaluation study (LTC 1986, p. 14):

> [T]he fundamental difference between the Agrarian Reform Law and the Titling Project decree is in the type of guarantee that is extended for payment of the lands that the beneficiary receives. In effect, under the Agrarian Reform Law, a provisional title is extended while the debt exists to give the beneficiary an incentive to pay. . . . Within the Titling Project, the incentive to pay is provided by a promissory note. The interest of the state in the land is protected with this mechanism. In addition, in the eventuality that the beneficiary decides to sell his rights to a third party, which he can do, he must request permission from INA. INA will not approve the transfer unless the beneficiary has paid any outstanding debt owed to INA.

Titles issued through the PTT may be mortgaged to private and public banking or financial institutions (Decree 89, Sec. 6.3), but, at present, private sector involvement is limited to one bank. The subdivision of parcels held under UAF is prohibited under the Agrarian Reform Law (Art. 100) and transactions involving these parcels must be authorized by INA. These restrictions do not apply to parcels larger than 17 hectares, or 10 hectares on "irrigated land."

All titleholders are required to fulfill certain obligations which include: (1) to exploit the land directly, efficiently and in accordance with the Agrarian Reform Law (Art. 41), and (2) to manage and conserve the soil, streams and other renewable resources (Art. 43).

The titles issued through the PTT now reflect the parcel identifier and cadastral map number. However, the legal requirement that the title itself contain all information necessary to define the land tenure status of a parcel, without relying on separate supporting documents (Greenwood 1982, p. 17), effectively negates the advantages to be gained from linking registry information to that furnished by the cadastral maps. With a reliable record of the location and extent of all parcels linked to the registry information, it should no longer be necessary to include the lengthy metes and bounds descriptions which are currently used on titles.

4.6.4 Feedback

At the time of this study, there was no feedback mechanism in operation in either the delineated PTT areas or the areas which had been delineated in previous cadastral efforts. It is imperative that this component be implemented if the Honduran CLIS is to remain current and effective. The potential waste of previous cadastral efforts was clearly spelled out in the midterm evaluation report (LTC 1986, p. 46):

> Ten years of work of cadastre surveys in Honduras has generated an enormous quantity of potentially very valuable material and

information. Significant work was done in the pilot cadastral project, and other cadastral work done by INA. . . . If this information is not processed and updated soon, in a very short time it will be out of date and with very little utility.

One of the factors that has led to this state of affairs is the requirement that a whole department be "cadastreed" (**catastrado**) before the new property registry system (**folio real**) can be implemented, and only once this occurs will new data be fed back into the CLIS. Presumably, the reason for this department-level approach is to make the cadastre coincide with the department-wide jurisdictions of the property registries. The practical implications of this policy, particularly with regard to feedback, become clear if one considers that one of the primary aims of the project was to implement an efficient titling system and that after nearly five years of activity, this has not been achieved in a single municipality in Honduras.

Since the time of the fieldwork for this study, efforts have been made to rectify the situation, and it is hoped that the municipality of Villa de San Antonio in Comayagua will have a functioning **folio real** in the near future. In the context of the feedback component, the introduction of a **folio real** will result in the activation of various mechanisms to capture new land tenure data and update the CLIS. New data will be composed of (1) spatial data emanating from subdivisions, consolidations, and boundary relocations, and (2) textual data arising from the transfer of existing tenure rights and the creation of new ones.

The Cadastral Law (Decree 933) stipulates that all municipalities, the metropolitan council of the central district, the central tax department and all property registries must submit, within thirty days of receipt, any data relating to new parcel mutations or property transactions (Art. 46). In addition, anyone acquiring a parcel of land that has not previously been registered must supply DEC with documents supporting this acquisition (Art. 47). The requirement that no subdivisions or consolidations be carried out without the prior authorization of DEC (Art. 48) provides another feedback mechanism to keep the CLIS current. INA's consent is also required for most subdivisions and property transfers, but the extent to which this has been solicited is not known. To date, DEC has not received any new data through the above-mentioned channels.

4.7 Evaluation of Honduran CLIS

4.7.1 Efficiency

The concurrency of various delineation and mapping activities, the shortage of statistical data at this level of resolution, and the unpredictable role of politics and administrative factors make it difficult to arrive at very precise and representative efficiency rates in Honduras.

The proposed efficiency level for the five-year project is given in Table 4.3.

TABLE 4.3

Proposed Delineation and Mapping Efficiency[a,b]

Area:	804,245 hectares
No. of parcels:	71,618
Field teams:	65
Time:	60.4 months
Field team months:	3,926
Parcels per field-team month:	18
Area per field-team month:	205 hectares

a. Source: U.S. Agency for International Development, "Honduras Small Farmer Titling," Project Paper (Washington, DC: USAID, 1982), p. 18.

b. These estimates relate to the project area as it was defined in the original project paper, including St. Bárbara, Copán, Cortés, Comayagua, La Paz, El Paraiso, and Yoro.

The original work plan (DEC 1982, p. 2) estimated that each property-delineation team would be able to complete an area of 36 hectares per team-month on land that had already been delineated in some manner, and 14.5 hectares per team-month on undelineated land. The more general estimates shown in Table 4.3 are misleading because they include a certain area of private land, that is, land not eligible for delineation and titling under the PTT. However, these figures are important because they do give some indication of the data that were used to compute the a priori logistics for the project.

The estimate for the number of parcels in the project area is based to a large extent on the agricultural census of 1974 and is a figure which many believe to be inconsistent with the de facto situation. To obtain a more realistic picture of what efficiency levels the PTT has actually been achieving, it is necessary to examine the statistics for the four departments that have already been delineated and mapped (see Table 4.4).

TABLE 4.4

Delineation and Mapping Statistics[a] Achieved

DEPARTMENT	AREA (ha)	NO. PARCELS	PARCEL SIZE (ha)	NO. MAPS	TIME (months)	TEAM-MONTHS[b]
St. Bárbara	181,500	21,373	8.5	134	13	676
Comayagua	301,960	32,566	9.3	207	11 (19)[c]	572 (988)[c]
Copán	157,540	23,311	6.8	135	5	260
Cortés	211,780	16,778	12.6	176	11	572
Total	852,780	94,028	9.1[b]	652	40 (48)[c]	2,080 (2,496)[c]

Source: Dirección Ejecutiva del Catastro (DEC).

a. The average efficiency rates shown in Table 4.5 are derived from these figures.

b. Based on an average of 52 field teams.

c. Including 8-month down period for installation of new computer.

The statistics shown in Tables 4.4 and 4.5 reflect the time taken for delineation in the field as well as the time involved in digitizing and producing the final cadastral maps. Data that deal with delineation and mapping as separate activities were not available at the department level, but these could be deduced from the time allocated to each activity in the work plan. An examination of the work plans for each department shows that field activities (delineation of property and administrative boundaries, quality control) generally take up 70 percent of the total time required for delineation and mapping.

The figures for titling are somewhat contradictory, but an attempt has been made to determine and present the most reliable statistics. The records of the computer center at INA are the source of the statistics shown in Table 4.6.

Statistics from a summary table of INA titling activities (<u>ejecución física</u>) show that 4,032 titles were issued in 1983 and a total of 21,037 were issued over the four-year period, 1983 to 1986. The annual and total titling

TABLE 4.5

Delineation and Mapping Efficiency

DEPARTMENT	NO. PARCELS/ TEAM-MONTH	AREA/ TEAM-MONTH (ha)	NO. MAPS/ TEAM-MONTH
St. Bárbara	32	268	0.2
Comayagua	57 (33) [a]	528 (306) [a]	0.4 (0.2) [a]
Copán	90	606	0.5
Cortés	29	370	0.3
Average	52 (46)	443 (388)	0.4 (0.3)

a. Including 8-month down period for installation of new computer.

figures obtained from various sources differ considerably from the summary table information. This discrepancy is almost certainly due to the delay between the processing and the actual issuing of titles, which in turn reflects the time lapse between their leaving the INA Computer Center and their reception by the beneficiaries.

In order to compute meaningful efficiency levels for titling (excluding delineation and mapping activities) in Honduras, it is necessary to resolve the procedure into three distinct stages, namely, the collection of field data, the processing of title applications, and the issuing of title.

The first stage may be assessed by examining the number of agronomists' reports submitted to the INA central office, since each parcel must have a corresponding report. These statistics are shown in Table 4.7 together with efficiencies per team-month.

Information for the second stage was obtained directly from computerized records at the INA Computer Center, where personnel enter title information in their records immediately prior to dispatching the titles to the INA field office. These data and related efficiencies are shown in Table 4.8.

The third stage, the issuing of titles, has also been affected by the institutional and political problems that led to an eight-month inactive period in title processing (see Table 4.5). The data shown in Table 4.9 were extracted from an INA summary of the physical execution of the PTT from 1983 to 1986.

TABLE 4.6

Titles Processed by INA
(July 1984 through December 1986)

YEAR	ST. BARBARA Area (ha)	ST. BARBARA No. Titles	COMAYAGUA Area (ha)	COMAYAGUA No. Titles	TOTAL Area (ha)	TOTAL No. Titles
1984	38,913	11,714	0	0	38,913	11,714
1985	22,505	3,795	-[b]	1,739	-	5,534
1986	76	15	-[b]	2,325[a]	-	2,340
Total	61,494	15,524	15,179	4,064	76,673	19,588

Source: INA Computer Center.

a. This includes 1,891 titles which had been processed but had not yet been issued to beneficiaries at the time of study.

b. No area data are available.

TABLE 4.7

Data-Collection Efficiency

YEAR	NO. REPORTS	TEAM-MONTHS[a]	NO. REPORTS/ TEAM-MONTH
1983	4,790	72	67
1984	10,689	72	148
1985	3,651	72	51
1986	5,100	72	71
Total	24,230	288	
Average			84

Source: INA.

a. Six teams in field unit.

TABLE 4.8

Title-Processing Efficiency

YEAR	NO. TITLES[a]	AREA[a] (ha)	TEAM-MONTHS	NO. TITLES/ TEAM-MONTH	AREA/ TEAM-MONTH
1984	11,714	62,615	72	163	870
1985	5,534	28,680	72	77	398
1986[b]	2,340	9,089	72	33	126
Total	19,588	100,384	216		
Average	6,529	33,461	72	91	465

a. Source: INA Computer Center

b. No titles processed between 30 April and 25 November 1986.

TABLE 4.9

Title-Issuance Efficiency

YEAR	NO. TITLES	NO. PARCELS	AREA (ha)	TITLES/ TEAM-MONTH[a]	PARCELS/ TEAM-MONTH	AREA/ TEAM-MONTH
1983	4,052	4,052	20,146	56	56	280
1984	10,689	13,254	58,268	148	184	809
1985	2,928	3,655	17,112	41	51	238
1986	3,368	5,100	22,878	47	71	318
Total	21,037	26,061	118,404			
Average	5,260	6,515	29,600	73	91	411

Source: Instituto Nacional Agrario (INA).

a. 72 team-months per year.

An examination of the efficiencies of all three stages (Tables 4.7, 4.8, and 4.9) shows that the system can deliver approximately 500 titles per month. This is well short (50 percent) of the initial target of 50 titles per day (1,050 titles per month) which was expressed in the project agreement (Decree 89, Annex 1, Sec. A.2). The primary reason for this shortfall appears to be the production time lost because of institutional and political problems. This, coupled with a decrease in promotional efforts, has tended to reduce titling efficiency to its current level.

4.7.2 Complexity

A criticism that is often leveled at titling and cadastral efforts in developing countries is that the resulting systems are overly complex and therefore not clearly understandable to local implementers and administrators. The computerized solutions so popular in developed countries are an example of the application of a technology that in many cases proves to be ineffective because of its complexity.

Parcel delineation in Honduras is simplified by the acceptance of natural features for boundaries. This general boundaries approach simplifies boundary delineation in the following ways:

1) no monumentation or demarcation is required as the majority of property boundaries are composed of physical features;

2) conventional field surveys, utilizing a tape, compass, theodolite, and the like, are necessary only in isolated areas where boundaries cannot be identified on an aerial photo due to cloud coverage, dense vegetation, or sparsity of physical ground features;

3) the aerial photos provide a general spatial record of the location of property boundaries, making it unnecessary to compute large sets of numerical data and merge them to provide a consistent spatial record of an area.

The fieldwork required for the collection of boundary data is for the most part a matter of mapping existing possession lines. Research into the gradual fragmentation of the original parent parcel and a complicated reconstruction of the legal boundary position based on existing evidence are <u>not</u> part of the delineation work in the Honduran system.

Delineators are required to pass a two-month training course which includes such topics as map reading, navigation, and photo interpretation, with an emphasis on the practical dimensions of these activities. Highly qualified land surveyors/engineers play a role at the supervisory, consulting, and training levels.

The process of generating cadastral maps is substantially more complex than field delineation. Honduras makes use of a modern high-technology approach which makes it possible to merge various digital graphic products. In order to support this advanced approach, the educational and training requirements are correspondingly higher. DEC employs university-trained programmers, data processors, and an electrical engineer to run its computer center. In

many cases these employees have received additional training from private software and hardware companies.

Further simplification measures include a reduction in the registration requirement and the introduction of standard registration forms (USAID 1982, p. 22). In addition, the formal tenure situation is not generally complicated by the need to register secondary tenures such as easements or right-of-way servitudes for purposes such as access.

4.7.3 Maintainability

Maintenance depends to a large extent on the effective operation of the feedback component. At present, this aspect is the "Achilles heel" of the Honduran CLIS since no new data are entering the system and the existing information base is becoming out-of-date. This weakness is due to three main factors: (1) the priority given to extending the system to cover the whole country within as short a time as possible; (2) the original intention of implementing only the full CLIS (including feedback component) after delineation and titling had been extended to the whole department; and (3) financial constraints.

The legal requirement, in chapter nine of the Cadastre Law (Decree 933), that DEC consent be obtained prior to any parcel subdivision or consolidation is, on its own, insufficient to insure that the system is maintained. Such requirements must be accompanied by incentives and measures that make it attractive and convenient for landholders to operate within the system. In some cases, access to credit and the additional tenure security provided by a title are reason enough for the owner to report tenure and parcel changes and keep the legal record straight.

The fact that there is generally only one property registry per department (there are a total of twenty-five registries for the seventeen departments) means that it is extremely difficult, in terms of both time and money, for many rural Hondurans living away from the department capital to formalize transactions through the registry. This situation may get worse as there are plans to reduce the number of registries to seven because of the shortage of qualified personnel to run these offices. If this reduction does occur, it will become extremely important to set up good communication links with municipalities and other agencies whose functions require current land tenure information and which are in a position to collect new tenure data.

The Cadastre Law (Art. 46) requires municipalities to submit new tenure data to DEC, implying that they will be the recipients of these data. These data will, presumably, be collected as part of a municipality's tax assessment and collection function. For the seller of a parcel of land, a land tax will generally provide the incentive to report a transfer, but in Honduras the taxation system has not traditionally had this effect. The lack of a reliable record of taxable parcels and owners (as well as political obstacles) has left Honduras with no uniform or comprehensive land taxation system. Although some municipalities have obtained copies of the cadastral maps produced by DEC, it is unclear how they will gain access to new tenure data or what taxation policies will be enforced. This is a difficult issue to address as taxation tends to act as a disincentive to individual holders within the context of a land

titling project. However, if a CLIS is to rely on the land taxation system to maintain its information base, it is extremely important to clarify the communication channels and policies between the two systems.

The PTT does not address any maintenance issues (besides the collection of revenue for land sales) beyond the initial delineation, mapping, and titling of parcels. For a project which aims to establish a land-titling system, this appears to be a major omission, particularly when viewed from an information-systems perspective. Although involving many of the same institutions associated with the development of the land tenure information base under the PTT, the functions, institutional relationships, and problems in the maintenance phase are usually quite different. There is much more reliance on the landholders' coming forward with data, thereby placing a higher priority on incentives and networks that can effectively channel new data back to the CLIS. These incentives and networks form part of the feedback component which, if the system is to provide the basis for addressing long-term tenure security and agricultural production, must be given the same priority as the other three components.

A proposal has recently been put forward which attempts to address some of the above-mentioned problems (Nuñez 1987). This proposal describes the structure of a "cadastral administration section" which functions as a unit within the DEC regional offices and has the responsibility of maintaining records (information) relating to land tenure and valuation. Detailed procedures are laid out for the sharing of information between this unit, the municipality, and the DEC regional office. The primary functions of the Cadastral Administration Section are listed as: (1) the resolution of discrepancies between the documented record and the de facto situation, and (2) the updating of the cadastral and valuation information bases. It was proposed that these sections be established in the same locality as the property registries, but it is not clear whether the responsibilities of this unit extend to the whole department, to a single municipality, or to some other administrative area.

While the above-mentioned proposal makes a valuable contribution to the maintenance of the Honduran CLIS, it also assumes that titleholders will come forward with new cadastral and fiscal data. There is always a danger that the individuals receiving titles through the project will subsequently find it more convenient, cheaper, and less threatening to return to an informal tenure system, particularly if they are not realizing the benefits that were promised in the promotion stage of the project.

In recent months, a "demonstration project" has been initiated in the municipality of Villa de San Antonio in Comayagua in order to implement the **folio real**. Since the original tenure data for this area were collected some time ago (1984/85), one of the initial phases of this project was to update the information base of the CLIS for the municipality. This project is an encouraging sign since it indicates a move from a proposed department-wide system to one that centers on the municipality. Furthermore, it shows a commitment to using the information emanating from the PTT and an activation of the link between the legal system and the CLIS.

The physical maintenance of computers and other hardware does not present as formidable a problem as it does in many other developing countries. This

is primarily due to the availability of an electrical engineer in DEC and the efficient service provided by vendors in Mexico, Panama, and the United States.

4.7.4 Cost

The activities of the PTT can be divided into three categories: (1) promotion and identification, (2) delineation and mapping, and (3) titling and registry. At the most general level, the unit costs shown in Table 4.10 can be computed.

In order to examine actual costs, it is necessary to examine the costs and achievements of the project since its inception. These costs are divided between those relating to, first, delineation and mapping and, second, titling. The actual costs for delineation and mapping for three departments are shown in Table 4.11.

The use of general boundaries, as opposed to fixed boundaries, reduces the delineation costs by eliminating the need to place monuments and measure their position relative to some reference framework. It also makes it viable

TABLE 4.10

Projected Costs for Four Departments (St. Bárbara, Comayagua, Copán, Cortés)

ACTIVITY	COST[a,b] (000)	COST PER HECTARE[c]	COST PER PARCEL[d]
Promotion and identification	$ 2,873.8	$0.9	$ 32.3
Delineation and mapping	10,695.6	3.3[e]	120.0
Titling and registry	3,133.8	1.0	35.2
Total	$16,703.2	$5.2	$187.5

a. Source: USAID 1982, expressed in U.S. dollars.

b. Includes cost of personnel, supplies, maintenance, and operations, 14 percent per annum contingency/inflation.

c. Based on a total area of 3,238,000 hectares which includes private land.

d. Based on an estimated 89,097 parcels to be delineated over the five-year life span of the project (USAID 1982, p. 18).

e. This figure reduces to $3.0/hectare when costs are limited to recurring costs (basic delineation costs, overhead items, supplies, and office work) (USAID 1982, pp. 51-52).

TABLE 4.11

Delineation and Mapping: Actual Costs[a]

DEPARTMENT	AREA[b] (ha)	NO. PARCELS	PARCEL SIZE[c] (ha)	NO. MAPS	COST[d]
St. Bárbara	181,500	21,373	8.5	134	$ 722,690
Comayagua	301,960	32,566	9.3	207	1,107,750
Copán	157,540	23,311	6.8	135	914,450
Cortés	211,780	16,778	12.6	176	938,430
Total	852,780	94,028	(9.1[b])	652	$3,683,320

Source: Dirección Ejecutiva del Catastro (DEC).

a. These figures are used to compute the unit costs shown in Table 4.12.

b. Excluding private land.

c. Average.

d. Expressed in U.S. dollars.

to use photogrammetry rather than relying on costly field surveys. Although not as precise or accurate as traditional field surveying, a photogrammetric approach does provide a useful record (image) of the land situation at the time of exposure and the photographs can be used for various other purposes.

The cost of titling (excluding delineation and mapping) in Honduras is generally more difficult to determine as this work is carried out within INA, making it hard to distinguish actual project costs from those related to the other functions of INA. In particular, demands on personnel and equipment outside the transfer and legalization division are difficult to document. Consequently, the costs shown in Table 4.13 represent those incurred by this division.

The recurring costs and achievements related to titling and registry over the four-year period, 1983 to 1986, are shown in Table 4.13.

The average cost figures shown in Table 4.14 do not compare very favorably with those estimated in the initial project design (USAID 1982). One of the difficulties faced in drawing up a priori costs for a project of this nature is the shortage of information on the number of parcels in the project area and how many of these qualify for titling. A comparison of estimated with actual unit costs is given in Table 4.15.

TABLE 4.12

Delineation and Mapping: Unit Costs[a]

DEPARTMENT	COST PER HECTARE	COST PER PARCEL	COST PER MAP
St. Bárbara	$4.0	$34	$5,390
Comayagua	3.7	34	5,350
Copán	5.8	39	6,770
Cortés	4.4	56	5,330
Average	$4.5	$41	$5,710

a. Expressed in U.S. dollars.

TABLE 4.13

Titling and Registry Costs (1983-86)[a]

	1983	1984	1985	1986	TOTAL
Area (ha)	20,146	58,268	17,112	22,878	118,404
No. of titles:					
Issued	4,052	10,689	2,928	3,368	21,037
Registered	4,052	10,064	2,972	4,050	21,037
No. of parcels	4,052	13,254	3,655	5,100	26,061
Cost (000)[b]	154.2	654.0	570.5	566.1	1,944.8

Source: Instituto Nacional Agrario (INA).

a. These figures, expressed in U.S. dollars, are the basis for the unit costs derived in Table 4.14.

b. Recurring costs--personnel, technical assistance--14 percent per annum contingency/inflation.

TABLE 4.14

Titling and Registry Unit Costs (1983-86)[a]

UNIT COSTS	1983	1984	1985	1986	AVERAGE
Cost per hectare	7.7	11.2	33.3	24.7	19.2
Cost per title issued	38.1	61.2	194.8	168.1	115.6
Cost per titled parcel	38.1	49.3	156.1	111.0	88.6

a. Expressed in U.S. dollars.

TABLE 4.15

Titling and Registry Unit Costs (Estimated versus Actual)[a]

UNIT COSTS	ESTIMATED[b]	ACTUAL[c]	DIFFERENCE
Cost per title issued	43.8	115.6	+71.8
Cost per hectare	3.9[d]	19.2	+15.3
Cost per titled parcel	35.2[e]	88.6	+53.4

a. Expressed in U.S. dollars.

b. Based on estimated 71,168 titles at a total cost of $3,133,800 (USAID 1982).

c. Average for 1983-86 (see Table 4.14).

d. Based on total area (ejidal/national land) of 804,245 hectares.

e. Based on estimated 89,097 parcels.

An important cost consideration in a titling project is the proportion of costs, if any, that is to be retrieved from the beneficiaries. In the PTT, delineation and titling services are free, but title recipients are charged for the land which passes into their name when the title is registered. The money collected from these land sales will be used for extending titling efforts beyond the project area so that ultimately, the whole country will be under the same system.

Assuming an average sale price of $50 per hectare and a 20 percent default rate, it was estimated that $43.2 million would be collected over the 1984-2001 period (USAID 1982, Att. N). This rate of repayment appears to be extremely optimistic in view of the repayment record to date. The situation as of 23 February 1987 for St. Bárbara and Comayagua is summarized in Table 4.16.

TABLE 4.16

Funds Collected from Land Sales
(000 U.S. dollars)

	ST. BARBARA[a]	COMAYAGUA[b]	TOTAL
Amount due[c]	1,739.7	328.0	2,067.7
Amount collected	271.6	46.8	318.4
Amount overdue[d]	1,468.1	281.2	1,749.3
% overdue[e]	84[f]	86	85

Source: INA Computer Center.

a. Including 26 municipalities.

b. Including 19 municipalities.

c. Amount due as at February 1987.

d. Value of payments in arrears.

e. Proportion of due debt in arrears.

f. This is consistent with the findings of the midterm evaluation study, where 83 percent of farmers had failed to make any payments (Stanfield 1985, p. 10).

The fact that only 15 percent ($318,400) of the due debt ($2,067,700) for land sales has been paid is a clear indication that this phase and the policies relating to it are in serious need of investigation. This situation could be indicative of (1) an inability of the title recipients to pay this debt, (2) a statement by the small-farmer sector that they disagree with the government's assertion of property rights in the project area, or (3) a breakdown in the collection system.

Stanfield (1985, p. 14) also points out that although title acquisition through the project is a relatively inexpensive process, future registration of transactions and subdivisions may become so costly and time-consuming that once again the poorer farmers will be forced to operate outside the formal titling system. This issue is addressed under the section on maintainability (Section 4.7.3), for this is essentially a system-maintenance problem.

Unless this problem is addressed and resolved or additional funding is obtained from an outside source, the Government of Honduras (GOH) will be unable to extend its titling efforts and attain the goal of a national cadastre.

4.7.5 Quality

The midterm evaluation study found that in many instances it was necessary for the quality-control teams to resurvey 30 to 40 percent of the delineated parcels (LTC 1986, pp. 40-42). According to this study, errors arose because delineators did not walk along all boundaries with the owners, supervisors were responsible for too many field teams, and participants lacked incentive to produce high-quality work.

Since the midterm study, the number of teams under each supervisor has been reduced from eight to four, but quality-control groups are still "resurveying" between 20 and 40 percent of the delineated parcels. Some of these parcels are problem parcels which are not visible in the photography or which present some other kind of difficulty. Instead of persevering with these parcels, delineators often leave them for the quality-control groups. The percentage of cases dealt with by quality-control teams therefore includes boundaries that are being delineated for the first time.

A further quality-control check by INA personnel from the Technical Assistance Department is carried out once the cadastral maps have been completed. Generally, only 3 percent of the parcels on a map are checked. The most common problems encountered in this quality-control check are: property corners omitted (indicating that the delineators have not walked all the boundaries), internal parcels omitted, and errors in map symbology.

One of the most debated quality issues in the Honduran CLIS is the precision of the methods used for delineating parcel boundaries, especially those boundaries that are not physically defined by a fence, boundary marker, or some other tangible feature. The argument presented by critics of this method is generally based on the following logic.

> If the parcels are not surveyed with the precision that a document of this nature deserves (because it is the basis for the property title registration), they could generate many controversies between owners. The inadequacies of boundary markings could become a future source of difficulties that could produce a questioning of the validity of individual titles and of the entire property system. Boundary surveying should have a high degree of accuracy not only to permit the issuance of titles, but also to guarantee the peaceful and legitimate possession of lands by their proprietors (LTC 1986, p. 15).

The notion that parcel delineation (or survey) for title purposes must be more precise and accurate than that for purposes such as taxation is a myth that tends to detract from the more important issues surrounding this subject. The certainty of the boundary position and the ability to relocate that position in the future are the two fundamental characteristics that should be possessed by any boundary system. However, this does not necessarily demand a high level of precision or accuracy. Accuracy in this context relates to the absolute position of a boundary within some larger spatial framework. Precision is a more important factor in titling since it is generally the relative position of parcels within a particular community that determines the certainty and the ability to relocate the boundary. Almost all boundary disputes occur between adjacent landowners, and surveys to relocate boundaries are usually based on survey control or reference points that are situated as close as possible to the boundary in question.

Contrary to the assertion in the above extract, accurate and precise boundary surveys do not eradicate boundary disputes. They will, however, minimize problems when they impart additional certainty as to the location of the boundary, but a higher degree of precision, or accuracy, is not always synonymous with higher certainty. Proponents of fixed boundary systems, where boundaries are accurately defined by corner monuments and precisely measured, tend to regard a general boundaries system as one which is inferior and approximate (see Dowson and Sheppard 1956, for example). Admittedly they are less precise, but a general boundary can often offer a higher degree of certainty as well as a substantial savings in cost, time, and personnel demands. England has been using a general boundaries system since the 1870s and there do not appear to be any more boundary problems than in other countries. England is a good example of a boundary system which provides certainty without the support of a highly precise set of spatial data.

One of the prerequisites of a general boundaries system is the existence of physical features (fences, trees, ditches, hedges, and the like) along the boundaries of properties. Although the majority of parcel boundaries in Honduras are marked by such features, there are boundaries that contain no markings. In these cases, the approximate position of the boundary is determined and recorded on the cadastral map by a broken line. There are two classes of "unmarked" boundaries in Honduras: (1) those where the landholders have not felt the need to define the boundary physically, and (2) those where boundary features are not identifiable on the aerial photography.

In the first situation, if the adjacent holders are satisfied with an approximate and unmarked boundary, then showing such an approximation on the cadastral map can be regarded as the most truthful representation. The counterargument is that such solutions provide a breeding ground for boundary disputes, particularly if there is an increase in the value of the land. The shortage of land, particularly among the small-farmer sector, generally leads to some form of boundary demarcation. This means that these "unmarked" situations do not occur very frequently and should not, therefore, affect the policy and procedures toward the vast majority of parcels, provided the latter are effective.

Where the boundary exists on the ground but is not visible in the photography, delineators will attempt to locate the boundary on the photograph by taking measurements to photo-identifiable features and "scaling" in the approximate position of the boundary. These measurements represent important secondary evidence (the physical boundary is regarded as primary evidence) which do not appear to be documented in any systematic way. These data should be stored in a retrievable fashion in order to assist with the future re-establishment of boundaries.

In reality, there is a range of different levels of precision for defining boundaries for titling purposes. Regardless of which particular level of precision is used for delineation, it should meet the following general criteria:

1) minimize the possibility of future boundary disputes (without attempting to provide a highly expensive system that is "dispute-proof");

2) define the extent of land rights clearly and unambiguously so as to impart the tenure security desired by landholders and required by banks;

3) facilitate the relocation of parcel boundaries;

4) maximize the certainty of the boundary position within the financial, time, and resource constraints of the environment.

The increased priority given to the development of LIS has resulted in a change of emphasis from precision toward <u>completeness</u>. In the context of a CLIS, this relates to the geographical coverage of the tenure information and its continuity across a department, municipality, or designated jurisdiction. The Honduran CLIS has a number of "holes" in its coverage since the project included only those parcels on national and ejidal land. The information base does not contain information on the departments outside the project area or on private, forestry, military, park, and other land used for educational and experimental purposes within the project area. This does not present much of a problem since in many cases these lands are already well documented and all that is required is for the relevant information to be entered into the CLIS. Textual land-tenure information is also missing for the substantial number of small farms on national and ejidal land which did not qualify for titling because they did not meet the minimum area requirements. The current policy is not to title these farms for fear of "institutionalizing <u>**minifundios**</u>," even though these people are the poorest and most needy in the agricultural sector. Unfortunately, these farms are a reality and will remain until their farmers are offered either more land or some other alternative.

The fidelity or accuracy of the textual information in the system will continue to erode until the **folio real** and related feedback mechanisms are activated. As five years have passed since the start of the PTT, one can expect substantial discrepancies between the information base and reality, particularly in areas where there is an active land market.

4.7.6 Utility

Over the past decade, there has been a marked effort to develop multipurpose LIS that will cater to a broader set of users and thus increase their utility. This movement is based to some extent on the synergistic benefits provided by a more diverse information system.

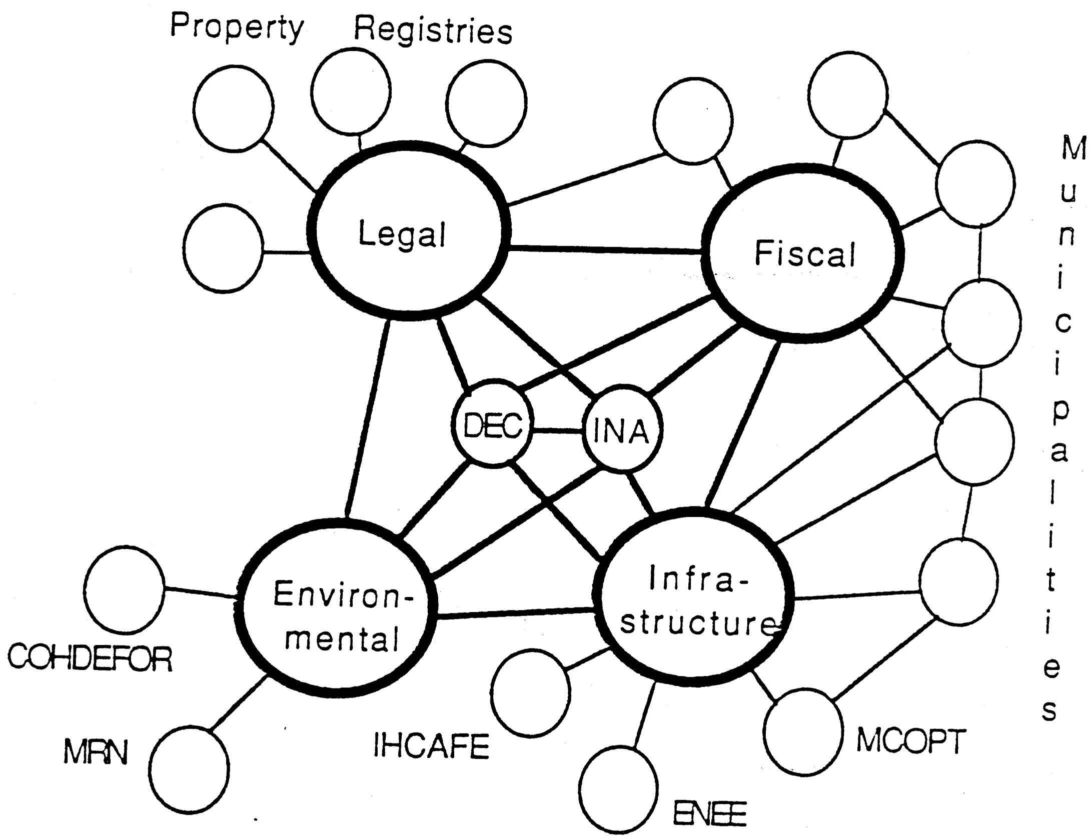
The Honduran CLIS has the potential to become a truly multipurpose system with a broad range of users. This is no historical accident as the goal has been to develop a multipurpose cadastre (catastro multifinalitario) ever since the inception of the PCN in 1974. It was recognized that a cadastre should provide land information of a physical, fiscal, and juridical nature. For this reason, DEC is structured so that it contains departments dealing with property registration, land valuation, natural resources, and cadastral mapping (see Section 4.1).

Unfortunately, a variety of factors has prevented DEC from developing into the major CLIS that was envisioned in the early 1970s. The primary obstacles appear to have been: (1) lack of funding necessary to extend its information base nationwide, (2) competition from other institutions that have traditionally performed such functions as property valuation, and (3) the entrenched interests of large landholders who suspect that a national CLIS which is efficient and complete will undermine their independence and lead to an increase in taxation. Furthermore, the lack of coverage at the national level causes potential clients to overlook the information already available because it is perceived to be patchy and incomplete.

The best remedy for this underutilization of the services of DEC appears to be in forging additional links with other institutions and by lobbying politically in order to give DEC a higher political profile and a wider role in the government's development plans. Apparently, DEC has already started working on both these fronts and continues to hold up a nationwide multipurpose system as its ultimate goal. It is unusual for a national cadastral or any other organization to contain natural resource, climatology, hydrology, soils, agricultural economics, vegetation, ecology, and property valuation sections all within the same institution. This arrangement will certainly facilitate the integration of land-related information and the development of a multipurpose LIS centered around the CLIS which is being established under the PTT.

Since the start of the PTT, DEC's primary client has been INA. There are, however, a number of other organizations which could use the information that is being collated through the project. This network of users is shown in Figure 4.5.

In general, one may conclude that the CLIS in Honduras has a serious maintainability problem but, otherwise, given the unstable sociopolitical climate, has managed to extend its spatial information base to an extensive area covering parts of several departments.



COHDEFOR - Honduran Corporation for Forestry Development
MRN - Ministry of Natural Resources
IHCAFE - Honduran Institute for Coffee Cultivation
ENEE - National Electricity Corporation
MCOPT - Ministry of Construction, Public Works, and Transport

FIGURE 4.5

Possible LIS Network in Honduras

5. THE CADASTRE-BASED LIS IN ECUADOR

5.1 Introduction

Ecuador, which covers an area of 27.1 million hectares (approximately the size of Colorado), is divided by the Andes Mountains into three natural and cultural regions. The coastal region, **La Costa**, is situated between the westernmost range of the Andes and the Pacific Ocean. To the east of the Andes lies the largely undeveloped Amazon region known as the **Oriente**. The third region is the **Sierra**, which lies in the highland basin that runs through the center of the Andes.

The country is divided into twenty provinces, including the province that encompasses the famous Galapagos Islands situated 1,000 kilometers off the west coast. The provinces are subdivided into cantons (counties), and these are in turn divided into **parroquias** (parishes). Approximately 96 percent of the 9.4 million population lives in the **sierra** and **costa** regions and it is in certain priority cantons within these two regions that the titling project, Proyecto de Legalización de la Tenencia de la Tierra (PROLETIERRA), is focusing its activities.

5.2 Historical Background

Ecuador's dynamic history is evident in the considerable diversity of land tenure arrangements found in the country today. The Spanish influence is the one that is most evident in modern-day Ecuador. The Spanish Crown impressed its colonial policies on the newly acquired country by extending large land grants to the successful conquistadores as well as to the Roman Catholic Church. Local indigenous communities were subjected to various subservient tenure arrangements which allowed the colonists to expand their holdings and consolidate their power. The **encomienda** system, for example, forced local communities to provide slave labor to the **encomenderos** (landowners) in return for the latter's "protection." In due course this led to the development of large haciendas and, as in most colonial countries at that time, resulted in a very uneven distribution of land with the indigenous population being pushed onto smaller and less fertile parcels of land.

Independence, achieved in 1822, did not, however, translate into major changes for the underclasses since, as Linke (1960, p. 23) noted, "[a]ll that happened was that the Spanish feudal landowners were replaced by equally white and powerful men born in Ecuador." The growing dissatisfaction among the dominated small farmers, or campesinos, with regard to land tenure arrangements in Ecuador culminated in the passing of the Agrarian Reform Law of 1964. The Alliance for Progress and the Cuban Revolution are also purported to have contributed to the passing of this act (see Seligson 1984, pp. 11-21; Blankenstein and Zuvekas 1973, pp. 74-78). The Agrarian Reform Law created the Ecuadoran Agrarian Reform and Colonization Institute (Instituto Ecuatoriano de Reforma

Agraria y Colonización, IERAC) and charged this body with the administration of the law. This law also aimed to eradicate all precarious tenures (**precaristas**)--those tenures involving the exploitation of campesinos by larger landholders--and increase the supply of land available to campesinos by expropriating all latifundio holdings larger than a specified size. In addition, land that was not being cultivated on large holdings would revert to the state without any compensation to the owner, and seventy-seven haciendas originally confiscated from the Church would be redistributed.

Agrarian reform in Ecuador has made significant inroads into the problem of precarious tenure, but the distribution of land remains skewed. In 1974, in the central sierra region, where 62 percent of Ecuadoran agricultural units are situated, some 78 percent of these units were estimated to be smaller than 5 hectares (Ecuador/North Carolina State University 1987, p. 12). The titling project addresses this problem by extending full ownership rights to those who hold only possessory rights, but it does not include a major redistribution of land.

5.3 Land Tenure Situation

Ecuador is similar to many other developing countries in that a number of informal tenures flourish alongside the formal, legal system. However, the existence of a significant number of parcels that are in the legal or formal system but have not been fully processed has given rise to another set of tenures which will be referred to as "semiformal" in this report.

5.3.1 Formal Tenures

The different tenures in Ecuador can be arranged along a private/public continuum, with registered private land at one pole and registered state land at the opposite one. Registered private land includes **comunas**, cooperatives, and societies which have a deed registered in the name of their supporting organization. In a strict legal sense, private and public tenures are the only legal holdings, as title to a property can be acquired only through registration in the cantonal Property Registry (**Registro de Propiedad**).

There is a substantial area of private registered land which either is not registered in the name of the current holder or is subject to an encumbrance which is no longer valid. This includes private land held by the heirs of the official titleholder, land adjudicated to beneficiaries who have paid off their mortgage but not had this encumbrance removed from the official record in the registry, and private land which has been rented or sold without IERAC's official approval.[4]

5.3.2 Semiformal Tenures

In the central part of this private/public continuum lie the semiformal tenures which are currently neither registered private nor registered state

4. Jack Rosholt, private communication.

land but are in the process of becoming one of these formal holdings. This category consists of parcels under adjudication or affectation (**afectación**) proceedings as well as unregistered national reserve lands (**tierras baldías**).

Adjudication in the Ecuadoran context refers specifically to the process required to transfer land from the state, represented by IERAC, to a private individual or community. Application is made to the IERAC zonal office, where the legal tenure history is investigated and a survey performed. The application is then forwarded to the central IERAC office in Quito where it is subjected to an elaborate set of procedures which, if the application is successful, will culminate in the issuing of a **providencia**. The zonal office is responsible for the notarization of the **providencia** and for the inscription of the notarized deed in the cantonal Property Registry. Prior to 1983, these two functions were the responsibility of the applicant, but in many cases they were not fulfilled either through a wish to avoid the required fees or through ignorance of proper procedures. The whole adjudication process can be a very lengthy affair, as was noted in a 1985 study of the IERAC information system (CMS 1985, p. 8): "The adjudication process . . . is at best a time consuming sequence of events which can take from nine months to five years to complete. Indeed, the most quoted estimate of backlog in adjudications is over 40,000 cases."

IERAC has recently begun to address this problem by simplifying their in-house adjudication procedures. This has allowed them to issue nearly 29,000 titles (covering 731,618 hectares) over the past three years (IERAC 1987b, p. 8). The problems with regard to ignorance of the titling procedure and inadequate finances for paying titling fees are being addressed by the promotional and financial aid components of the land titling project, PROLETIERRA.

Land parcels under affectation (**afectación**) are those which are not fulfilling the "social function of land" (Agrarian Reform Law, Art. 38). It is worth elaborating on the meaning of this term as this is an important factor behind both the Agrarian Reform Law and PROLETIERRA. Land is regarded as not fulfilling its social function when: (1) the parcels are not efficiently exploited, (2) the renewable natural resources are not being conserved, (3) the owner is not directly responsible for the administration of the property being exploited, (4) the property is part of a land monopoly (**acaparamiento**), and (5) the owner is not conforming with the labor laws (Agrarian Reform Law, Art. 40).

The transfer of affected land to the state is achieved by means of expropriation (Art. 46), reversion (Art. 48), or extinction (Art. 49). In general terms, expropriation is applied to those cases where land is not being properly exploited, reversion to cases where land is not being exploited at all, and extinction to cases where exploitation is being carried out through the use of illegal labor practices (**precarisma**). The decision as to whether or not a property is fulfilling its social function is made by the IERAC regional office and the result is registered in the Property Registry in the name of the successful party.[5]

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5. Further details of this whole process together with appeal procedures may be found in Rowles 1985 (pp. 6-7).

National reserve land (**tierras baldías**) is all land owned by IERAC (for the state) and consists of: (1) land that forms part of the national territory, including land that does not have another owner; (2) land that has reverted to the state; (3) land that has not been permanently cultivated for more than ten consecutive years; and (4) that portion of land which has not been transferred by the state and which does not correspond to property titles or to the exact area occupied, regardless of whether or not it is being cultivated (Ley de Tierras Baldías y Colonización, Art. 1).

Unfortunately, IERAC has not always registered land which they have acquired through affectation or other means, and these unregistered **tierras baldías** constitute the third and final category of "semiformal" tenures.

5.3.3 Informal Tenures

Informal tenures are possession, precarious tenures (**precaristas**), and squatting. These informal tenures may be found on any semiformal or formally registered parcel of land. Possession refers to the occupation and/or use of a parcel of land for more than two years by an individual (or group) who does not have registered title to the land, including undivided land occupied by heirs. It also includes **comunas,** such as those granted to indigenous Indian communities, where parts of the communally held land have been subdivided into individual lots without adherence to the required legal procedures (USAID 1985, p. 7).

Precarious tenures arise when a small farmer "works a portion of another person's land and gets paid money, products, work or services in exchange for use rights" (Agrarian Reform Law, Art. 51). This type of tenure is explicitly prohibited by the Agrarian Reform Law (Chapter 5). Although there are some contradictions associated with the legal position of precarious tenure on very small land parcels, current IERAC policy is "not to affect lands of less than 8 hectares for purposes of expropriation, despite the clear authority granted to it in Art. 46(2) of the Law of Agrarian Reform to expropriate lands which have been worked by precaristas" (Rowles 1985, p. 8). Most precarious tenures have, however, virtually disappeared since the 1964 Agrarian Reform Law made it illegal to cultivate land in this manner.

Squatter tenure occurs when a person or group has occupied or possessed a parcel of land titled in another's name for less than two years. Registered owners may bring a usurpación action against the squatter in order to regain possession and use of the piece of land (ibid.). Although rural squatting does occur, it does not take place on a very large scale.

A graphic summary of formal, semiformal, and informal tenures is shown in Figure 5.1. This diagram attempts to present, in a simple fashion, the complex overlaying of land tenure rights in Ecuador. PROLETIERRA is attempting to eradicate semi- and informal tenures so that all land in the project area will be under either registered private or registered state tenure. This involves moving (processing) all semiformal tenures to either one of the two poles, as indicated in Figure 5.1.

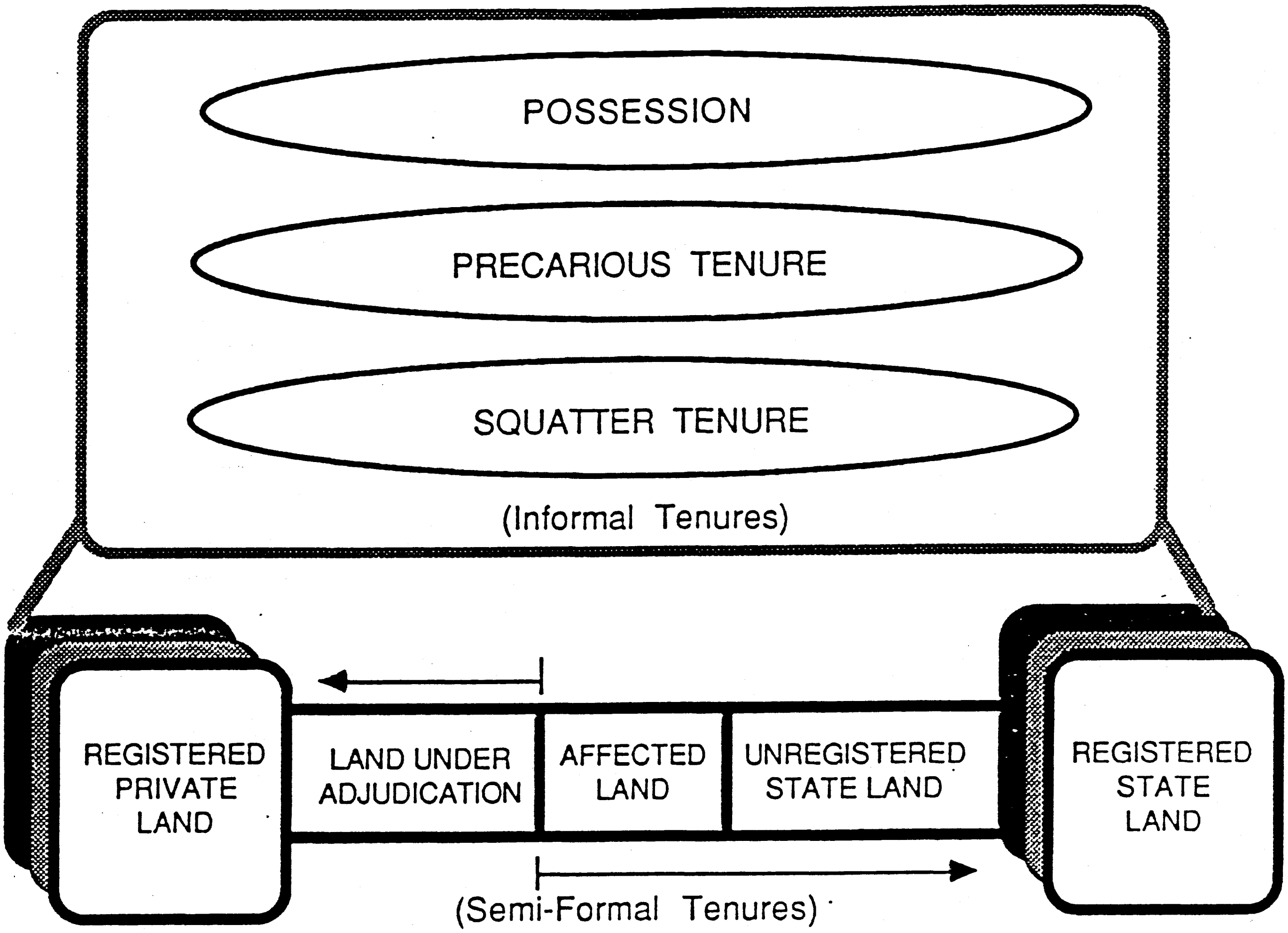


FIGURE 5.1

Land Tenure Situation in Ecuador

5.4 PROLETIERRA: The Land Titling Project

The $20 million land titling project is funded through $9.7 million in Government of Ecuador (GOE) funds, together with a $3.3 million grant and a $7 million loan from USAID. It is anticipated that the revenue generated from land sales and the expected savings to be accrued from a more efficient titling system will enable titling efforts to be extended beyond the project area without any further financial assistance from foreign agencies.

The objective of PROLETIERRA is "to increase IERAC's capacity to title efficiently and effectively rural properties and stabilize the rural land tenure situation within each canton" (IERAC 1987a, p. 7). Like most land-titling projects, its long-term goals are to increase agricultural production and to raise rural incomes by providing security of tenure and improved access to formal credit.

PROLETIERRA will cover an approximate area of 4 million hectares (15 percent of the total area of Ecuador) and will involve the delineation of an estimated 400,000 rural land parcels and the issuing of 120,000 new titles over its 5-year life span. The project will be implemented on a canton-by-canton basis as this is the jurisdictional unit of the various property registries. Out of a total of 131 cantons, 40 have been identified as priority areas, with 14 of these situated in the Sierra and the remaining 27 in the Costa. It is estimated that some 93 percent (38,000) of the backlog of titles in IERAC is situated in these cantons. Although most of the fieldwork to date has been carried out in the Sierra province of Pichincha, some work was started in the flat coastal area toward the end of 1987.

The activities of PROLETIERRA can be divided into two categories, those involved with data and information of a spatial nature and those concerned with textual or nonspatial land-tenure data and information. The spatially oriented activities include (1) acquisition of aerial photographs, (2) delineation of legally recognized parcels, and (3) production of cadastral maps. Activities related to the textual aspects of tenure legalization are (1) acquisition of documentation describing the de jure tenure situation, (2) investigation of de facto tenure arrangements, (3) adjudication and processing of legally recognized tenures, and (4) issuance of title where applicable.

There are many aspects of the project that have been changed from the original design which appeared in the 1985 project paper (USAID 1985). These changes have been necessary because of the inappropriateness and weakness of certain aspects of the original design, particularly those relating to delineation and mapping. The original design proposed an almost wholesale transfer of methodologies and techniques from the titling project in Honduras (Proyecto de Titulación de Tierras, PTT), with little consideration given to the significant topographical, land tenure, and institutional differences between Ecuador and Honduras. Orthophotography, proposed for the delineation of properties, is not appropriate in many parts of Ecuador because of the extreme changes in elevation and the additional control required to produce accurate orthophotomaps. The land tenure situation in Ecuador is much more complicated than that in Honduras, primarily because of the longer history of land reform, the complex registration procedures, and the long delays that have been experienced in the adjudication process.

Project implementation began early in 1987, and fieldwork for seven jornadas (ten-day work periods) had been completed as of July 1987. During the seventh jornada, the seven-team field unit was increased to thirteen teams and some thought is being given to contracting out a portion of the remaining fieldwork.

The short period that PROLETIERRA has been in process means that the analysis included in the latter part of this chapter must be based on a relatively

small data sample. The data do, however, allow one to perform a preliminary evaluation and comment on the characteristics of the system design. Some of the system components, notably those concerned with mapping, are not yet in place and information on these parts of the system is, therefore, based to a large extent on proposals that have yet to be implemented. Unlike the initial project design (as portrayed in the 1985 project paper), there is not much expected change between the proposed and the implemented design of these components.

5.5 Institutional Framework

IERAC is the institution with the overall responsibility for both accomplishing the project goals and housing the cadastral information base. It is an autonomous body, under the Ministry of Agriculture, which reports directly to the president of Ecuador. The IERAC processes with regard to titling and adjudication are neither simple nor uniform, and the complexities of these processes have contributed significantly to the low output of titles over the last decade.

IERAC consists of nine directorates which can be divided into four different functional levels--executive, assessment, auxiliary, and operative. The general structure of IERAC within this framework is illustrated in Figure 5.2. For the purposes of the project, IERAC has created a separate unit, called PROLETIERRA (or the Project Implementation Unit, PIU), which mirrors several of the existing departments in the central office but is devoted entirely to the titling project. This unit is designed "to cut across much of the confusing and complex bureaucracy that currently exists" (USAID 1985, p. 32). The internal structure of the PROLETIERRA unit is shown in Figure 5.3.

Although there is currently no computer link to the field office, the plan is eventually to provide both this connection as well as one between the Department of Information and the central IERAC Computer Center. The primary role of the central IERAC office in the titling project is to deal with properties that require some form of IERAC action such as adjudication or sale of national land (**tierras baldías**).

The field teams operating from the field office are made up of two investigators (paralegals), one delineator, and one legal advisor (per two teams). Over the past four months, the field teams have included only one investigator, but this experience has shown that the delineation work is generally accomplished in a much shorter time than the investigation work and it is, therefore, more efficient to have an additional investigator in the field team.

Prior to the commencement of any fieldwork, it is necessary to acquire information from a number of government agencies. These agencies and their respective land-related functions are as follows:

1) Ministry of Agriculture (registers cooperatives, comunas, and farmer associations; defines forestry reserve boundaries);

2) Ministry of Government (establishes canton, **parroquia**, and urban-area boundaries);

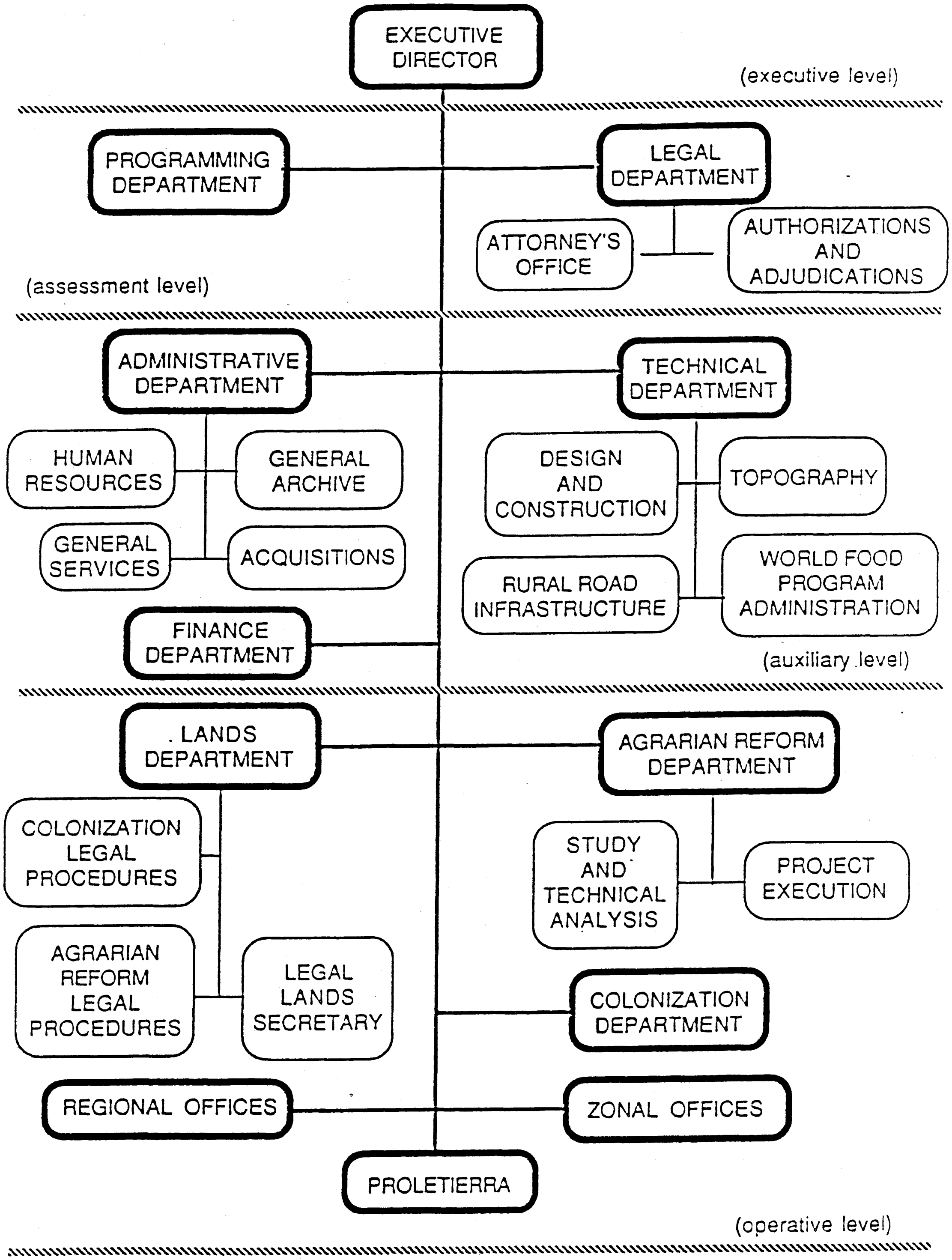


FIGURE 5.2

General Structure of IERAC

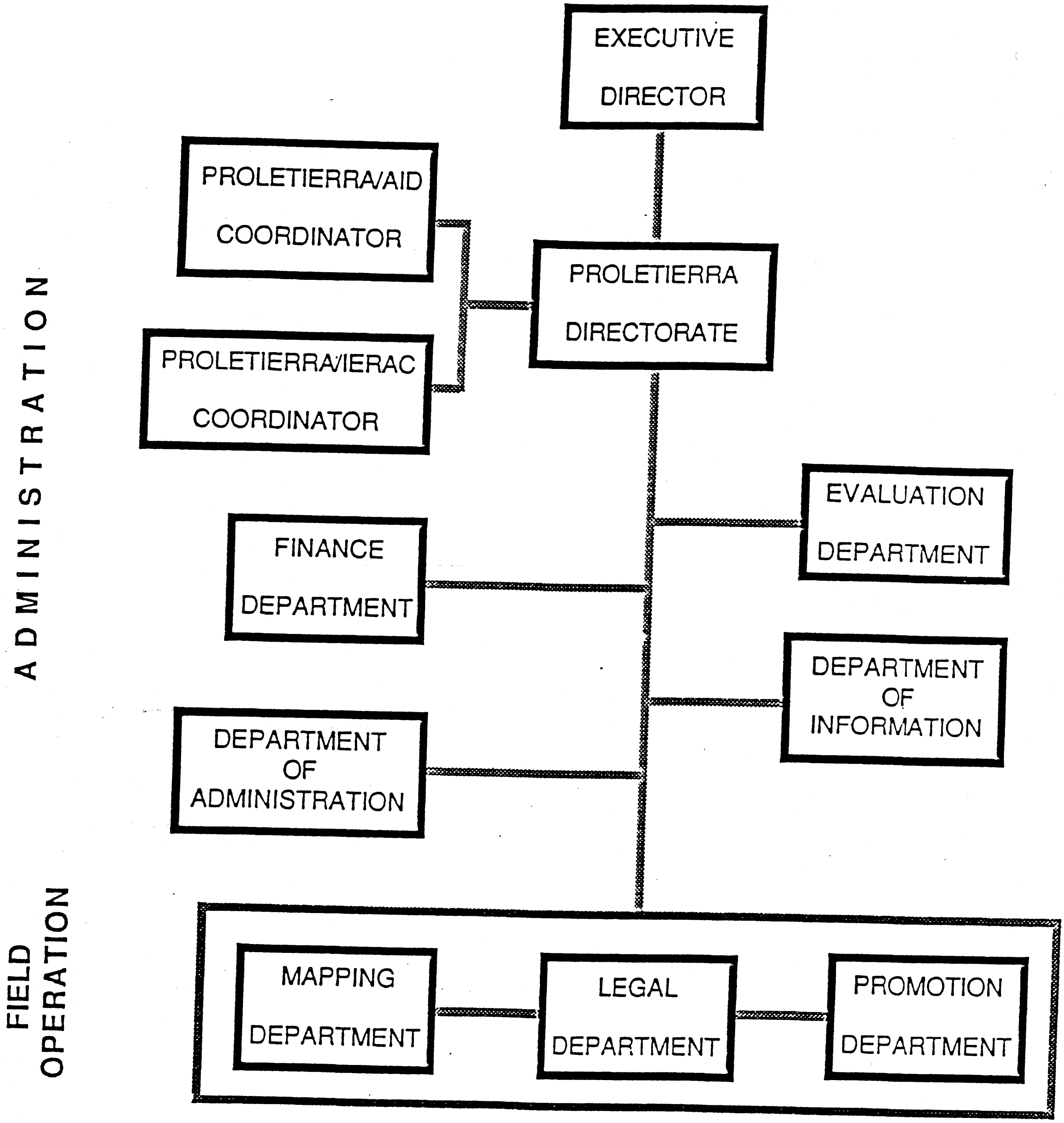


FIGURE 5.3

Institutional Structure of PROLETIERRA

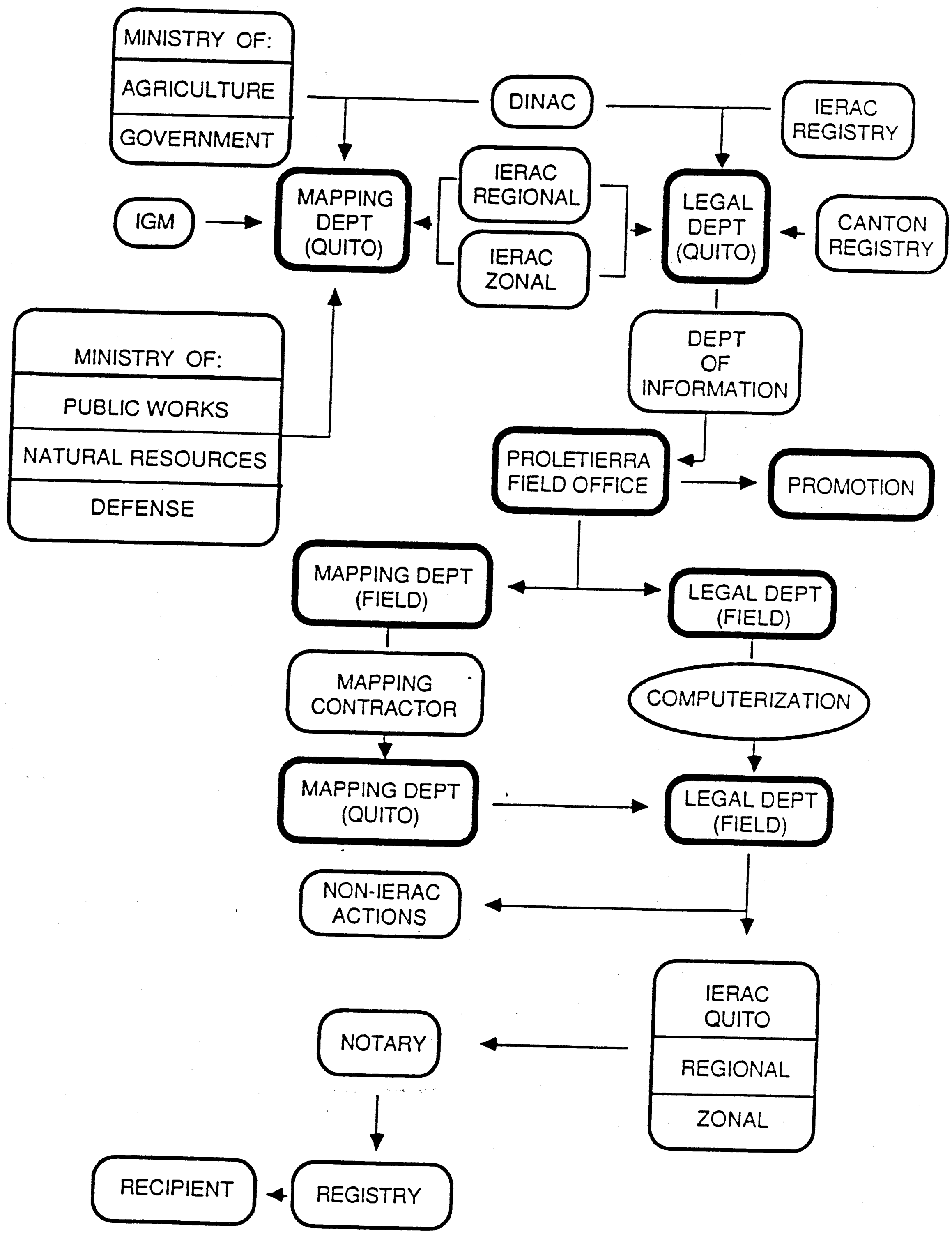


FIGURE 5.4

Institutional Framework of Titling Process

3) Ministry of Public Works (defines width of public roads and rights-of-way);

4) Ministry of Natural Resources (defines boundaries of public land around lakes, streams, watersheds, mines, and quarries);

5) Ministry of Defense (determines boundaries of public land along the coast and along navigable rivers);

6) Military Mapping Institution (is responsible for all topographic mapping in Ecuador and for flying most aerial photography in the country);

7) National Directorate of Evaluation and Cadastre (is responsible for assessing properties for tax purposes and preparing a fiscal cadastre).

Unfortunately, the fiscal "cadastre" developed by the National Directorate of Evaluation and Cadastre (Dirección Nacional de Catastro, DINAC) is not very extensive (covering ten to twelve cantons) and very little consideration has been given to its transformation into a legal cadastre. The 1:12,500 cadastral/fiscal maps prepared by the Military Mapping Institution (Instituto Geológico Militar, IGM) are, however, a very useful tool for the initial planning of the fieldwork as they depict the general land tenure situation as well as land-use patterns.

The general institutional framework of the titling process of PROLETIERRA is outlined in Figure 5.4.

5.6 Components of Ecuadoran CLIS

5.6.1 Input

Spatial Land Tenure Data. The collection of spatial data is the responsibility of the Mapping Department of PROLETIERRA. Its duties in this regard include: (1) collection of all existing map information; (2) identification of all provincial, cantonal, parochial, and sector boundaries in the project area; (3) acquisition of new aerial photography from IGM; and (4) delineation of parcel boundaries (**linderos**).

The widespread practice of demarcating boundaries by means of natural features (trees, bushes, and the like) makes it possible to use a general boundaries approach to define the spatial extent of parcels. The original project proposal suggested using orthophotomaps to capture the boundary data, but, as mentioned earlier, this is not a practical alternative in the mountainous regions of Ecuador. Instead, standard black-and-white aerial photographs at an approximate scale of 1:20,000 are being used for the field delineation. This photography is obtained from IGM, which is contracted by PROLETIERRA to fly photography for certain areas.

The first step in the delineation process is the acquisition of the required base materials. These include aerial photographs, topographic maps, flight plans for the aerial photography (showing flight lines and photo

numbers), and data describing administrative boundaries. These base materials are then used to develop a comprehensive work plan for the fieldwork.

Most administrative (provincial, cantonal, and the like) boundaries are described verbally in various legal decrees. These descriptions are translated onto 1:50,000 topographic maps (supplied by IGM) and then onto individual aerial photos. The identification of the cantons is particularly important as this is the jurisdictional unit of the registry offices (**registros de propiedades**) and legal title is valid only if a property is registered in this office. Furthermore, the project explicitly excludes urban areas, and urban/rural boundaries must consequently be determined in order to define the project limits. The delineation of administrative boundaries does not generally pose much of a problem as these boundaries usually consist of prominent natural features such as rivers or gorges (**quebradas**) which are easily identifiable on the maps, in photos, and on the ground.

The delineator works together with an investigator (two for the seventh **jornada**), who collects data on the nature of the tenure and various other nonspatial details (see following subsection). The delineator interviews landholders in order to acquire data on the extent of their holdings and the parcel boundaries. This generally involves walking around the perimeter of the property with the holder and one or more neighbors. The role of the delineator is to identify and delineate parcels according to **escrituras** (deeds or any legally registrable documents supporting a land claim) or, where there is no formal documentation, according to possessory evidence.

Initially, the parcels are traced onto a transparency which is overlaid on the aerial photograph. The corners, or bends, of the property boundaries are then pricked through the photo and these holes are used to draw a plan of the parcels on the reverse side of the photo. In particularly complicated areas, such as those that include a number of **minifundios**, the delineators draw a sketch (**croquis**) which elaborates on the spatial data depicted on the aerial photo. A special field-survey team is created to deal with problem cases, such as when the boundaries cannot be identified on photographs because of cloud or vegetation cover.

Part of the delineator's job is to allocate unique parcel identifiers (PIDs) to each parcel so that the spatial data can be linked to the corresponding textual data. The provisional PID (final identifiers are allocated only when mapping is completed) consists of a five-digit photo number attached to a four-digit parcel number (**número de lote**). As a general rule, every parcel with a deed is given a parcel number, such as 0120, and any unregistered subdivisions of a registered parcel are allocated the same number with an additional subdivision number, for example, 0120-1, 0120-2, and so forth. Any parcels that present a legal problem or require a legal decision are given parcel numbers which end in an alpha character, for example, 0120-a or 0120-1-a, and these problems are subsequently resolved by the legal advisor attached to the field team or by the advisor's superior in the PROLETIERRA field office.

When extremely small parcels, known as **minifundios** or micro-**minifundios**, are encountered, it is often necessary to make use of photographic enlargements. Enlargements at an approximate scale of 1:5,000 will be obtained from IGM and used for the field delineation of these small parcels. As the

majority of **minifundios** occur in clusters, it has been proposed that these areas or clusters be specially designated as zonas especiales on the final cadastral map and that properties in these zones be subject to additional title restrictions, particularly with regard to subdivisional rights (Rosholt 1986).

In addition to the delineation on the aerial photos, two sketches are drawn on the cadastral card or **ficha** (see following subsection). The first, the **croquis de uso**, shows the approximate spatial distribution of the different kinds of land use on the parcel, and the second depicts the location of the parcel with respect to adjoining parcels. Neither of these sketches is drawn to scale and they both function more as a rough guide than as an accurate spatial definition. The delineated photos and supporting sketches are then sent to the central PROLETIERRA office for mapping. The **ficha** is also forwarded to this office, but only once the Legal Department has collected all required textual land-tenure data.

Textual Land Tenure Data. Before any fieldwork commences the following land tenure data are collated: a list of registered properties from the cantonal Property Registry, a list of properties appraised by DINAC, and a list of properties adjudicated by IERAC.

The field investigators use these data as an initial indication of the land tenure situation in a particular area. In the field they interview all landholders and, if possible, examine their supporting deeds and documents. Although it is sometimes necessary to acquire copies of documents from the local notary or deeds registry, an examination of the landholders' documentation generally suffices. The data obtained from the landholders and their deeds are recorded on a cadastral card (**ficha de actualización y legalización de la tenencia de la tierra**), which is divided into the following major categories: (1) parcel identifier (PID); (2) personal data; (3) activities on the land and method of exploitation; (4) notary and registry data (name, date, and reference number); (5) physical characteristics of parcel (location, area, crops, stock, irrigation); (6) names of adjoiners (colindantes); (7) form of tenure; (8) tenure history; (9) legal data concerned with adjudication, notarization, and registration; (10) credit data; and (11) land-use and land-tenure sketches (**croquis de uso y croquis de tenencia**).

The task of obtaining the above data has been relatively problem-free thus far as most of the project work has been in one of the best-documented cantons in the country. Whenever a legal or procedural problem arises, it is referred to a legal advisor. There is generally one legal advisor per two field teams, and it is the advisor's duty to instruct and assist the landholder on what processes or actions are required to secure registered title to the parcel. In many cases the landholders do not have title because they, or IERAC, have failed to complete the appropriate legal process. This may include the following situations: (1) transfer or adjudication not notarized, (2) transfer or adjudication not registered in the cantonal Property Registry, (3) IERAC authorization not obtained for transfer or subdivision of titled parcel, (4) mortgage payments outstanding, or (5) mortgage repaid but not canceled on deed.

The legal advisors submit summary reports of the cases they have examined to the central PROLETIERRA office in Quito. These serve as progress reports

as well as notification of actions required by IERAC in order to fulfill all titling requirements. The cadastral cards are also submitted to the central office where they will eventually be computerized. To date, no computerization of these data has taken place, but consideration is being given to contracting out this work to a private company.

5.6.2 Conversion Mechanism

Cadastral Mapping. The information in this section is based on proposals as no mapping has yet been carried out under the project. IERAC does not plan to develop a major mapping capability and anticipates contracting cadastral mapping work either to IGM or to one or more of the private mapping companies in Quito. There are currently three private mapping companies in the capital, and there is some possibility that these companies will form a consortium for the purposes of the project.

Analyses of the mapping capabilities of IGM (McEwan 1986) and the three private companies (CMS 1985, pp. 53-59) have been done, with the latter study specifically focusing on the consortium issue. The recommendations made to IGM in the McEwan (1986, pp. 17-18) study highlighted the need for more cooperation between IGM and the various cadastral map users in Ecuador. In the study of the private mapping companies, two out of the three companies were judged to be suitable for carrying out project work on a consortium basis.

Two different cadastral mapping techniques have been proposed, one for the mountainous areas and a second, simpler approach for the flat coastal regions which are covered by large-scale topographic maps (IERAC 1988).

In the Sierra and the coastal area not covered by large-scale topographic maps, cadastral maps will be produced by stereo-digitization techniques. This work will be contracted out to local cartographic firms which will be required to establish photo-control in areas where there is no existing geodetic control. They will also be required to perform a block adjustment on each block of photography that is supplied to them and to stereo-digitize all parcel corners. These data will be delivered on diskettes containing coordinate point files for each stereo-model.

In the flatter, coastal areas which are covered by 1:10,000 topographic maps, IERAC will create its own point files of property corners using a PC-based computer system linked to one or more digitizers and plotters. Photo-control will be obtained by digitizing appropriate control points off the topographic maps. Property corners will then be digitized directly from the delineated aerial photographs and transformed onto the coordinate system of the map. In this way, a point file similar to that obtained through stereo-digitization will be obtained.

PROLETIERRA's map unit will take the coordinate point files and manipulate them to form parcel files. One parcel file will be created for each parcel and the parcel files for all properties within a canton will be consolidated and stored on hard disk. A hard copy and property lists (PID and owner) of this cantonal information will be forwarded to the IERAC legal units in order to facilitate the completion of the legal analysis. IERAC will also plot manual

cadastral maps covering a geographical area of 2 minutes by 3 minutes, which coincides with the existing map coverages.

Parcel Mapping. Individual parcel maps are required for titling adjudicated parcels under current adjudication procedures. These maps are generally produced from isolated field surveys carried out by IERAC surveyors. The existence of a systematically delineated spatial record (map) of all parcel holdings in a canton will considerably simplify the spatial problems associated with adjudication. With the cadastral map in a digital environment, parcel mapping will entail simply extracting the required information from the cadastral database and plotting it out at the required scale.

Although the original project design (USAID 1985, p. 39) envisioned the production of parcel maps to be included in the title portfolio, there does not appear to be a great need for parcel maps as long as information of a more precise and accurate nature is referenced to the PID shown on the cadastral map. In most cases, a reference to, or copy of, the relevant cadastral map should suffice. However, until current deed-registration procedures are changed, there remains a need for parcel mapping.

Title Registration. Title registration can be traced back to the new Civil Code of 1837 which established property registries in every canton in the republic and provided the mechanism for registering land titles. Today Ecuador is one of the few Latin American countries to have a compulsory registration-of-deeds system.

Outside of IERAC, the two most important offices in the titling process are those of the Notary and Registrar of Deeds. Notaries are appointed by the Superior Court (provincial) for a four-year period (Ley Notarial, Part 1) and are generally fully qualified lawyers. There may be from one to eight notaries in a particular canton and they are empowered to perform their notarial duties only within that canton. In order to be legally binding, every deed must be recorded in a "protocol" book (**protocolo**) kept by the Notary. "Protocol" books are divided into monthly or 500-page volumes that are formed annually from original deeds and public or private documents that the Notary authorizes (Ley Notarial, Ch. 1). Deeds are entered in the "protocol" (**protocolizado**) in chronological order and an alphabetical grantor index must be included at the back of each protocol (Art. 23). Before drawing up a deed, notaries are required to obtain proof of the payment of various taxes, including rural and income taxes.

Although the protocol acts as a type of register, the original deeds in these books are not proof of title as they do not contain the registrar's signature and in some cases may not have even been registered. In transactions between private parties, the grantee (purchaser) will receive a copy of the original deed for purposes of registration in the cantonal registry.

By law, every contract or act resulting in a transfer of property rights, or imposition of restrictions or obligations, must be registered in the cantonal registry for it to be legally recognized. Registrars of deeds (**registradores**) are appointed for a six-year term by the Superior Court (Ley de Registro de Inscripciones, Art. 4) and must have the same qualifications as a notary. Generally, registrars are fully qualified lawyers.

The primary functions of the Property Registry are: (1) to serve as a medium for the recording of property and other rights, (2) to give publicity to contracts that transfer property rights or impose tenure restrictions or obligations, and (3) to guarantee the authenticity and security of titles, public instruments, and documents that must be registered (Ley de Registro de Inscripciones, Art. 1).

Each registrar is required to maintain registry books for property, encumbrances, mercantile matters, and interdicts and prohibitions (Art. 11.6.c). They must also keep an applications book (**repertorio**) in which all applications for registration or inscription are recorded. Inscriptions (**inscripciones**) in the registry books must contain the following information: date, names, and addresses of parties to the transaction; date and registry in which original title is recorded; name and boundaries of property; and the signature of the registrar (Art. 41).

Once a deed has been inscribed and signed by the registrar, it becomes legal proof of title to a parcel of land. The procedure for obtaining title through adjudication follows a different notarization and registration sequence. In these situations, the **providencia** from IERAC is inscribed in the registry prior to notarization (**protocolización**).

The Ecuadoran system is different from many other registration-of-deeds systems in that notaries and registrars are private lawyers who pay their own office and other expenses from the revenues they make through notarization and inscription fees. The extensive role of the notary, who essentially maintains his own property registry, is a luxury which very few countries enjoy. Although the project will not introduce any major changes to the registration system, there certainly appear to be opportunities for streamlining procedures in order to reduce the cost and delays in the system.

5.6.3 Output

Cadastral Map. The cadastral map will contain all the legal parcel boundaries, prominent topographical features, and a final PID (**número catastral definitivo**) for each registered parcel. The PID will be the link between the spatial information portrayed on the cadastral map (and recorded in a digital database) and the textual land-tenure attributes recorded in a separate series of computer files. The map will be maintained in a digital environment with manual products being generated at a scale of 1:10,000 for everyday use.

The verbal descriptions (bounds or metes and bounds) which currently define the spatial extent of parcels on deeds will remain the legal description until the laws governing the registration-of-deeds system are amended. It is envisaged that these laws will in due course be changed to refer to the cadastral map, or derived parcel map, for the legal spatial definition of parcels and that adjoiners' names (**colindantes**) will be replaced by unique PIDs.

It is essential that a parcel identification system be simple, understandable, and permanent in design (Rosholt 1987). The DINAC system of relating the identifier to administrative/political units is inadequate as these basic units are not permanent. New cantons and **parroquias** are continually being

formed as the population increases, since the qualification for such a designation is related to population level. For example, five new cantons have arisen in the two-year time period between the project paper (USAID 1985) and this study. Fortunately, a well-defined, permanent, and simple numbering system already exists for topographic maps in Ecuador and this can be used as a framework for the new cadastral map series and as a basis for the PID.

The final PID is a ten-character alphanumeric string where the first five characters identify the map sheet (for example, N3B54) and the last five contain the final parcel number (for example, 00128).

Parcel Map. The original project design called for the plotting, at a scale of 1:1,000 or 1:500, of individual parcel maps which would form part of the title documentation (USAID 1985, p. 39). Although the later project description mentions that "[r]ural parcel maps will be produced by local firms contracted by IERAC" (IERAC 1987a, p. 60), no mention is made of these maps in the section that deals with mapping requirements (ibid., pp. 25-27). It is assumed that this mapping will be done by IERAC itself.

The parcel maps which are plotted for adjudicated parcels do not appear to play any role in the legal definition of these parcels other than to provide an area and metes-and-bounds description. This information is used on the deed, but no reference to the map is included even though it contains valuable evidence as to the location of property boundaries. In the Ecuadoran system, it seems that the area of a parcel is far more important than its location or dimensions, possibly because of the role that area plays in computing taxes. In moving toward an integrated cadastre, the reliance on verbose metes-and-bounds property descriptions will have to be eliminated and replaced by a more practical system that uses maps to provide spatial information at the parcel level. Only then will the true utility of cadastral and parcel maps be realized.

Title. A title in Ecuador is a deed (**escritura pública**) that has been notarized and "protocoled" (**protocolizado**) by an authorized notary and inscribed (**inscripcionado**) in a cantonal Property Registry. The deed must be drawn up in Spanish and should include the information relating to the place, day, month, and year in which this was done; the name of the notary and the canton in which he/she is authorized to practice; and the names, nationality, marital status, age, profession, occupation, and address of grantors (sellers) (Ley Notarial, Art. 29).

Title generally conveys freehold rights to the holder, but the tenure is subject to various restrictions and obligations. IERAC authorization is required for any subdivision of rural land and this will be granted only if it does not "contravene the spirit of the Law" (Agrarian Reform Law, Art. 107). Subdivisional rights are completely withheld from **minifundios** and IERAC will generally authorize transfers of these small units only to adjacent landholders (Art. 67). In addition, any land that has been obtained directly from IERAC (representing the state) may not be transferred without its consent (Art. 111). Permission from the Council of Agrarian Coordination is required if a private holder wishes to take land out of agricultural production (Art. 108), and landowners who do not use their land in an appropriate manner can be subject to expropriation (Art. 46) or reversion (Art. 48).

One of the positive rights attached to titles issued under the project is the right legally to mortgage the land to any private or public banking institution. Besides the usual bundle of rights that are associated with freehold title, titleholders in Ecuador can also use their title to gain access to technology transfer, forestry, coffee-rust control, irrigation, and various other projects (USAID 1985).

5.6.4 Feedback

The feedback component of the Ecuadoran CLIS has been given very little consideration, even at the conceptual design level. In the original design, only feedback associated with the impact of project activities during the life of the project received any treatment. A "Land Titling Evaluation and Monitoring Unit" is to be established within PROLETIERRA to conduct these impact studies. This unit will "feed information into the management information system that the PIU [Project Implementation Unit] will use for continually updating project progress and planning ongoing efforts with regards to the distribution of tasks, personnel and equipment" (USAID 1985, p. 33).

The capture of new land tenure data is dealt with in a very superficial manner and nowhere in the project design is the critical importance of this activity recognized. In the original design, the only references to this aspect lead one to believe that the computerization of the system will inherently solve all updating problems. The extracts shown here demonstrate this assertion:

> The automation will allow establishing and updating the land inventory (USAID 1985, p. 37).
>
> The automated information system design and its implementation will create a foundation that will permit IERAC to efficiently continue to process new title requests in those cantons where the Project has already computerized the land and title data (ibid., p. 43).

Clearly, there is a need to define more specifically both the tasks involved in maintaining the information base and the institutions responsible for carrying out these tasks.

5.7 Evaluation of Ecuadoran CLIS

5.7.1 Efficiency

This efficiency analysis is restricted to the delineation of properties and the collection of textual land-tenure data; no further data were available at the time.

For the purposes of this evaluation, delineation includes all the fieldwork involved in this activity as well as the preparation of sketches and tracings in the field office. Fieldworkers operate on a schedule that comprises a ten-day work period (**jornada**) followed by a four-day rest period. Tables 5.1 and 5.2 show proposed and achieved efficiency levels, respectively.

TABLE 5.1

Proposed Efficiency, Total Project
(Delineation, Adjudication, Mapping, Titling)

AREA (000 ha)	NO. PARCELS	NO. TEAMS	TEAM-MONTHS	NO. PARCELS PER TEAM-MONTH	AREA[a] PER TEAM-MONTH
4,000	400,000	83	4,980	80	800

a. In hectares.

TABLE 5.2

Delineation Efficiency Achieved
(April-October 1987)

REGION	AREA (ha)	NO. PARCELS	TEAM-MONTHS	AREA PER TEAM-MONTH (ha)	PARCELS PER TEAM-MONTH	AVERAGE PARCEL SIZE
Sierra	51,830	6,354	62[a]	836	102	8.2
Costa	23,142	561	8[b]	2,893	70	41.3
Total	74,972	6,915	70			
Mean				1,071	98	10.9

Source: Mapping Department, Proyecto de Legalización de la Tenencia de la Tierra (PROLETIERRA).

a. Represents 3.5 months with 7 teams, 1.5 months with 13 teams, and 2 months with 9 teams.

b. Includes 2 months with 4 teams.

The efficiency level actually achieved is slightly higher than that anticipated in the project paper (USAID 1985). In the Sierra, both the area and the number of parcels per team-month is higher, whereas in the Costa, only the area is higher. The effect of different parcel sizes is clearly reflected in the results.

The efficiencies obtained in the Sierra may not be an accurate reflection of the general situation in Ecuador as the cantons delineated and adjudicated are known to be well-documented and may therefore be viewed as "best-case" situations.

The textual land-tenure data collected in the field are examined by legal advisors, who decide what processes are necessary to convert the landholder's existing tenure into registered title. When the holder already has clear registered title, no action is necessary. Table 5.3 reflects the data available for the first fourteen **jornadas**, with the problem-free cases (saneados) indicating the proportion of clear titles encountered.

TABLE 5.3

Adjudication Statistics for the First Fourteen Jornadas

JORNADA	CLEAR TITLES ( )	CLEAR TITLES (%)	REQUIRE CIVIL PROCEDURE	REQUIRE IERAC ACTION	TOTAL FICHAS
J1	37	29	-	-	129
J2	44	21	-	-	213
J3	81	31	-	-	260
J4	135	46	-	-	294
J5	-	-	-	-	343
J6	-	-	-	-	317
J7	-	-	-	-	-
J8	-	-	-	-	-
J9	-	-	-	-	-
J10	214	73	37	43	294
J11	120	59	27	57	204
J12	340	54	115	176	631
J13	277	58	97	107	481
J14	71	55	35	24	130
Average per jornada	147	49	62	81	300

Source: Legal Department, Proyecto de Legalización de la Tenencia de la Tierra (PROLETIERRA).

TABLE 5.4

Planned Efficiency versus Actual Efficiency for 1987

MONTH	PARCELS DELINEATED			FICHAS PROCESSED		
	Planned	Actual	Difference	Planned	Actual	Difference
January	0	0	0	0	0	0
February	210	0	-210	63	0	-63
March	490	0	-490	147	0	-147
April	840	145	-695	252	129	-123
May	1,260	553	-707	378	473	+95
June	1,950	672	-1,278	525	637	+112
July	2,240	-	-	672	-	-
August	2,730	-	-	819	-	-
September	3,220	-	-	966	-	-
October	3,710	-	-	1,113	-	-
November	4,200	-	-	1,260	-	-
December			(v a c a t i o n)			
Total	20,850	1,370	-3,380	6,195	1,239	-126

Source: PROLETIERRA, "Objetivos específicos," 1987.

Using the data in Table 5.3 as representative of all **jornadas**, an adjudication efficiency of 68 **fichas** per team-month can be computed for the Sierra, where 4,200 **fichas** were processed in 62 team-months. In Table 5.4, these achievements are compared with the annual plan for 1987.

The discrepancies between planned objectives and achieved objectives can be partly attributed to the late start of the project as well as to deficiencies in the number of field personnel.

Although fieldwork was scheduled to commence at the beginning of February, it actually began in the second half of April. In the 1987 plan, the initial seven-team field group was to increase by an additional group every month, so that by the end of the year there would be ten field groups (seventy teams). But by the end of July, there were only two groups (fifteen teams) operating in the field. Other factors that had a detrimental effect on efficiency include: (1) delays in price negotiation and acquisition of aerial photography from IGM, (2) inefficiency in the field-team structure of one delineator and one investigator, and (3) smaller parcel sizes encountered (4.8 hectares) than estimated for the average project area (10 hectares).

An additional thirty fieldworkers have received training since the sixth **jornada**; the work force currently (as of late 1987) consists of thirteen

teams (two groups), each comprising one delineator, two investigators, and one legal advisor (per two teams).

It is important once again to point out that the current field area, in the cantons of Pedro Moncayo and Cayambe, may not be representative of the whole project area and that certain conclusions drawn from efficiency levels in these areas may not be valid when extrapolated beyond this two-canton area. On the other hand, the advantage of working in such well-documented areas may well be counterbalanced by the smaller-than-average parcel sizes encountered.

In any event, this efficiency evaluation does highlight certain problem areas and provides an accurate comparison of the achieved fieldwork with that proposed in the 1987 work plan. As more experience is gained in the field and procedures become more streamlined and familiar, one can expect a corresponding improvement in efficiency.

5.7.2 Complexity

The delineators and investigators in the field teams all have the equivalent of a high school diploma and several hold university degrees. They are selected from existing IERAC staff and, on average, possess about ten years' work experience with this institution. Many of the investigators have worked as promoters for IERAC regional or zonal offices and generally have a fairly thorough knowledge and understanding of the Agrarian Reform Law and its related procedures. Several of the delineators have worked as "topographers" (surveyors) for IERAC and are familiar with conventional theodolite and tape survey techniques, but very few have any previous experience with aerial photography. The legal assistants generally hold a law degree (licenciado) but usually have not completed the thesis that is required to register as a lawyer (abogado). The legal supervisors and the two advisors in the field office are all fully qualified lawyers.

The delineators, investigators, and legal assistants receive a ten-day training course prior to project participation. This consists of a five-day course in the theoretical aspects of PROLETIERRA, followed by five days in the field working with their more experienced colleagues.

The more complicated mapping aspects of the project will be contracted out so that it is not necessary for IERAC to develop a sophisticated mapping capability or train personnel to fulfill these tasks. However, IERAC will need someone who understands problems associated with digital mapping, particularly those related to managing and updating digital databases.

The three private mapping companies in Quito and IGM possess stereo-plotting and stereo-compilation equipment as well as some computer facilities for obtaining digital information. Each company has its own surveying facilities and all are equipped with modern surveying instruments, such as theodolites and electronic distance measurers (EDM). One company, Inaldez, also owns a Wild total station.

Although it is not clear what "intelligence" (capability to answer questions without human interference) level is being contemplated, the digital

database should be structured to facilitate the following operations: (1) merge digital data from different stereo-models so that the cadastral map coincides with the 2-minute-by-3-minute geographic area of the map scheme, (2) generalize the cadastral data to the parroquia or canton level (USAID 1985, p. 39), (3) accomplish the efficient updating of cadastral data (see Section 5.7.6), and (4) integrate cadastral information with other types of information to lay the foundation for a national cadastre (USAID 1985, p. 18).

5.7.3 Maintainability

The breakdown of the Property Registry jurisdictions to the cantonal level in Ecuador has distinct maintainability advantages over countries where larger districts, such as the province or department, are used. The smaller registry district of the canton means that the titling system is more accessible to landholders, and the frequency of transactions and amount of information recorded in the registry are much smaller, making the system less unwieldy and easier to manage and maintain. However, the large volume of informal transactions that have occurred outside the registry, and the complexity of the administrative procedures related to titling, have tended to nullify these advantages. The project will attempt to improve this situation by promoting the advantages of formal registration and by simplifying and streamlining titling procedures.

Making the possession of title a prerequisite for the acquisition of credit from most formal lending institutions has provided a strong incentive to follow the legal channels associated with tenure changes. In the past, the widespread use of credit from informal sources (an estimated 60 percent of total agricultural credit) has enabled many small farmers to circumvent these channels, but attempts are being made to expand the use of formal credit in the small-farmer sector through the Land Market Financing Project (Stringer 1985). The higher market price of titled land is a further motivation to work within the formal system, particularly for those owners who wish to sell land.

The maintenance of computer hardware does not appear to present much of a problem in Ecuador as there are several computer firms with offices in Quito. The calibration and maintenance of photogrammetric equipment, for example, is done in-house or by technicians from Wild (CMS 1985, pp. 52-59).

The maintainability of the computer databases in the system will depend to a large extent on the "intelligence" of the system and its ability to access, relate, and edit specific data items (such as the coordinates of a property corner or the name of a property owner). If new property corners are created through subdivision or existing boundaries are altered through consolidation, it should not be necessary to redigitize the whole cadastral map sheet in order to incorporate these changes in the digital database. The system should facilitate the maintenance of the database through providing efficient and inexpensive updating mechanisms.

Naturally, it is equally important to provide adequate incentives, such as those discussed above, to insure that landowners come forward with these new data. The degree to which landholders work within the formal system is often a direct indication of their confidence in that system and a measurement

of tenure security and other benefits to be gained from their possession of title. The currency of the CLIS can, therefore, be used as an indicator of the success of the system within the landholding sector, provided effective procedures are adopted for the maintenance of information within the agencies managing these systems.

5.7.4 Cost

The cost data available and the manner in which they were categorized do not allow a very detailed cost analysis. Consequently, this evaluation will be restricted to a consideration of general budget figures and a rough estimate of the number of parcels and hectares in the project area.

TABLE 5.5

Proposed Unit Costs for All Activities (in U.S. dollars)

	(1) TOTAL COST[a]	(2) RECURRING COSTS[b]	(3) 1987[c]
Amount[d] ($000)	$20,000	$16,563	$3,100
Area (000 ha)	4,000	4,000	670
No. parcels	400,000	400,000	46,946
No. new titles	120,000	120,000	17,809
Cost per hectare	$5.0	$4.1	$4.6
Cost per parcel	$50	$41	$66
Cost per new title	$167	$138	$174

Source: Instituto Ecuatoriano de Reforma Agraria y Colonización (IERAC), "Proyecto de legalización de tenencia de la tierra: Proletierra," 1987.

a. Source: Ibid.

b. Source: PROLETIERRA budget plan, n.d.

c. Source: PROLETIERRA, "Objetivos específicos," 1987.

d. $1 = sucres 194.

In Table 5.5, unit costs are shown for the total cost of the project (column 1), for the recurring costs over the lifetime of the project (column 2), and for the recurring costs in the 1987 budget (column 3). The costs shown in column (3) can probably be regarded as the most representative since they are based on specific budget figures for a single year, as opposed to those in columns (1) and (2), which are based on the five-year project budget. The extremely high unit costs for new titles are somewhat misleading as they apply only to those parcels which have not previously been subject to any part of the titling process. This means that the many "semiformal" tenured parcels (those which have entered the titling process but have not completed it) are disregarded even though they constitute a large proportion of the project work.

A more refined analysis of the Ecuadoran system will be possible once further fieldwork has been completed and contracts have been awarded for mapping.

5.7.5 Quality

The fact that this project commenced in April 1987, with data available only until October 1987, makes it difficult to comment on the textual quality of the information in the system. There has not been sufficient time to test the quality of this information nor to obtain any feedback from new titleholders. The focus in this section is, consequently, on spatial quality issues.

The current project design proposes the use of an automated stereo-compilation approach to cadastral mapping. The quality of the data generated through stereo-compilation will generally be higher than that acquired through the direct manual digitization of a map or orthophotograph, assuming an equivalent photo scale in all cases. This is due primarily to the stereovision capability and the superior magnification available on a stereo-comparator. Whether this higher quality is significant or not is a question of the types of boundaries that are being mapped and the requirements and uses of the system. In Ecuador, the improved spatial quality to be derived from stereo-compilation does not appear to be significant, but it does offer cost, efficiency, and various other advantages.

One factor that causes degradation in the spatial quality of boundaries in Ecuador is the practice of representing general boundaries, such as fences and natural boundaries, as straight lines when, in reality, these lines are generally curvilinear. In the English general boundaries system, this problem does not arise as the precise physical feature is mapped and constitutes the legal property boundary. In Ecuador, straight lines are used to approximate the physical boundaries. Although there may be some spatial degeneration in this approximation process, it is highly unlikely that this will ever prove significant. Furthermore, there are distinct advantages to this linear approach when data are being recorded in a digital environment, for it not only reduces the amount of data to be recorded but also simplifies the organization, manipulation, and updating procedures.

When considering the spatial quality of cadastral maps, digital or manual, it is important to remember that the map is only documentary evidence of the legal position of the boundary. In the same way that the physical monument

takes precedence over field measurements in a fixed boundary system, so the physical feature (fence, ditch, line of trees, and the like) should take precedence over the cadastral map in a general boundaries system. This does not detract from the fact that a cadastral map, in addition to furnishing evidence as to the location of boundaries, provides a valuable record of the general distribution of land parcels and a means of linking textual land-tenure information to its corresponding spatial description.

Cadastral systems, and the land surveyors who support them, are often accused of being unnecessarily precise and therefore overly expensive (see Dale 1975, for instance), particularly in areas where property values are very low. To answer the question of what is an appropriate precision level, one must examine the needs of the users of the system (landholders and land administration agencies) and the precision necessary to support a secure land tenure system. In the course of the fieldwork for this study, it was interesting to observe the attitudes of Ecuadoran landholders toward the question of boundary precision. Two important quality factors emerged.

The first factor relates to the fact that landholders' spatial accuracy demands are often proportional to the <u>quality of the land</u>. In one case, a 6-meter shift in the boundary position on poor sloping ground was acceptable while a 4-meter displacement on marginally flatter and more fertile ground was not.

The second quality factor relates to the high priority given to the <u>certainty</u> or <u>stability</u> of the boundary position regardless (within reason) of its precise location. Presumably this stability will prevent future boundary disputes and thereby provide additional security of tenure to the holder.

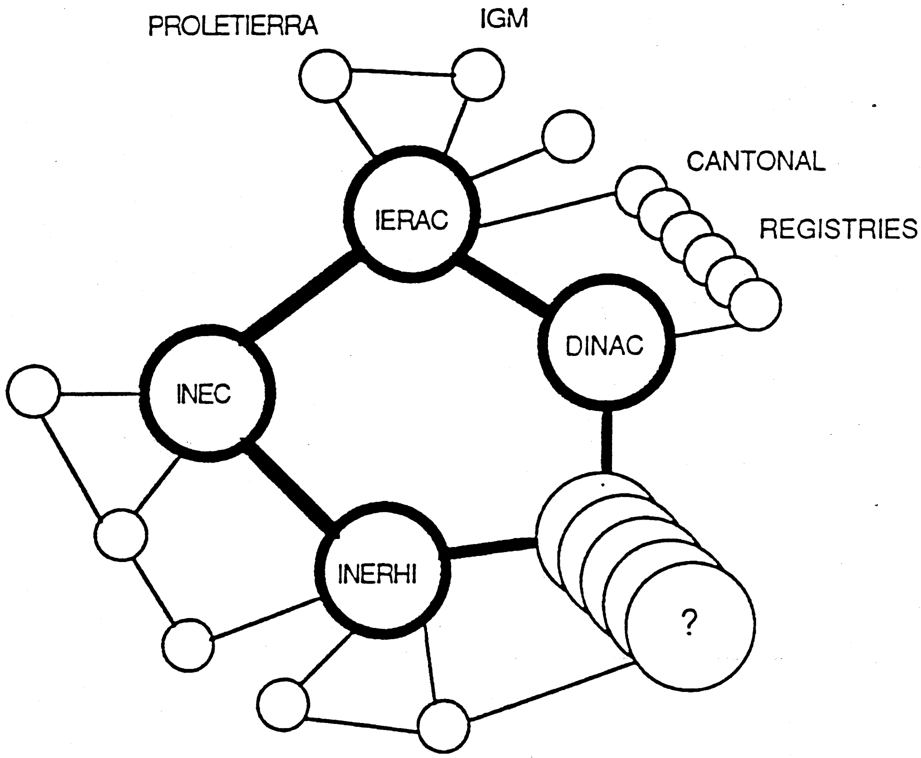
These two factors are regarded as essential considerations in deciding precision and accuracy standards in a country such as Ecuador.

5.7.6 <u>Utility</u>

The aim of PROLETIERRA is to create not a dominant central information system but rather one that will involve a variety of interacting user agencies in a network arrangement. Besides the obvious political dangers of having a centrally controlled system in a country where the governments change often, there is apparently no single agency that could successfully manage such a role.

The network approach envisioned by PROLETIERRA places the responsibility of creating and maintaining individual databases with each agency within the network. Once a database has been created, any other user agency will be able to access and use it for its own particular purposes. This access will be through a modem link or through an exchange of removable disks. Possible participants in an LIS network are shown in Figure 5.5.

Each agency (node) in the network will require digitizing and graphics-editing capabilities to facilitate the maintenance of its particular database. IGM is currently negotiating the purchase of an INTERGRAPH system, possibly to place the institute in a strong bargaining position to become the lead agency



a. National Statistics and Census Institute
b. National Assessment and Cadastre Office
c. Ecuadoran Institute of Hydrological Resources
d. Military Geographical Institute

FIGURE 5.5

Possible LIS Network in Ecuador

in the information system. The security clearances, delays, and priorities traditionally associated with military organizations make such an eventuality highly undesirable. It is also unlikely that IGM shares the same horizontal network ideal as PROLETIERRA.

PROLETIERRA/IERAC will also have a subnetwork which will link the IERAC Computer Center to either the cantonal property registries or, in the smaller and poorer cantons, the regional and zonal IERAC offices. In the latter cases, the IERAC offices will be responsible for creating and maintaining the Property Registry database.

While the structure described above is still a long way from implementation, it is highly desirable that potential user agencies be identified early so that their inputs and needs can be considered in the general network design. Too often, titling projects create information systems which are not sufficiently utilized by agencies that could gain considerable benefit from the land-tenure information available from the system (Barnes 1987).

The Ecuadoran CLIS is particularly interesting as it proposes to use a mapping approach which essentially consists of a series of digitized coordinates. Political activity in the country, unfortunately, resulted in the stoppage of all field activity in 1988. Consequently, data on the implementation of this system have been limited and evaluation efforts, severely restricted.

6. THE CADASTRE-BASED LIS IN ST. LUCIA

6.1 Introduction

St. Lucia is the second largest island in the Windward Islands of the eastern Caribbean, lying immediately south of Martinique and north of St. Vincent. The whole country covers an area of 61,660 hectares (approximately one-sixth the size of Dane County, Wisconsin) and is divided into eleven administrative districts called "quarters."

The 1980 population of St. Lucia was estimated to be 119,000, with the capital city of Castries housing approximately 40 percent of these people. Population growth has been relatively slow (1.59 percent in 1980), due primarily to the large number of emigrants. A survey of women farm residents at the beginning of this decade revealed that 37.4 percent of their children were no longer living in St. Lucia (Knudson and Yates 1982). The concentration of people in urban areas has caused some observers to describe the island as "fundamentally a village society, with farm families living in urban centers and walking to their land daily" (OAS 1986, p. 1). A survey of small farmers from various parts of the island showed that the literacy level is around 84 percent (Laville 1978), considerably higher than in most other developing countries. Most of the population (40 percent) are employed in the agricultural sector, and the cultivation of bananas for export remains the chief farming activity.

The island is extremely mountainous, with peaks reaching altitudes over 3,000 feet. The major mountain ridge runs along St. Lucia's south-southwest to north-northeast axis and has a major influence on rainfall patterns. The highest rainfall is recorded in the mountains and this decreases as the elevation drops off to the coast. The humid tropical climate of this region is tempered to some extent by the trade winds. The central mountainous region of the island falls in the central forest reserve which, together with adjacent forest and woodland areas, covers an area of some 6,634 hectares (MUCIA/LTC 1983). The Land Registration and Titling Project covered all of the land in St. Lucia with the exception of the forest reserve.

6.2 Historical Background

When Napoleon was defeated by the allies in 1814, St. Lucia was one of the few captured colonies that was not returned to France. The island was ceded to Britain under the Treaty of Paris, but the Civil Code introduced by the French was retained. This code was based originally on the Quebec Civil Code (White 1981) and is still in force today. The first and only islandwide cadastral survey was undertaken between 1783 and 1787 by a team of French surveyors led by Lefort. In addition to surveying and mapping all quarter and individual parcel boundaries, the French created a register containing owners' names, parcel areas, and crops grown (LRC 1980; Lawrance 1979). Unfortunately, this cadastre was never maintained and could not be used as a sound basis for a new survey.

6.3 Land Tenure Situation

Land tenure is an extremely important consideration in the design of any CLIS, but few countries have given it the recognition and emphasis it deserves. St. Lucia is one country where land tenure has received a great deal of attention. Problems related to tenure have been cited as one of the primary justifications for the implementation of a new land registration system (OAS 1986; Woodson 1982; Laville 1978; LRC 1980; Meliczek 1973; Lawrance 1979).

The strong person-person relationship inherent to land tenure on the island is demonstrated by the following description: "In St. Lucia . . . land functions not only as a legally defined economic good, but also as a medium through which social relations between individuals and groups are expressed and sustained" (Woodson 1982, p. 2). "Family tenure," whereby land is held in undivided shares by the intestate successors of the original owner, has generally attracted the most attention (see, for example, Bruce 1983), but this constitutes only one of seven different tenure categories. These tenure classifications are shown in Figure 6.1 and described more fully in the remainder of this section.

STATE (CROWN)	PRIVATE OWNERSHIP	FAMILY TENURE	OCCUPATION "BY PERMISSION"	RENT	SHARE CROPPING	SQUATTING

FIGURE 6.1

Classification of Land Tenure in St. Lucia

It is fairly common in St. Lucia for a holding to be made up of several separate parcels held under different tenure conditions and located in different areas. The 1973/74 census maintained that some 29,150 hectares were in agricultural holdings and that approximately 83 percent of these (including 502 holdings "without land") was under 2 hectares (5 acres) in size. The average number of parcels per holding (of an individual or group) was 1.12.

State land, or crown land, as it is more commonly known, comprises fairly extensive forest areas as well as land that has escheated to the state over the years. It is interesting to note that under the Land Registration and Titling Project (LRTP), the state is required to come forward and claim its land just like any other landholder.

Private ownership, or freehold, occurs when an individual, corporation, or group of individuals (proprietors in common) holds the full bundle of property

rights, including rights of possession, use, usufruct, and disposal. A socio-economic survey of 300 household heads in the Morne Panache pilot-project area determined that most people in this category possessed documentary proof of their claims (Woodson 1982). The 1973/74 census showed that 72 percent of the holdings was held under this tenure form.

Woodson (1982, p. 26) defined family tenure as "the collective inheritance of possession, use and usufruct rights in land by a group of persons who are related by blood." The practice of leaving family land to all heirs in equal and undivided shares means that the pool of "shareholders" grows significantly with the passing of each generation. This situation is further complicated by numerous intestate inheritances, the large number of illegitimate children [possibly as many as 50 percent of all children on the island (Bruce 1983, p. 3)], and the huge emigrant population with claims in family land.

Although it is popularly believed (Meliczek 1973; Allsebrook 1978) that the complex Civil Code laws relating to intestate succession have led to the emergence of family tenure, several authors (Bruce 1983; Lawrance 1979; Woodson 1982) point instead to land scarcity and various socioeconomic factors such as the pooling of resources to acquire land. Like many customary tenures in Africa, family tenure provides a form of social security by functioning as a tangible bond between family members who have moved off the land and those who have remained. The geographical extent of this type of tenure is a matter of some debate (see Bruce 1983, p. 28, for a summary), with the most reliable estimates being between 25 and 35 percent of the total area of farmland held in the private sector (Bruce 1983, p. 46). In a survey of the Morne Panache district, approximately one-third of the family land parcels was found to be affected by title and boundary disputes (Woodson 1982, p. 23).

Leasehold tenure refers to land in which the use and usufructuary rights have been temporarily transferred from the owner to another party in exchange for an agreed sum of money. Leases may be formally documented in a contract or simply arranged verbally, and the lease period varies from a single crop season to several years (Woodson 1982, pp. 30-31). The 1973 census revealed that 2,000 agricultural holdings (19 percent) were held under leasehold while 469 holdings (4 percent) were held under a mix of leasehold and ownership.

Sharecropping is an arrangement whereby the owner gives the use and usufructuary rights to another in exchange for a share (usually one-third) of the harvested crop. Typically, the harvest is divided into three equal quantities with the "cropper" getting first and third choice (Woodson 1982, pp. 31-32). Some 400 holdings (4 percent) were found to be under this kind of tenure in the 1973 census.

Occupation "by permission" is the granting of use and usufructuary rights to a person for a short period of time (usually one crop season) without any expectation of monetary or crop remuneration. This tenure is generally extended to family members or friends and in some cases may incorporate several acres.

In the legal context, squatting is defined as the occupation and use of any land without the lawful holder's permission or sanction. Woodson (1982,

p. 33) explains that the customary definition of squatting excludes the use of fallow state land by a local community member who desperately needs more land. In a survey of small farmers cultivating bananas, an islandwide sample revealed that all but 7 percent of squatter tenure was on state-owned land (Laville 1978, p. 11).

When asked to rank tenure types according to tenure security and "degree of autonomy over farm operations," respondents in the Morne Panache survey rated ownership first, followed by leasehold, family land, sharecropping, occupation "by permission," and squatting, respectively (Woodson 1982, p. 34). The same respondents indicated that they were in favor of a land registration project as they felt it would help resolve many land tenure problems and possibly facilitate rural development. In Laville's (1978, p. 6) study of small farmers, the primary reasons for not registering property were found to be: (1) insufficient finances, (2) lengthy delays (up to two years), (3) registration being regarded as unnecessary as there were no disputes with neighbors, and (4) family tenure holders living outside the country being wary of the implications of surveying the land.

Laville (1978) also found that tenure insecurity and land tenure complexities acted as major constraints against the use of credit within this sector. In many instances rural development is constrained by the extremely fragmentary nature of agricultural holdings and the subeconomic size of individual parcels. Bruce (1983, p. 21) noted that "family land is for all practical purposes shut out of St. Lucia's land market, frozen in the hands of the co-owners in possession." It was suggested that this problem could be addressed through the LRTP by providing the tenure security and credit resources necessary to promote a land market which would include family land and encourage consolidation.

Recognizing the need to address these land-related problems, the Government of St. Lucia (GOSL) appointed a Land Reform Commission (LRC) to investigate and recommend appropriate strategies. As a result of the recommendations of this commission (LRC 1980; LRC 1981) and the support offered by the Organization of American States (OAS), the GOSL decided to go ahead with a land-registration pilot project to test the viability of introducing an islandwide initiative.

6.4 LRTP: The Land Registration and Titling Project

Toward the end of 1982, a pilot project was initiated in the Morne Panache area of Dennery. The objectives of this project were:

> to test the feasibility of the technical solutions proposed for the establishment of a land cadastre and the granting of land titles. The pilot project was also designed to enlarge existing knowledge of the multiple constraints affecting the development of the small farming community . . . and to investigate the extent of the existing land tenure problems . . . (OAS 1986, p. iii).

The project covered a 600-hectare (1,500 acre) area which was selected as being representative of other farming communities in St. Lucia, where lack of

clear title and land fragmentation were prevalent (St. Lucia 1983, p. 1). Titling efforts were restricted to boundary demarcation (the clearing and/or marking of boundaries) and survey, since new legislation dealing with adjudication and registration had not yet been passed by Parliament. Although only about one-third of the area was demarcated in the twenty-eight weeks devoted to this task, the project demonstrated very clearly the kinds of problems to be faced in a project of this nature and the mechanisms that would be required to implement an islandwide project in an efficient manner.

USAID agreed to fund the LRTP as part of the St. Lucia Agricultural and Structural Adjustment Project. The general aims of this project were to improve tenure security, promote crop diversification, and intensify and improve banana production through a replanting program (USAID 1983). The $8.5 million LRTP, funded primarily through a grant from USAID, formed the largest component of the adjustment project and included demarcation, adjudication, survey, mapping, and implementation of a registration-of-title system modeled on systems operating on other islands in the Caribbean.

In August of 1984, United Aerial Mapping (UAM), a commercial company based in Texas, was contracted to record the estimated 27,000 parcels in the project area and to create the initial information base for the new registry. Initially the contract specified that only those parcels outside Castries and the forest reserve were to be recorded, but in 1987, a decision was taken to include the estimated 7,000 parcels in Castries. This is one of the first times that a commercial company has taken on a project of this nature and scale. The contract between GOSL and UAM was based on a so-called "cost-plus" principle, whereby the contractor agrees to a certain maximum budget for project costs and in return receives a fixed fee (Syrett 1986b). The LRTP consists of the following phases or components: (1) planning, preparation, and promotion; (2) reform of existing land adjudication, surveying, and registration legislation; (3) training; (4) processing of land claims; (5) boundary demarcation; (6) adjudication of land rights; (7) boundary survey (parcel delineation); (8) cadastral (index) mapping; and (9) registration of title.

From the start, UAM emphasized the planning and management aspects of the project. The UAM project team leader explained, "We had already decided at the proposal stage that an adjudication project did not involve sophisticated surveying techniques. Rather, it was one that needed careful and precise management and in this regard sophisticated management tools were deemed to be the most important aspects of the project" (ibid. 1986b, p. 128).

Each adjudication area ("section") was assessed in terms of terrain, access, climate, parcel density, awareness of the landholders, and realistic efficiency of the field teams. This assessment provided the basis for a comprehensive workplan which was formulated by using a critical path management (CPM) approach.

Orthophotography was considered as a base for the delineation of property boundaries, but the overlap in existing photography proved to be inadequate for generating orthophotographs. The use of unrectified photos for this purpose was not regarded as a viable option because of the severe scale distortion caused by the steep terrain (ibid. 1986b, p. 132). Therefore, it was decided that existing 1:25,000 topographic maps would be used for boundary delineation.

Since less than half the island was covered by these maps, UAM was required to produce additional maps from existing aerial photographs. These line maps provide the spatial (graphical) control necessary for the graphical survey of property boundaries.

It was evident from the pilot project that a stronger promotional effort was required to introduce the LRTP efficiently and effectively. Promotion, therefore, was given a high priority in the LRTP: articles were published in local airline magazines; advertisements were placed in newspapers and aired over TV and radio; seminars were held for politicians, bankers, lawyers, and surveyors; and a special "LRTP calypso" was broadcast over the radio (ibid. 1986b, p. 131).

The legal foundation of this project was laid out in three acts that were introduced specifically for this purpose. These are the Land Adjudication Act (No. 11 of 1984), the Land Registration Act (No. 12 of 1984), and the Land Surveyors Act (No. 13 of 1984). The Land Adjudication Act outlines the process of acquiring title to land under the new system and defines the responsibilities of the adjudication team and landholders. The Land Surveyors Act describes the legal requirements for the spatial definition of land, and the Land Registration Act details the elements and working of the new title registration system.

The training component was aimed at the technical employees who were recruited locally, as most of the fourteen UAM staff members already possessed extensive experience in the techniques and procedures to be used in the LRTP. Local recruits, including field and drafting personnel, were required to attend a six-week training course prior to participation in the LRTP.

Each quarter was subdivided into clearly identifiable adjudication "sections" which were then used as separate units of operation for the implementation of the project. The field personnel were organized into two survey brigades, each led by an adjudication officer and composed of a survey party leader, four demarcation/survey/recording officers, and eight survey parties. Initially (December 1984 to May 1986), only four survey parties were used in each team, but this was increased to six in June 1986. The composition of the two field brigades is detailed in Figure 6.2.

Each field team in the two brigades is composed of a demarcation/survey/recording officer (UAM), a demarcation assistant, two survey assistants, a recording assistant, a driver, and two to three laborers.

Although the roles of the demarcation, survey and recording officers were described as three distinct duties in the Land Adjudication Act, the LRTP combined these duties so that a single officer was vested with complete responsibility for these three elements of the project. Fieldwork commenced at the beginning of 1985, with the two survey teams working from opposite sides of the island. The project completion date was set for August 1987, which was then extended to include the urban area of Castries. The project was completed in December 1987.

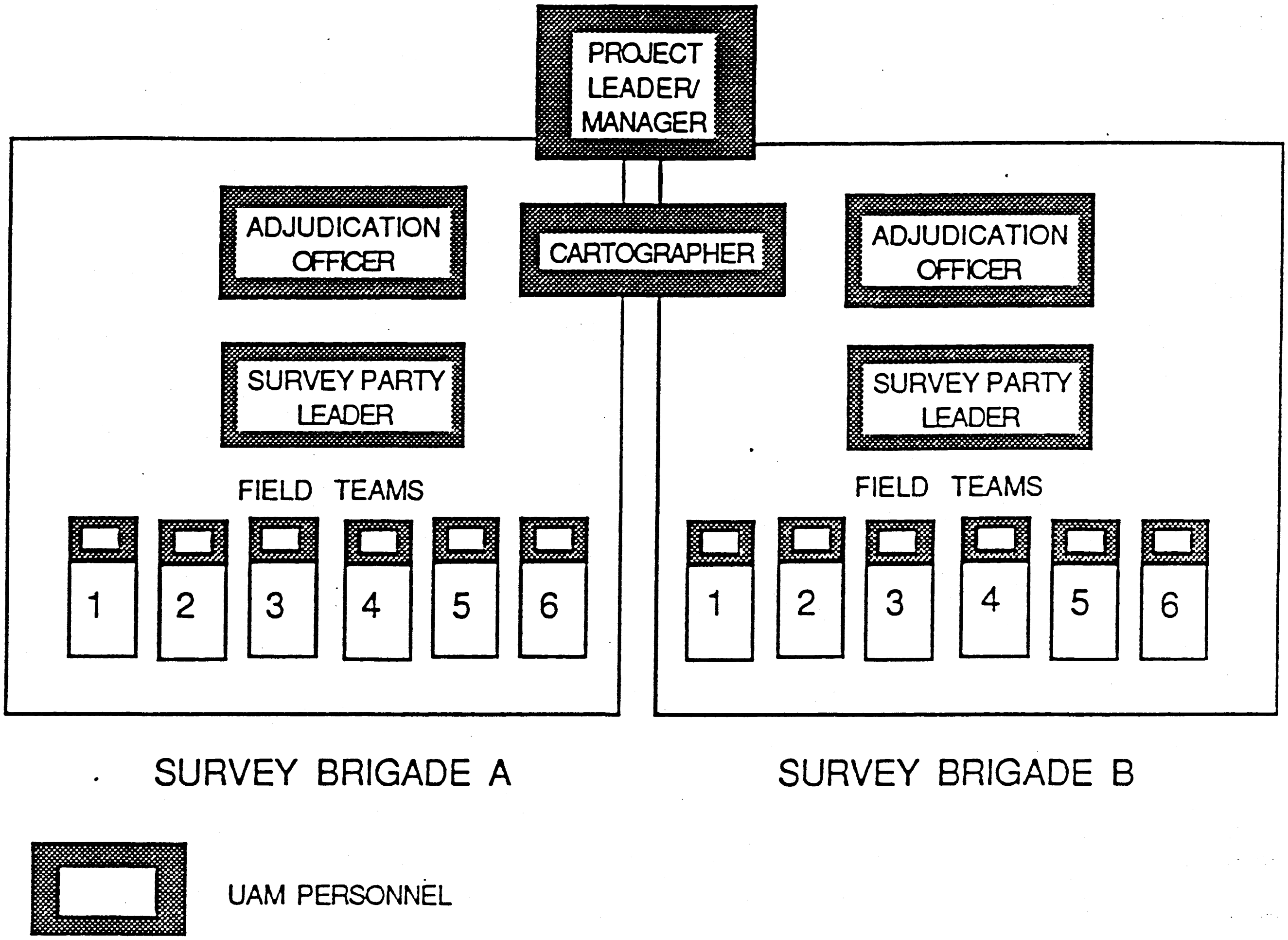


FIGURE 6.2

Structure of LRTP Project Team

6.5 Institutional Framework

Eighteen different government agencies have been identified as major users of land information in St. Lucia (Green 1986). In his study of user requirements for a St. Lucian LIS, Green (ibid., p. 159) described the institutional arrangements as "a large array of organizations" with a clear need for better cooperation and coordination, particularly in the areas of natural resource management, environmental assessment, land use planning, and soil and water conservation.

The Land Registry and Survey and Mapping Offices form part of the Central Planning Unit, the primary user of land information within the Ministry of Finance and Planning. The Development Control Authority (DCA) is an executive level body which shoulders the ultimate responsibility for development control. All applications submitted for physical planning must be approved by the DCA. The proposed "Land Management Information System" will link databases in physical planning, survey, and mapping and the Land Registry. The institutional framework, showing the agencies with an interest in a broad-based LIS, is shown in Figure 6.3.

6.6 Components of the St. Lucian CLIS

6.6.1 Input

In order to simplify the implementation of a new registration-of-title system in St. Lucia, all land (including state land) was declared to be unclaimed and unowned. While this may be regarded as a rather drastic measure which ignores the historical legal record in the registry, in reality, the public record had become buried by a myriad of documents generated by transactions over the past 200 years. A further advantage of a "clean break" from the old deeds system was the avoidance of a situation in which the old system continues to operate after the implementation of the new system, thus challenging its effectiveness and completeness. ÑIt is interesting to note that an "old system" based on deeds still persists in parts of Australia, the birthplace of the Torrens system (Williamson 1983).ñ

Once an adjudication section was declared open, all landholders within the area were given six to eight weeks to come forward and claim their land. Participation in the project was compulsory and only those land rights that were claimed, adjudicated, surveyed, and registered were recognized under the new system. Claimants were required to provide information on the location of their holdings, how they acquired the land, and other facts relating to their boundaries and adjoining holders. In the case of absentee owners who had not submitted claims, the adjudication officer requested the registrar to supply him with all information pertaining to the claim and then treated this in the same manner as other claims.

The demarcation and surveying officers, together with their assistants, were responsible for collecting all the spatial data relating to parcel boundaries, while the recording officers and their assistants carried the responsibility for collecting textual data associated with the tenure of each parcel. Although the demarcation, surveying, and recording officers' duties were carried out by the same person in the LRTP, they are treated as three separate roles in this section.

<u>Spatial Land Tenure Data</u>. The delineation of the administrative boundaries of quarters did not present any problem since these boundaries were well known and easily identifiable. The boundaries of the adjudication sections (subdivisions of the quarter) were specifically selected to coincide with roads and other major features in order to simplify the identification and delineation of these units.

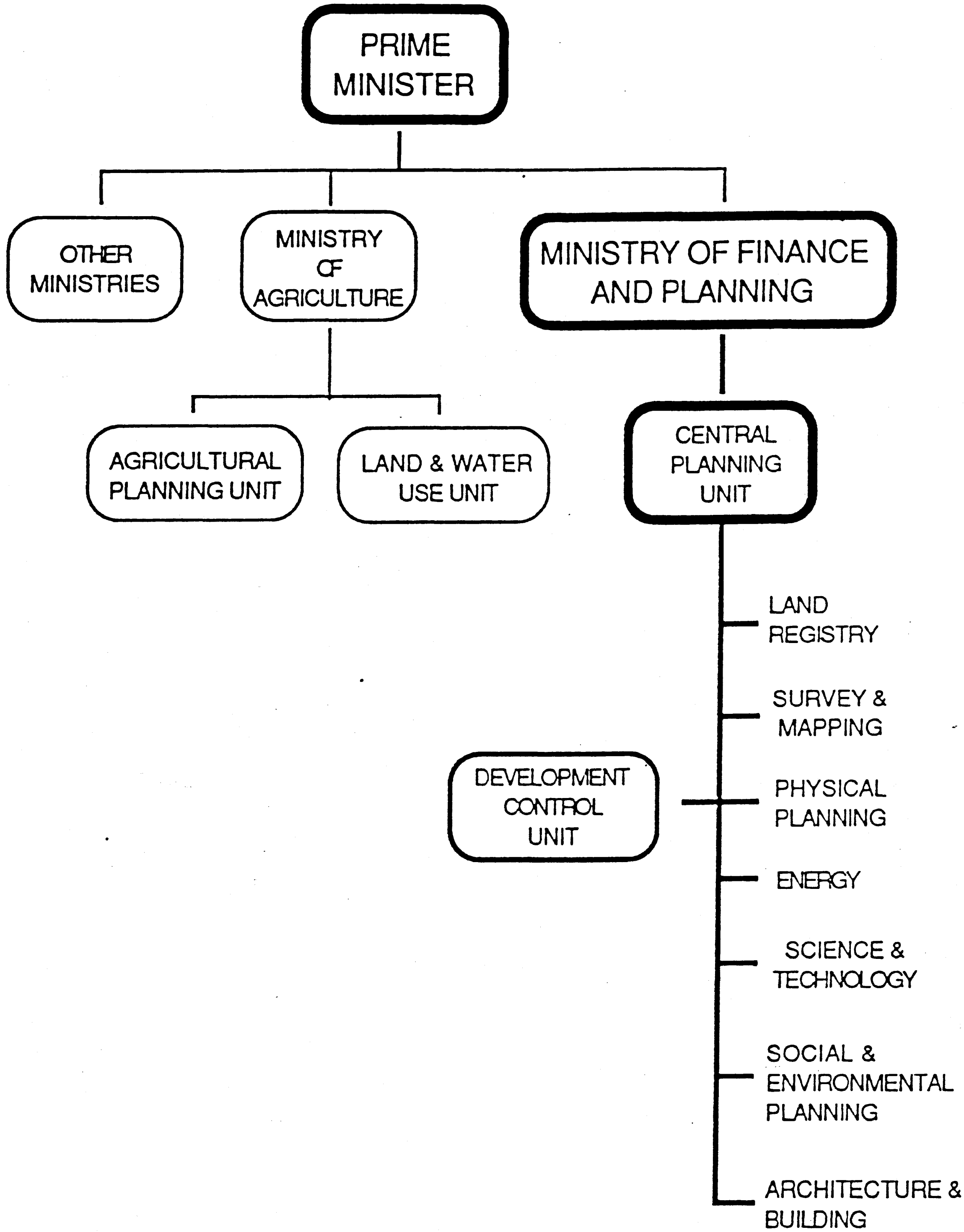


FIGURE 6.3

Institutional Framework (St. Lucia)

In the past, a "fixed" boundary system had been used for defining property parcels in St. Lucia, but it was decided that using a general boundaries system in the new CLIS would be quicker and cheaper. In St. Lucia, many boundaries are defined by "immotel" (immortal) trees growing at intervals along the boundary, and the boundary is accepted as the approximate invisible line between these point features.

The Land Registration Act (Sect. 6.1.d) required that all claimants "mark or indicate the boundaries of the land claimed in such a manner and before such date as shall be required by the Demarcation Officer." The landholders were encouraged to demarcate their boundaries by means of metal pegs set in concrete and were expected to clear their boundary lines. The demarcation officer was responsible for the inspection of the boundaries of each parcel to insure that they had been appropriately demarcated (Sect. 11). A demarcation certificate was used to record the observations of the demarcation officer. This certificate contains a sketch of the parcel, a description of the boundary features (fences, trees, and so forth), and a reference to the fieldbook. The demarcation officer was also empowered to resolve boundary disagreements between claimants, even if this involved adjusting the existing boundaries. Where no resolution could be attained, he referred the dispute to the adjudication officer.

The base maps which were prepared at the start of the project were used as a framework for both the survey and the demarcation map. The survey officer and survey teams were responsible for carrying out all the necessary survey work and for preparing a "demarcation map" of the section. This map could be compiled from survey data, or from aerial photographs, and had to display a parcel identifier for every parcel. The majority of the survey work involved the establishment of the position of the parcel boundaries relative to the features shown on the base map. This was generally accomplished by simply taping between the two or by running a compass/tape traverse around the boundary. In some rural areas where map features were scarce, it was necessary to run EDM/theodolite traverses from the geodetic control network (Syrett 1986a, p. 191). This control, however, was used only as a means of determining the graphical position of the boundaries to an accuracy that allowed it to be plotted on the demarcation map.

A recent questionnaire survey of properties which benefited from the LRTP showed that approximately 20 percent of these properties had been physically surveyed prior to the project (LTC 1988). In these cases, the parcels were defined by conventional survey methods and, though the parcels still appeared on the registry (cadastral) map, the original survey information took precedence over that collected by the LRTP (Land Registration Act, Sect. 18). In other words, the conventional survey was given a higher priority than the graphical survey of the LRTP.

Textual Land Tenure Data. It was the duty of the recording officer to "consider all claims to any interest in land and after such investigation as he considers necessary [to] prepare . . . a record in respect of every parcel of land shown on the demarcation map" (Land Adjudication Act, Sect. 14). In investigating these claims, the recording officer examined all of the claimant's documents, including old land-tax receipts, and in some cases retained

these for inclusion in the adjudication record. This record was the first instrument of registration in the new system and formed the textual component of the new cadastre.

In order to prove full ownership and qualify for absolute title, the claimant had to produce documentary evidence of ownership for a period of at least ten years. To obtain absolute title through prescription, the claimant was required to have held that land in "public, continuous, uninterrupted, unequivocal peaceable possession" for a period of at least thirty years (Land Registration Act, Sect. 16.1.a.i). In cases where the claimant had held land in this manner for a period of less than thirty years, he/she qualified only for provisional title. Prescription applied only to privately held land as it is not enforceable against the state. Provisional title was also awarded in cases where claimants were unable to produce documentary evidence of ownership for a full ten years (Syrett 1986a, p. 192). The recording officer was also required to investigate claims relating to secondary rights, such as mortgages, leases, and servitudes, and record all relevant details in the adjudication record so that they could be reflected in the register.

One of the more challenging aspects of investigating claims was the determination of rights in family land. Rights to this land may have accrued to numerous family members through intestate succession and in some cases it was difficult to ascertain who owned what, particularly when individuals with a valid claim were living outside the country. The adjudication teams made no attempt to partition (subdivide) family land and generally recorded the land in the name of "the heirs of Leonard Lewis," for example, where Leonard was the ascendant who most recently had held sole rights to the whole parcel. The onus is therefore on the heirs to subdivide and register their individual shares.

The final adjudication record contained the following information for each parcel: (1) parcel identifier and "approximate" area, (2) name and description of successful claimants, (3) manner in which land rights were acquired, (4) nature and holders of secondary rights, (5) list of documents retained by the recording officer for adjudication purposes, and (6) verification of records by claimants.

The identification of individual claimants was complicated by the absence of a national identification system for St. Lucians as well as by the custom of using multiple first and last names. One of the arguments for retaining the services of notaries in the conveyancing process is that it leaves the responsibility of personal identification in their hands (Martyr 1986, p. 139). Since notaries have traditionally played this role, this approach would not involve an increase in conveyancing costs. It has been suggested that identification problems could be alleviated by adding occupation descriptions to the information that is conventionally kept for this purpose (Lemel 1987, p. 10).

Once the adjudication records for a whole section were completed, the adjudication officer published a notice to that effect and opened the records and demarcation map for public inspection (Land Adjudication Act, Sect. 19). If any parties were unhappy with this record, they were allowed ninety days to petition the adjudication officer for a hearing. Where this officer's ruling did not satisfy all parties to the petition, the matter was appealed to an

adjudication tribunal, which was composed of a lawyer (chairman), a land surveyor, and an agriculturist. Appeals to this body had to be made within two months of the publication of the completion notice (Sect. 24.1).

As of October 1986, a total of 438 petitions and disputes had been heard and 109 were pending; 26 cases (6 percent) had been referred to the adjudication tribunal, and in only 4 of these appeals had the adjudication officer's ruling been overturned (Syrett 1986b, p. 134). When all petitions and disputes had been resolved in a section, or 90 days after the publication of the completion notice, whichever was later, the adjudication record became final and was sent, together with the demarcation map, to the registrar (Sect. 23).

6.6.2 Conversion Mechanism

Cadastral Mapping. Besides the early cadastral mapping efforts of Lefort and a subsequent attempt to compile an index map of all estates larger than 25 acres on the island (Rodgers 1986), very little mapping of this nature has been undertaken in St. Lucia. Prior to the LRTP, most parcels were described by reference to an individual survey plan and isolated survey data or simply by means of a metes-and-bounds description.

The LRTP cadastral or registry map in St. Lucia was compiled directly from the demarcation map that was produced by the field teams. Since this map is a true orthogonal projection of the landholding pattern, no rectification was necessary to convert it into a planimetric map.

Although computerization has been suggested (Paul 1987, p. 10), there are currently no plans to digitize the cadastral map. The potential benefits attainable from an automated cadastral database should be carefully weighed against the high costs and complexities involved in maintaining this base. It is probably too early for a country such as St. Lucia to venture into this level of technology, but due regard should be given to such an alternative in the conceptualization of the developing CLIS.

Parcel Mapping. The LRTP did not carry out any individual parcel mapping as all parcels were adequately displayed on the cadastral map. Parcel mapping is, however, undertaken by private land surveyors through individual parcel surveys. These surveys may be general boundary surveys, involving the relocation or establishment of general boundaries, or conventional surveys. When certain conditions have been met (for example, agreement of all adjoining owners), the registrar may declare a boundary to be "fixed," thus giving it a higher legal status than the other types of boundaries, such as the general boundaries established in the LRTP. The Survey Regulations (Regulation 32) specify that, "[a]ny boundary survey . . . [must] be carried out in such manner as is consistent with the existing survey data, boundary information, the nature of the boundary, and any recommendations made by the Chief Surveyor . . . ."

Conventional surveys must be connected directly to the national geodetic reference system (Reg. 33) and the required accuracy for both general and fixed boundary surveys is 1:3,000, with the exception of urban areas where it rises to 1:5,000. Surveyors are required to submit a parcel map or plan of

all property surveys, together with supporting fieldnotes, computations, and the like, to the chief surveyor for "authentication."

Title Registration. A rudimentary registration-of-deeds system had been in operation in St. Lucia since 1830 (Lawrance 1979), but no provision had ever been made for the linkage of this system to a reliable cadastral or parcel map (LRC 1980). After examining this system in 1980, the Land Reform Commission concluded that it should be replaced by a new system based on registration-of-title principles. This decision was based to a significant degree on the following four "cardinal" defects in the old system: (1) an incomplete record; (2) an inconsistent record (the format of the deeds was checked but not their content); (3) an ineffective link between the textual deed information (holders, nature of rights) and the spatial information describing the location, size, and dimensions of property parcels; (4) no means for "weeding out" obsolete documents, thereby allowing the Deeds Registry to become increasingly "congested" and "unmanageable" (LRC 1980, p. 15). Moreover, though survey plans had been submitted to the Lands and Survey Department, these did not play a role in the deeds description since all deeds were deposited in the registry, which was administered by a different department (Lawrance 1979, p. 9).

The need for a parcel-based registration system had been recognized for some time prior to the LRC investigation. In 1960, Clark's study of the registration systems in St. Lucia and five other islands led him to conclude that "what is wanted in each of the islands is a Cadastral Survey on which a system of land registration may be based" (Clark 1960, p. 1). This recommendation for a registration system based on the cadastral parcel was subsequently supported by Mathurin (1967), Meliczek (1975), Allsebrook (1978), and several others who studied the land tenure situation in St. Lucia. The system proposed by the LRC (1980, pp. 20-24) is modeled on similar systems operating in Antigua, Cayman Islands, Turks and Caicos Islands, Montserrat, and Anguilla and is a modified version of the Torrens registration-of-title system. The registration system (with small changes) that was implemented through the LRTP is known as the "O.D.A. system" because it was developed by the British Overseas Development Administration.

The central elements of the O.D.A. system are: (1) a parcel register containing the names and addresses of the owner(s), nature of title, description of secondary rights (appurtenances, encumbrances, and so on), and a reference to the cadastral (registry) map; (2) a cadastral map showing the location, size, and shape of all parcels; (3) an alphabetically arranged name index of property owners and holders of leases and mortgages; (4) an adjudication record for each parcel; (5) an application book showing the order in which applications were made to the Land Registry; and (6) a register and file of powers of attorney.

The register is arranged so that each parcel of land is represented on a separate page which contains details that are abstracted, in the first instance, from the finalized Adjudication Record. After this initial registration, register information is extracted from instruments of conveyance before they are filed in the Adjudication Record. All subsequent entries in the register must be supported by an instrument such as a deed (Land Registry Notes C.60). An instrument of conveyance and the format of the register folio (both

sides) are shown in Appendices B, C, and D, respectively. Register volumes, each comprising 250 folios, are maintained for individual adjudication sections. The folios in the volume are arranged numerically according to parcel numbers, and the register folio for a particular parcel may be traced by identifying the volume corresponding to the relevant section and then searching for the parcel number. An example of the full reference is given below.

BEEF ISLAND GROUP	**3641A**	**37**
(section name)	(block no.)	(parcel no.)

Although the O.D.A. system is technically a registration-of-title system like the Torrens system, it differs from the latter in three important respects. In the Torrens system, instruments that convey land rights actually form the folios in the register and so there is no need to maintain a separate, more detailed series of documents or to employ a notary to draw up the documents. The O.D.A. system does not contain a graphic plan or map of the parcel (such as the one on the Torrens certificate of title) but only a reference to the relevant cadastral map. No duplicate title documents are given to the owner, as they are in the Torrens system, and the register is the only authoritative record of the legal tenure status of a parcel.

Although landowners may obtain a "land certificate" of their parcel, this document is subservient to the register and cannot be used to effect legal transactions or to secure bank loans. It was felt that restricting the legal record to the registry, and not legally recognizing transactions outside the registry, would prevent the emergence of an informal conveyancing system. Such a system might well develop if duplicate certificates of title were given out (as they are in the Torrens system), since these would represent evidence of a valid and marketable land claim.

6.6.3 Output

Cadastral (Registry) Map. The cadastral or registry map was compiled directly from the demarcation map and is treated as an index to the register. This map was plotted manually at scales of 1:1,000 (urban areas), 1:2,500 (densely populated rural areas), and 1:5,000 (rural areas) and contains a graphical depiction of the adjudication section boundaries, individual parcel boundaries, and road reserves. The parcel number allocated to every parcel also appears on the map. Although major public rights-of-way are shown on the map, no private servitudes are depicted. Additional information relating to roads, rivers, improvements, and other natural and artificial features is obtainable from the base map to which the cadastral map forms an overlay.

The Land Registration Act (Sect. 17.1) declares that "the Registry Map . . . shall be deemed to indicate the approximate boundaries and the approximate situation only of the parcel" [author's emphasis], and the following disclaimer appears at the bottom of every map sheet: "This plan is not conclusive in the precise position of any boundary unless this has been fixed in accordance with . . . the Land Registration Act of 1984." Since this map is

regarded as an index map and not prima facie evidence of parcel boundaries, one has to question what records or information do in fact provide this evidence. This question is explored further as a quality issue in Section 6.7.5. The maintenance of the cadastral map is the responsi- bility of the chief surveyor, and any alterations to the map must be authorized by the registrar.

The numbering system used for these maps is identical to the system used for the base maps, except that an additional alpha character is added to the end of the map numbers, for example, 6852.B. This character may be an A (1:5,000), B (1:2,500), or C (1:1,000), depending on the scale of the cadastral map. The full parcel identifier (PID) is composed of the following elements:

BASE MAP NO.		**PARCEL NO.**
6 8 5 2	B	4 2 0
CADASTRAL MAP NO. (block no.)		

From a cartographic standpoint, it is worth noting that neither the base maps nor the cadastral maps contain a north point. The cadastral maps also omit any indication of the date of publication or compilation. Samples of the base map and cadastral map are shown in Appendices E and F.

Parcel Map. The survey regulations require that all parcel maps be drawn to a scale that is consistent with that of the cadastral (registry) map containing the parcel (1:1,000, 1:2,500, or 1:5,000) or to whatever scale is required by the chief surveyor. The map should contain "sufficient information to allow the survey to be recomputed" (Reg. 65.2) and must be plotted by rectangular coordinates (Reg. 67). In addition, the following data must be displayed (Regs. 67-73): (1) coordinate grid, (2) coordinates of permanent control stations, (3) a plot of all monuments and control stations, and (4) all topographic features surveyed to a "reasonable" degree of precision.

Parcel maps depicting fixed boundaries must also contain the coordinates of all block and parcel corners as well as boundary distances and bearings (Reg. 70). When a fixed-boundary parcel map has been approved by the chief surveyor and filed in the registry, it "shall be deemed to define accurately the boundaries of the parcel" (Land Registration Act, Sect. 18.2). The register folio for that parcel will refer to the parcel map which is permanently archived in the parcel file.

Parcel File. A parcel file is maintained for every individual registered parcel and contains various documents supporting the information in the registry. These files are simply open-ended envelopes designed to hold the adjudication record, the demarcation certificate, all instruments and orders affecting the tenure status of the parcel, old canceled documents, parcel maps and plans, and old editions of the register folio that have been closed for some

reason or another (Land Registry Notes, Paragraphs 60-64). All instruments that have been inactive (that is, no longer supporting a registry entry) for a period of six years or more may be removed from the files and destroyed (Land Registration Act, Sect. 70.1). Parcel files are referenced by means of the PID and are therefore linked directly to the register and cadastral map.

Title. Under the new registration-of-title system in St. Lucia, the legal title status of a parcel of land is reflected in the register for that parcel. Although a notarized instrument (deed) is required to effect changes to the register, this document is not regarded as prima facie evidence of title.

Absolute title under the Civil Code is allodial, that is, it is free of all obligations and services that are traditionally associated with title under English common law. Absolute title in St. Lucia conveys "absolute ownership of that parcel together with all rights and privileges belonging or appurtenant thereto, free from all other interests and claims" (Land Registration Act, Sect. 23.a), except those referred to in the register.

Title may be held in the name of more than one person and there is a special provision for dealing with multiple holders of undivided shares in land. When land is owned by two or more persons, they are regarded as "proprietors in common." If any proprietor-in-common wishes to sell his/her undivided share, he/she must deal only with the other proprietors holding shares in the same parcel of land or obtain their permission to do otherwise (Land Registration Act, Sect. 62-66). When proprietors-in-common possess a valid claim to a parcel of land on the grounds that they are the heirs of an unadministered estate, the parcel is registered in the name of "the heirs of [the ascendant]" (Land Registration Act, Sect. 17.6).

When there are four or more proprietors-in-common, the property is regarded as being held in "trust for sale" by four of these proprietors. The method of selecting these four persons is unclear, since the Land Adjudication Act (Sect. 17.7) requires the agreement of "a majority of the proprietors in common who have made a claim," whereas the Land Registration Act (Sect. 62.2) simply states that the "first four named" (presumably in the Adjudication Record) become the trustees. Generally the names of the co-owners are written into the Adjudication Record without any consideration of the order. This could lead to problems in situations where trustees are minors or represent a minor share of the property (Lemel 1987, p. 4). These trustees have the authority to deal with the land but are not obligated (as the name infers) to sell the property.

The advantage of this concept is that transactions involving the property are simplified by limiting the number of co-owners who have to be dealt with to the four trustees. Clearly this was introduced to simplify dealings involving family land. Although new in St. Lucia, this concept has been used previously in England and the Sudan (Simpson 1976).

Claimants who do not qualify for absolute title may be awarded "provisional title" until such time as they become eligible for absolute title (see Land Registration Act, Sect. 6.2.a.ii). Eligibility status may be attained by the cancellation or disappearance of a condition which initially rendered the

parcel ineligible or by the provisional title remaining on the register for a period of at least twelve years. The provisional titleholder may then apply to the registrar to have the title converted to absolute title. Provisional title may not be mortgaged, leased, or sold. This does not appear to be a major obstacle for property dealings but, instead, provides the motivation for converting these titles into absolute title. The essential difference between absolute and provisional title is that the latter can still be challenged by an unregistered interest whereas the former is indefeasible.

Title in St. Lucia is guaranteed by the state and anyone suffering damage as a result of a mistake or omission in the register, <u>other than errors related to first registration</u>, is entitled to compensation (Land Registration Act, Sect. 99). A "consolidated fund" is maintained for such eventualities. It is interesting to note, however, that no compensation is payable when errors are discovered in the survey information (area or measurements) (Sect. 103).

6.6.4 Feedback

The chief surveyor and registrar (currently one person) are responsible for the maintenance of the formal (public) title records. Once the initial registration records for a section are finalized and incorporated in the registry, all subsequent dealings are required to be done through this office and recorded in the relevant register.

The most common problems experienced by titleholders, and reported to the registry, have derived from errors in the registry record, parcels farmed separately but registered as part of a larger family parcel, and false and inaccurate claims (Lemel 1987, p. 10).

Although there has been some opposition to the new system by surveyors and lawyers, landholders appear to be making use of the system. During the fourteen-month period from October 1986 to November 1987, the registry received over 4,000 applications; this is shown in greater detail in Table 6.1. Given the large number of applications for land and lease certificates (1,722), it will be interesting to observe whether an informal land market, based on these certificates, will emerge. As mentioned earlier, these certificates are not regarded as legal instruments for conveyancing purposes and the register must be examined to establish the legal title status of a piece of land.

Partitions of land held under common proprietorship must also be effected via a notarial instrument with the agreement of all proprietors and the written consent of the mortgagee on mortgaged property (Land Registration Act, Sect. 64). If the number of applications for partitioning received thus far (nine) is representative of longer-term trends, the rapid partitioning of large tracts of family land does not appear to be very likely.

Alterations to the registry map must be authorized by the registrar via a "mutation form." This form identifies the land parcel(s) subject to mutation and specifies whether the registrar or the chief surveyor is responsible for allocating parcel numbers to the new parcels (Land Registry Notes, para. 64). Whenever mutation (subdivision, partition, consolidation, and so forth) occurs, the old parcel number is canceled and the next highest number available in the section is allocated to the new parcel. Canceled numbers are never used again.

TABLE 6.1

Applications Received by the Registry
(October 1986 to November 1987)

PURPOSE	NO. APPLICATIONS	% OF TOTAL
Land transfers	957	21
Mortgages	852	19
Mortgage cancellations	223	5
Conversions[a]	47	1
Cautions[b]	50	1
Rectifications	335	8
Restriction removals	57	1
Transmissions[c]	61	1
Land and lease certificates	1,722	39
Other	149	4
Partitions	9	-
Total	4,462	100

Source: St. Lucia Land Registry.

a. From provisional to absolute title.

b. Restrictions (caveats) on dealing.

c. Transfers through inheritance, bankruptcy, or court order.

When a parcel is "mutated," the register folio for that parcel is closed and withdrawn from the register. All closed folios are archived in the parcel files and the new folios created for all new parcels are filed in the register volume according to their new parcel numbers. Changes in ownership and encumbrances which do not involve mutation are simply recorded by the cancellation of the obsolete information and the addition of the new textual information.

6.7 Evaluation of St. Lucian CLIS

6.7.1 Efficiency

Initial estimates of the efficiency levels that could be expected under the LRTP were based on the Regional Cadastral Survey and Registration Project (RCS&RP) achievements in Antigua. The RCS&RP managed to record 144 parcels per team month, but the island of Antigua is both flatter and less forested than St. Lucia. In addition, family-land problems in St. Lucia were expected to be more difficult and extensive than those in Antigua (MUCIA/LTC 1983). Taking these factors into consideration, 100 parcels per team month were estimated to be a realistic goal for surveying and registering the 27,000 parcels which lay in the project area. This area did not include 7,000 parcels in Castries, which were subsequently included in the project, nor 6,630 hectares in the forest-reserve, which covers a large area of the island. In Table 6.2, the proposed efficiency figures are compared with the levels actually achieved.

TABLE 6.2

Efficiency, Achieved versus Proposed
(demarcation, survey, and registration)

	1985[a]	1986[a,e]	AVERAGE[b]	12/84-04/87[c]	PROPOSED[d]
No. parcels	8,764	8,727		27,343	27,000
Area (ha)	17,146	17,814		51,793	52,000
Team months	96	88		276[f]	384
No. parcels per team month	91	99	95	99	70
Area (ha) per team month	179	202	190	188	135

a. Source: Syrett (1986b), p. 134.

b. For 1985/86.

c. Source: UAM (1988), p. 25.

d. Source: MUCIA/LTC (1983).

e. First 9 months of 1986.

f. For period 12/84-05/86, 8 teams; for 06/86-04/87, 12 teams.

Table 6.2 shows that the efficiency levels achieved in this project were significantly higher than those anticipated in pre-project estimates. This allowed UAM to fulfill their contractual obligations within the allotted time, an achievement that is seldom attained in projects of this nature. A large part of this success has been attributed to the use of a commercial company and the profit motivation inherent to such organizations (Syrett 1986b). Since profit margins are directly linked to efficiency, it is in the company's interest to fulfill the project goals within the contracted period in order to maximize profits.

In cases where claimants did not meet the demarcation officer at the appointed time, an "unprocessed claim" was reported. If claimants were unable to identify the boundaries of their parcel of land, the land was simply recorded as "undemarcated." In this way, the field teams were able to carry out the demarcation, delineation, and recording in an efficient manner without being held back by "problem cases." Some project participants, nevertheless, feel that efficiency, particularly with regard to boundary demarcation, could have been improved if more encouragement and support had been provided for landholders to demarcate and clear their boundaries (Lemel 1987).

6.7.2 Complexity

The complexities involved in carrying out the base mapping and adjudication phases of the project were resolved, to a large extent, by contracting this work out to a foreign company with both the required expertise and technology. This meant that the GOSL did not have to contend with the problems of acquiring expensive mapping equipment or training personnel to operate and maintain it.

The demarcation and survey phases of the project were simplified by adopting a general boundaries system, which made it possible to use a graphical approach for the definition and recordation of property parcels. Graphical surveys are generally much less demanding than numerical surveys in terms of both expertise and equipment requirements. The task of the adjudication officers and their assistants was simplified by essentially abandoning the historical public record of land rights and regarding all land as unclaimed. The onus of producing documentary proof of tenure was transferred to the landholders, thus averting the unenviable task of tracing the chain of title through the public records system. The use of expatriates for the adjudication work avoided the potential conflicts of interest that might have arisen if St. Lucians had undertaken the job, thereby facilitating a more impartial adjudication process (Martyr 1986).

The personal identification difficulties caused by the custom of using aliases were minimized by leaving that responsibility with the notaries. It has been argued that by retaining the services of the notaries, the illiterate and ill-informed, who cannot be expected to understand the complex set of laws governing land tenure and conveyancing, will be protected against fraud (Martyr 1986).

To insure that project personnel were adequately prepared, surveying and drafting technicians recruited locally were expected to have at least a high school certificate and were required to attend a six-week training course prior

to participation in the project. This course consisted of a two-week general unit followed by a four-week specialized unit in either surveying or drafting.

6.7.3 Maintainability

Once an adjudication section was finalized and recorded in the registry, all subsequent land transactions in that section were required to be transmitted through the registry. From a maintenance perspective, the choice of the section as the unit of implementation has some definite advantages. Most importantly, the small area covered by a section means that a relatively short period of time passes between the initial adjudication and the opening of the register, thus minimizing the opportunity for transactions to occur outside the registry.

Although the banks are very supportive of the new system because of the additional security it offers them, many lawyers and surveyors are reluctant to change from the system with which they are familiar. The support of these professions is essential for the long-term maintenance of the cadastre and any LIS that uses this as a base. It is anticipated that the greater security offered by the new CLIS, to both landholders and banks, will motivate landholders to make greater use of the system and thereby force lawyers and surveyors to participate as well.

The retracement of boundaries of registered parcels is anticipated to present some difficulties in the future as many of these parcels have not been defined by permanent features (Martyr 1986). This situation is further complicated by the fact that St. Lucian land surveyors, the accepted guardians of property boundaries, have minimal experience with a general boundaries system and the graphical survey methods associated with such a system. Undoubtedly, many of the surveys will be conventional, but it will nevertheless be necessary to use the evidence of the general boundaries survey as this is often the best available evidence.

Dealings outside the registry are always a threat to the maintenance of the system and the currency of its information base, and every effort should be made to avoid the emergence of an informal land market. Often the most difficult information to obtain is that associated with inheritance. It is simple for land to be conveyed unofficially by inheritance without any perceived need (by the heirs) to formalize this transaction in the registry. The heirs can derive security from the fact that the land is still registered in the name of a family member, even though this person has passed on.

To counteract the occurrence of such a situation and to contribute to the maintainability of the system, Liverpool (1986) has suggested that the land registrar should arrange to acquire information about deaths from the registrar of births and deaths. Furthermore, the registrar should be empowered to request publicly (via notices posted in the newspaper and on the affected land) all legal heirs to come forward and register the land under their names, failing which the land will be placed under the trusteeship of the registrar.

The present (acting) registrar feels that it would be advantageous to set up a regional office in the Vieux Fort area so that people living on the south side of the island do not have to make the trip to Castries every time they

TABLE 6.3

Estimated Cost per Activity (in U.S. dollars)

ACTIVITY	(1) COST[a] ($000)	(2) PERCENT[b,c]	(3) COST PER PARCEL	(4) COST PER HECTARE
Adjudication	$1,360	17	$ 50	$ 26
Demarcation	1,680	21	62	32
Delineation[d]	2,560	32	95	50
Recording	1,040	13	39	20
Administration and overhead	1,360	17	50	26
Total	$8,000	100	$296	$154

a. Based on percentages in column (2).

b. Source: Furmston (1986, p. 18).

c. Syrett (1986b, p. 134).

d. Includes surveying and mapping; excludes base mapping and pre-project control densification.

TABLE 6.4

Actual Unit Costs,[a] 1985/86 (in U.S. dollars)

UNIT COSTS	1985[b]	1986[c]	AVERAGE	FIELDWORK[d,e]		
				1985	1986	Average
Cost per parcel	$235	$193	$214	$106	$87	$96
Cost per hectare	$120	$95	$108	$54	$43	$49

Source: Syrett 1986b, p. 134.

a. Excluding capital purchases and start-up costs.

b. First year of project (expenditure of $2.06 million, excluding capital purchases and start-up costs).

c. First 9 months of 1986.

d. Demarcation, survey, recording, and drafting of registry map.

e. Based on 45 percent of total cost (Syrett 1986b).

wish to use the registry (Lemel 1987). Greater accessibility will always enhance maintainability, but it is important that suitably qualified personnel are available to staff regional offices and effective linkages are established so that new information emanating from activities in the regional jurisdictions is efficiently relayed back to the central office. In this way the central information base can be kept up-to-date, ensuring that the register continues to reflect the true legal situation at all times for all parcels in St. Lucia.

6.7.4 Cost

The dearth of cost data on the LRTP has restricted this section to a general evaluation of costs. No cost data are available for individual activities, but these may be estimated by drawing on the experience of other Caribbean titling projects, most notably the project in Antigua. Accepting the project goals of delineating, mapping, and registering 27,000 parcels (excluding urban Castries), covering approximately 52,000 hectares at a total cost of $8 million, the unit costs in Table 6.3 can be computed. Unit cost figures, shown in Table 6.4, have been reported for the first two years of the project. Since the unit costs in Table 6.3 ($296 per parcel and $154 per hectare) include capital purchases and start-up costs, the slightly lower costs displayed in Table 6.4 are to be expected. Given that the figures in Table 6.3 are based on general estimates, the unit costs in Table 6.4 should be regarded as the most accurate estimates that can be computed from the limited data currently available.

The use of an adjudication officer, in the first instance, and an adjudication tribunal, in the second instance, is another factor that should be mentioned. This approach can lead to substantial savings in cost and time which would otherwise be spent on resolving land and boundary disputes through the court system. However, the future costs of using the new title-registration system is a question which could not be answered with the data available.

6.7.5 Quality

One of the criticisms that has been made of the LRTP is the minimal amount of quality control during the process of creating the project outputs (cadastral map, adjudication record). Martyr (1986, p. 141) described the quality-control dilemma that arises in a project of this nature:

> There is a tendency in such situations [where work is contracted to a foreign company] for the host country department to undertake the task of quality control. Caution must be exercised since many developing countries do not have the survey resources which will allow for checking of the contractor's output while maintaining other regular work programmes. Attempts by Government Agencies to over-regulate the contractor's work programme will lead to delays in project completion.

Consequently, a key issue is how to strike a balance between quality control and efficiency. Whether the LRTP has achieved this balance or not is a question which will be answered once the registry has been in operation for a few years.

The general boundaries system in St. Lucia is similar to its counterpart in England in that they both make use of visible features to define property boundaries. That, however, is where the similarity ends. In England, the physical boundary feature(s) generally run the full length of the boundary, whereas in St. Lucia the boundary may consist of an imaginary line between two "point" features such as trees or fence posts.

The use of the term "general boundaries" to describe the system in St. Lucia derives, in part, from the graphical methods used to delineate property boundaries. The Land Registration Act (Sect. 2) defines a parcel as "an area of land separately delineated on the registry map and given a number." Boundary precision is therefore limited to the precision afforded by this map. Furmston (1986, p. 15) elaborated on this concept:

> In effect the government decides that it will neither determine nor record the exact position of the (invisible) legal boundary. It will determine that the boundary position is related (usually closely but not exactly) to a physical feature, be it a linear feature or corner mark, and it will record the position of that physical feature to what the government considers is a reasonable accuracy in relation to cost.

A fixed boundary under the new system is one that is defined as such by the registrar. In addition, once a parcel is registered under the new system the owner may apply to the registrar to have his/her parcel boundaries converted into more precisely defined "fixed" boundaries. Although the survey regulations lay down procedures and requirements for general and fixed boundary surveys, they do not specifically describe the information to be used to move from a general to a fixed boundary system. Survey Regulation 10.1, for example, requires that prior to the actual survey, the surveyor should "provide himself with all available information in respect of any previous survey of the parcel of land to be surveyed and of any adjoining parcel." Regulation 27.2 emphasizes the importance of searching for physical evidence in reestablishing property boundaries.

The role of the cadastral (registry) map in either the re-establishment of boundaries or the "fixing" of general boundaries is unclear as this matter is still in the process of being defined. Since the field notes compiled in the LRTP are not organized on a parcel basis and are sometimes impossible to locate for a particular parcel,[6] surveyors may have to rely on physical and verbal evidence and the evidence provided by the demarcation certificate, cadastral map, and related base map. In a situation where all physical boundary evidence has disappeared (a common occurrence in rapidly developing or urbanizing areas), the cadastral map will be much more than an index map, particularly when the land has changed hands and verbal evidence becomes less reliable.

The problem of relocating boundaries could be alleviated to some extent if clear and systematically recorded field notes were maintained. Measurement

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6. This analysis is based on a study carried out on a limited sample by A.P. Vonderohe in 1987 during a visit to St. Lucia.

data, such as those obtained in locating boundaries relative to graphical control (as portrayed on the LRTP base maps), constitute primary evidence of the original survey and the effect of not recording these data in a retrievable manner is to remove the most primary level of information from the record of boundary evidence. (Primary, in this context, means that information which is most directly related to the real ground situation.) This problem should be evaluated against the efficiency gained through carrying out a survey on a boundary-by-boundary basis as opposed to a parcel-by-parcel basis. In the former, a parcel with one or more boundaries on a long line of trees or fence may be part of several different surveys. This means that data pertaining to that parcel will be found in different parts of the field notes.

The Survey Regulations, controlling all subsequent surveys, stipulate that all field notes must be submitted to the chief surveyor and should be indexed and referenced so that "any competent person shall be able to prepare a true plan therefrom, and the entries shall be capable of one interpretation" (Reg. 50.3). Clearly the value of field notes and the accessibility of this information was recognized when these regulations were formed.

Since the general boundaries surveys performed under the LRTP are used to define the parcels spatially on the registry (cadastral) map, these surveys apparently have some legal significance. However, there appears to be some confusion on this issue as evidenced by the following extracts.

> It is not a legal survey which will unambiguously define the boundaries to the satisfaction of a court of law . . . .
>
> Alternative projects that produce only a Fiscal Cadastre are inconclusive, incomplete and immaterial since they do not accurately define ownership, title, parcel or location (Syrett 1986b, p. 135) [author's emphasis].

Since legal, marketable, and mortgageable titles based on the LRTP surveys and related products (maps) have been issued to thousands of landholders, there does seem to be an overwhelming argument for treating the LRTP surveys as legal until they are replaced by something more reliable.

It would be unfair not to include a note on completeness since the lowering of quality standards, such as precision, facilitated a more complete coverage in a shorter period of time. All landholders with a valid claim to land were legally required to participate in the LRTP and no land, other than certain categories of state land, was exempt from the registration process. If claimants did not present themselves at the appointed times, or if they were unable to identify the boundaries of their land, an "unprocessed claim" was reported. These cases amounted to an estimated 0.5 to 0.7 percent of the total number of claims (Lemel 1987, p. 2) and can be regarded as the only "holes" in the coverage of the new system.

6.7.6 Utility

The linking of the spatial (survey and mapping) information base to the textual information base of the registry, including the institutional and legal

reforms necessary to achieve this, can be regarded as the final step in the creation of a legal cadastre. This is, however, only an initial phase in the development of an LIS network in which the legal cadastre forms a single node. It will be necessary for this node to be linked with other nodes focusing on infrastructure, natural resource, socioeconomic, and other information.

One of the more compelling arguments for improving the taxation system is that it pressures large landholders to either use their land productively or sell it to someone who is able to do so. The cadastre created through the LRTP provides the opportunity not only to improve the land taxation system but to bolster other land administration and management systems which depend on land information as a basic resource.

In an investigation of the user requirements of land-information users in St. Lucia, Green (1986) summarized the spatial information requirements as illustrated in Figure 6.4.

In a recent study aimed at detailing the structure of a "Land Management Information System" (LMIS), Paul (1987, p. 1) identified six institutions whose land information needs should be directly addressed by any broad-based LIS: (1) Land Registry, (2) Survey and Mapping Unit, (3) Physical Planning, (4) Inland Revenue, (5) Land and Water Use Unit (Ministry of Agriculture), and (6) Crown Lands/Forestry. Paul proposed an LMIS consisting of three databases: (1) the Land Registry textual database (LRDB); (2) the Physical Planning and Ministry of Agriculture database (PPMS); and (3) the Surveying and Mapping Unit database (S&M), which includes a catalog of survey plans, control stations, and other survey data. These databases may be maintained in different formats, but within the LMIS environment they should be restructured into a mutually compatible format. The parcel identifier acts as the linkage between different data sets, and access and use of the data are controlled through predefined protocols. This model, which should be regarded as only a partial view of the ultimate LIS network, is shown in Appendix G.

In summary, the St. Lucia CLIS can be regarded as a system which has incorporated many of the more desirable dimensions in a CLIS. This includes the introduction of registration of title and a strong link between the registry and the surveying and mapping office. Progress, at the rate of 80 parcels per day (Lemel 1987), is being made on the creation of the LRDB while the existing PPMS is being converted to a more universal format. The S&M database has yet to be created.

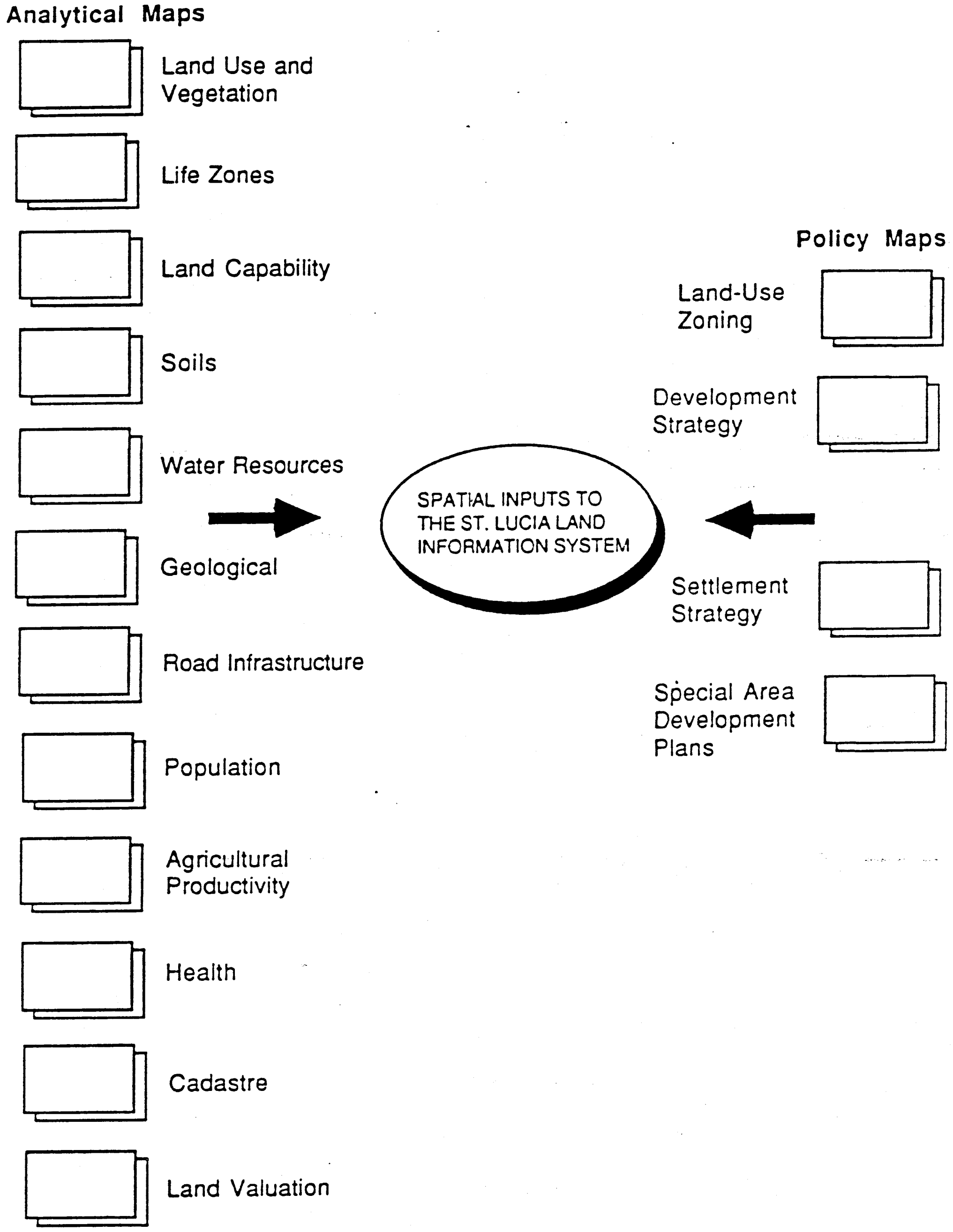

FIGURE 6.4

Land Information Users in St. Lucia

Source: K.M. Green, "Determining User Requirements for Land Information Systems in the Eastern Caribbean," in Proceedings of a Symposium on Land Registration, Tenure Reform and Land Information Systems, Castries, St. Lucia, 6-8 October 1986 (Castries: Organization of American States, 1986), p. 164.

7. A COMPARATIVE EVALUATION

While intercountry comparisons of CLIS are complicated by different institutional and land tenure arrangements, varying approaches, and other factors, it is nevertheless illuminating to compare the experiences of different countries. Dale (1986, p. 2) sums up the benefits of comparative studies as follows.

> There are many lessons to be learnt both from looking at a subject historically through time, and geographically through space, assessing how and why systems differ throughout the world. Comparative studies sharpen critical faculties, reveal relative strengths and weaknesses and identify alternative possibilities which can lead to greater efficiency and effectiveness especially in the cadastre.

Although culturally and geographically distinct, Honduras, Ecuador, and St. Lucia do share certain common characteristics. All three countries (1) operate under Civil Code law and have at one time or another been subject to a colonial European administration, (2) contain a large small-farmer sector with an urgent need for improved tenure security and increased agricultural production, (3) have received large financial loans and grants from USAID in order to create a CLIS, (4) make use of a graphical approach for the spatial definition of property boundaries, and (5) possess a diverse range of land tenures, both formal and informal. A comparison of some of the geographical and cultural characteristics of these countries is shown in Table 7.1.

One difficulty in studying systems that have recently been implemented, or are in the process of being implemented, stems from the different stages of development of each system. This affects not only the type and quantity of available data but also the depth and breadth of studies based on these data. The willingness with which project participants provided data varied considerably between the three countries studied. The Hondurans, possibly because of the perceived success of the PTT and the competitiveness of the two implementing agencies, were extremely helpful and possessed a large amount of useful data. Ecuador was less forthcoming with data on PROLETIERRA, but this was probably due to the relative immaturity of the project. The fact that the author could not travel to St. Lucia placed a major constraint on the collection of data on this CLIS, making it necessary to rely on secondary information sources. The dimensions of the three projects evaluated are compared in Table 7.2.

TABLE 7.1

Intercountry Comparisons: Physical and Cultural Characteristics

	HONDURAS	ECUADOR	ST. LUCIA
Total area (ha)	11,200,000	27,067,000	61,660
Population[a]	4,155,000	9,410,000	120,000
Population density (per hectare)	0.37	0.35	1.95
Predominant languages	Spanish	Spanish Quechua	English French Patois

a. Population in 1984.

The comparative evaluation in this chapter is based on data samples that differ in size and content from one country to the next. The projects in Honduras and Ecuador were not completed at the time of this study, whereas the St. Lucian sample represents the total project. Table 7.3 shows the dimensions of the sample sizes in each country.

The remainder of this chapter is devoted to a comparative evaluation of the three projects in terms of the criteria developed in Chapter 3.

TABLE 7.2

Intercountry Comparisons: Project Dimensions

PROJECT DIMENSIONS	HONDURAS	ECUADOR	ST. LUCIA
Lifetime (years)	5	5	3
Area (ha)	-	4,000,000	52,000
% of country	-	15	84
No. of parcels	89,000	400,000	27,000
No. of new titles	71,628	120,000	27,000
Average parcel size (ha)[a]	-	10	1.9
Implementation:			
Unit	department	county	section
Average area (ha)	622,000	206,600	530
No. units in project	6	41	98
No. units in country	18	131	98
Field Personnel:[b]			
Total (people)[d]	121	47	65
Delineators/surveyors	98[e]	13	46[f]
Delineation teams	52	13	12
Adjudicators	11	30	18
Adjudication teams	6	13	12
Expatriate support[c]	3	1	16
Total cost ($000,000)	16.7	20.0	8.1[g]
USAID grant funds	2.5	3.3	7.3
USAID loan funds	10.0	7.0	0
Local funds	4.2	9.7	0.8
Type of parcel boundary	general	general	general
Registration system	deeds	deeds	title

a. Based on pre-project estimate of number of parcels in project area.
b. Represents actual, not proposed, figures.
c. Employed on a full-time basis for the duration of the project.
d. Excludes laborers and drivers.
e. Includes 11 administrative boundary delineators and 12 quality controllers.
f. Includes expatriate personnel.
g. Excludes costs for urban Castries.

TABLE 7.3

Data Sample Dimensions

SAMPLE DIMENSIONS	HONDURAS	ECUADOR	ST. LUCIA
Delineation:			
Sample period	09/83-10/87	04/87-10/87	12/84-04/87
Time (months)	49	6	29
No. of parcels	94,028	6,915	27,343
Area (ha)	852,780	74,972	52,000
Team months (TM)	2,080	70	276
Titling:			
Sample period	09/83-12/86	04/87-10/87	12/84-04/87
Time (months)	39	6	29
No. of titles	21,037	4,200[a]	27,343
Area (ha)	118,404	-	52,000
Team months (TM)	216	62	276
% of total[b] project completed	80	2	100

a. Approximate number of **fichas** processed (an estimated 50% of these properties require further processing in order to clarify title).

b. Based on delineation statistics.

7.1 Efficiency

The relative efficiencies for (1) delineation and mapping and (2) titling for each country are shown below in Table 7.4.

The Honduras and Ecuador projects both suffer from an apparent lack of commitment by their respective governments. Part of this is due to opposition from certain sectors of the population, such as large landholders with vested interests or campesino organizations, as well as an impending change in administration. Since many project participants are political appointees, it is difficult to maintain continuity in CLIS implementation and avoid delays due to elections and other political activities. The project in Ecuador has been inactive since January 1988 for this very reason.

The nature of the terrain to be delineated and mapped also has a major effect on the efficiency of capturing, processing, and mapping spatial data.

TABLE 7.4

Comparison of Efficiencies

	HONDURAS	ECUADOR	ST. LUCIA[e]
Delineation and mapping:			
No. of parcels/TM	52 (46)[a]	98[b]	99
Area (ha)/TM	443 (388)[a]	1,071[b]	188
Average parcel size	9.1	10.9	1.9
Titling:			
No. of titles/TM	91	68[c]	99
Area (ha)/TM	411	-	188[d]
Area/title	5.6	-	1.9

a. Includes 8-month stoppage for installation of new computer.

b. Does not include any cadastral mapping.

c. Based on **fichas** processed through PROLETIERRA Legal Department (no data available on titles registered as a result of the project).

d. Estimated from average parcel size.

e. Data reflect efficiencies related to demarcation, delineation, survey, and registration.

All three countries are mountainous, and walking around property boundaries (as required by the three systems) can be extremely time-consuming. The exception in this regard is the coastal region of Ecuador, which is flat enough to allow the use of unrectified photographs for parcel delineation.

Both Honduras and St. Lucia have improved delineation efficiency through the use of experienced follow-up teams for dealing with difficult and unusual cases (for example, parcels obscured by cloud on aerial photographs, changes in landscape since date of photography). St. Lucia also made use of an adjudication tribunal in order to deal with disputes and disagreements in an efficient manner. However, efficiencies in Honduras have been detrimentally affected by stoppages due to computer installation and institutional restructuring, which left the project with very few experienced adjudicators or legal assistants.

7.2 Complexity

The majority of parcels in the three countries are demarcated by artificial (for example, fences) and natural (for example, trees) features, which

makes it possible to use a simple general boundaries approach. In countries where this is not the case, general boundaries may be a more complex solution than fixed boundaries, since it may be necessary to plant or construct features along the boundary lines. Hedges, for example, were planted for this purpose as part of the cadastral initiatives in Kenya (Larsson 1971).

General boundaries also simplify the delineation process by resolving it, for the most part, into a mapping exercise. Fixed boundaries, on the other hand, demand greater adjudication efforts as a boundary hinges on two terminals whose position is dependent on various forms of verbal, documentary, measurement, and physical evidence. The strong emphasis on physical evidence in the definition of general boundaries often leads English and other surveyors trained in this system to treat general boundaries as if they were mere indicators of the approximate boundary position and not the "legal" position (see Syrett 1986a, 1986b, for instance). In St. Lucia, general boundaries, or their map representation, are used for land-registration purposes and it is expected that this will eventually become the case in the other two countries. This type of boundary should therefore be regarded as a "legal" boundary until it is superseded by a boundary of a higher quality.

The training period for field personnel differs a great deal between the three projects. Honduras requires two months; Ecuador, ten days (five days theory, and five days practical); and St. Lucia, six weeks. One reason for this discrepancy is the extensive practical training period, or apprenticeship, that is demanded by the Hondurans. The previous experience of the trainees in Ecuador is undoubtedly the reason for the short practical training requirement (five days) in that country. The figure for St. Lucia does not include an apprenticeship, but some practical training is included in the six-week course.

Complexity has been limited in St. Lucia by employing a foreign company to create the initial information base, thereby minimizing the demand for sophisticated equipment requiring specialist skills not available in the country.

The system in Ecuador is complicated by a demanding and time-consuming titling procedure, but this has been aided to some extent by the PROLETIERRA project, which short circuits this procedure and assists landholders in meeting certain requirements. The registration-of-title system introduced in St. Lucia offers the simplest approach to registration and conveyancing by providing a simple graphical means of defining parcels as well as an organized register of property rights.

In all three countries, the initial creation of the CLIS information base has been simplified by relying almost exclusively on the records held by landholders. This means that problems associated with investigating claims in the badly-maintained and -indexed public record are minimized.

Rights-of-way are not required to be registered in Honduras, thus avoiding the complexities inherent to the adjudication of such secondary rights. They are, however, an integral part of the information bases of the other two countries. On the other hand, adjudication in Honduras is complicated by the fact that titling involves a transfer of ownership (from state to individual). This has created a great deal of animosity and confusion, especially among landholders who have occupied and farmed their land for several years. In Ecuador and

St. Lucia, titling efforts are essentially aimed at confirming and legalizing existing land ownership and claims.

An issue which should become increasingly important as more countries computerize their land records and automate existing processes is database "intelligence." The choice of an appropriate level of intelligence is no simple matter, as indicated by a study of LIS in the United States (Dueker and Kjerne 1987, p. 19):

> This research has not demonstrated that the most advanced implementation path is "better." Currently, paths involving less effort and lower [cadastral] base layer accuracy, and lower levels of spatial knowledge ["intelligence"] are advantageous. But experience in two instances indicates that systems using such paths cannot handle new applications that might have been anticipated, resulting in subsequent cadastral layer redesign and data reconversion and, essentially throwing away much of the earlier work. This indicates the nature of some of the pitfalls awaiting organizations in the process of developing multipurpose LIS.

Perhaps the best strategy in this regard is to begin with a simple approach (low "intelligence") but allow for gradual upgrading as skills, technology, and institutions evolve in this relatively new information environment. For example, the use of aerial photography for parcel delineation allows for the upgrading of the spatial data through photogrammetric restitution. The digitization and rectification of parcels and other image features can also be carried out if a country wishes to move from a manual photo-based system to a digital system.

7.3 Maintainability

A higher priority needs to be given to maintainability in the design of CLIS. This is particularly true in Honduras and Ecuador, where the link to the property registries is weak. The absence of effective feedback mechanisms can seriously challenge the realization of long-term benefits (tenure security, increased production, stewardship) to be gained from titling efforts.

The situation was found to be most severe in Honduras, where cadastral efforts have continued for over a decade without the activation of any feedback mechanism. In the Honduran CLIS, this mechanism is designed to come into operation once all cadastral mapping and titling activities have been completed in a department (state). For various reasons, departments in the project were never fully titled, with the result that none of the legal provisions for obtaining new tenure data was enforced. The information bases created in the PTT, and previous projects, have consequently become increasingly out-of-date and misrepresentative of the situation on the ground.

One of the reasons why Ecuador and St. Lucia have better feedback capabilities is the smaller administrative unit of implementation and operation used in creating the CLIS. In Ecuador, this is done on a county level; and in St. Lucia, a special adjudication section is used. If this unit is kept

small, it will minimize the time between the initial implementation and the full operation of the system, thereby minimizing the amount of defunct data and information.

The maintainability of the system in St. Lucia is raised through the merging of the cadastral surveying and mapping information with that of the title registry. In Honduras and Ecuador, the CLIS is not centered around the registry and it has, in fact, had little effect on the registry system. Both countries still rely on metes-and-bounds descriptions to describe property even though the cadastral and parcel maps produced by the titling projects are, in most cases, less ambiguous and more accurate, up-to-date, and concise. Using a map as an integral part of the legal deed description is a practice that is foreign to the Honduran and Ecuadoran registration-of-deeds systems, possibly because this option has not previously been available. Although these systems have begun to include a reference to cadastral maps in the body of the deed, the often lengthy and ambiguous metes-and-bounds description is still regarded as the legal description. A copy of the relevant part of the cadastral map (showing the parcel in question and surrounding parcels with their PIDs) could quite easily be substituted for the metes-and-bounds description by attaching it to the deed. The advantages of using PIDs instead of the names of adjoining owners are the same as those that are advanced when comparing a registration-of-titles with a registration-of-deeds system. These relate to the permanence and simplicity of a parcel-based system over a person-based one.

An important maintenance aspect that is not addressed by many of these types of project is how property surveys are to be carried out once the initial information base has been created. All three projects use a graphical approach to create this base, whereas the local surveying community is schooled in the use of conventional numeric surveys for defining property boundaries. This problem is not as severe in countries such as Ecuador where private surveyors do not play an active role in rural boundary surveys, but it can present a major educational and training problem elsewhere.

Where digital mapping is used, surveyors are often under the misconception that the digitizing of a graphical product will allow them to use numerical survey methods for all subsequent resurveys. Discussions with delineators and surveyors working in the three countries revealed that the re-establishment of boundaries is seen as a matter of locating the position of the digital coordinate in the field. This view tends to overlook the fact that this approach relies on the existence of a network of coordinated points, or a geodetic reference framework, and that the difficulties (cost, time, skill requirements, and so forth) in establishing such a network was one of the main reasons for reverting to a graphical approach. Further problems can be expected to arise from the inaccuracies of these coordinates due to digitizing errors and, to a lesser degree, the use on the three-dimensional earth of coordinates based on a two-dimensional map projection.

It is important that positive incentives be provided to encourage landholders to participate in the long-term maintenance of the CLIS by reporting tenure changes. Although improved access to credit is touted as a major incentive for maintaining a clear title to land, this does not always materialize. In Honduras, the provision of credit is viewed by some as a vehicle for

the rich to gain control over land belonging to smallholders (see Alvarado 1987). Positive incentives can also include access to agricultural extension assistance, greater tenure security, and a higher market value for land that is titled. Communally oriented tenure arrangements, such as the family lands in St. Lucia, can complicate the process of acquiring new data on subdivisions and transfers as these are often carried out within the family circle, where official sanction and recording is not viewed as a necessary part of the traditional land-allocation process.

Hardware maintenance does not appear to be a problem in Honduras, where competent in-house maintenance is available, or in Ecuador, where vendor support is provided on a regular basis. This is a potential problem in St. Lucia, as the island is relatively isolated and does not possess the funds for expensive maintenance contracts. Computer hardware-maintenance problems can be alleviated to some extent by the use of PC systems, which are simpler and cheaper to maintain than mainframe systems. St. Lucia is currently pursuing such an approach.

Issues and demands relating to maintainability do not appear to be fully appreciated in the design of many CLIS. Creating an information base for the first time is vastly different--in software, hardware, procedures, and data-structure requirements--from maintaining an information base. This is particularly true for the spatial components of an information base where certain spatial or topological relationships need to be retained. For example, changing the coordinates of a parcel corner will affect the definition of adjoining parcels sharing that corner, as well as the boundary line(s) that either terminate at the point or run tangentially through the point.

7.4 Cost

Costs are generally the best-documented aspects of a titling project, but they are almost always portrayed in general budgetary terms that do not lend themselves to detailed cross-country comparisons. Ideally, one would like to compare unit costs for parcel delineation, mapping, and titling and use these to draw conclusions about the relative costs of each approach. In reality, such comparisons become complicated and "colored" by factors specific to a situation as opposed to a particular approach. Dividing costs according to participating agencies (for budget purposes) tends to mask the costs for specific activities, especially when an agency is responsible for more than one activity. Furthermore, budget figures may only reflect the anticipated (versus the actual) cost involved in producing a piece of information. Some of these problems can be overlooked as they apply to all systems and therefore do not affect relative comparisons.

In Honduras, cost figures are divided into (1) delineation and mapping costs, and (2) adjudication and titling costs, as these tasks are clearly divided between two agencies. In St. Lucia, there is no distinct division between these tasks, as they are all carried out by the project team. The only cost data available for Ecuador were those reflected in the total project budget and individual annual budgets. A comparison of the unit costs in each country is shown in Table 7.5.

TABLE 7.5

Comparison of Unit Costs

UNIT COSTS	HONDURAS	ECUADOR	ST. LUCIA
Delineation and mapping:			
$/parcel	41	66	96
$/ha	4.5	4.6	49
No. of parcels/100 ha	11	9	53
Titling:			
$/Title	116	(174)[a]	118
$/ha	19	-	59
$/parcel	89	-	118

a. Based on total budget for 1987.

The relatively high costs per hectare for both delineation and mapping and titling in St. Lucia are almost certainly due to the high parcel densities in that country. This is borne out to some degree by the smaller disparities in the cost-per-parcel figures in St. Lucia and the other two countries. It is unclear how much, if any, of the higher cost in St. Lucia is due to a higher profit margin.

Costs in all three systems have been lowered by using a general boundaries approach which does not require monumentation at every property corner or the use of expensive surveying techniques for capturing boundary data. Aerial photography, orthophotography, and line maps derived from aerial photography are used in place of conventional field surveys.

Costs also vary according to the size and composition of the field teams. For instance, the delineators do their own driving in Honduras, whereas specialist drivers are employed for this task in the other two countries. The skill level of the field team will also influence cost as highly qualified personnel, such as those used in St. Lucia, will inevitably demand higher salaries.

The ultimate cost of implementing a CLIS will be somewhat dependent on the revenue that the government manages to recover from title beneficiaries and users of the system. In Honduras, beneficiaries are required to pay for the land that is conveyed by the new title, and in Ecuador, titling and registration fees are used to generate this revenue.

7.5 Quality

Lowering survey-accuracy requirements allows the use of a photogrammetric approach which can secure substantial cost-savings without a significant degeneration in the spatial data quality. A general boundaries approach toward boundary demarcation, such as that used in Honduras, Ecuador, and St. Lucia, lends itself to the graphical delineation methods available through a photogrammetric approach. The following description of the situation in El Salvador applies equally well to the three case studies: "[A] characteristic of our properties in many instances is that property boundaries are natural features producing an irregularly shaped parcel, and therefore it is difficult to justify a costly numerical method or conventional survey methods when some accuracy can be obtained using the simpler and more practical graphical methods" (González 1975, p. 377, emphasis added).

It is useful to re-examine the guidelines on cadastral precision that were recommended at a 1985 U.N. regional conference: "The precision of a cadastral survey should not be more than necessary for the fulfillment of practical requirements. The system, the method of production and the legal basis should be adapted to local circumstances, both social and physical" (USAID 1983, p. D22).

The spatial quality of boundary information is partly a function of the medium that is used to portray this information. In Honduras, unrectified aerial photographs are used initially, but the boundaries are then transferred to higher-quality orthophotos. Ecuador also makes use of unrectified photographs which will be mapped using stereocompilation techniques. St. Lucia delineates boundaries through the use of a line map, where the map features are treated as graphical control. Cadastral and parcel maps derived from these three methods vary in quality. The stereocompiled product can be expected to be of a higher quality than the other two.

Honduras has more extensive quality-control provisions than either Ecuador or St. Lucia. While this function is carried out by special quality-control teams in Honduras, it is left to field supervisors in the other two countries.

Completeness of coverage also has a bearing on the quality of a CLIS. Honduras does not rate very highly in this respect as its information base is limited to land under certain types of tenure (national and ejidal) in six different departments of the country. The Ecuadoran system is designed to cover all land within forty counties, but this could be extended to the remainder of the country if the initial effort proves successful. The St. Lucian CLIS covers all land outside the forest reserve and is therefore the most complete of the three systems.

7.6 Utility

The utility of the three systems is still limited either by an incomplete information base or by the infancy of effective communication links to other land information users.

In Honduras, information captured in the system is being used to establish an agrarian registry and, on a limited scale, for land valuation and resource management. In St. Lucia, lawyers, bankers, and surveyors are set to be the chief users of the LRTP information. The system in St. Lucia has an advantage over the other two systems in that it is integrally linked to the property registry. Current efforts at linking the physical planning, registry, and surveying and mapping information bases should provide a strong framework for the development of a distributed LIS network. In Ecuador, efforts have focused almost entirely on supporting and expanding information for land administration purposes and for legalizing existing tenures by assisting landholders in completing titling requirements.

In Honduras, the broader utility of the information in their CLIS has been constrained by its limited geographical coverage as well as by competition from other agencies. The information base fails to satisfy potential users with a national mandate or interest, and DEC, for example, is only one of several bodies responsible for land valuation.

All three systems appear to be moving toward a more integrated, networked arrangement, and the current utility of each system is naturally dependent on the progress of the project and the completion of coverage of the CLIS information base.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

This research has successfully developed a mechanism for documenting and evaluating CLIS in a developing country context. The CLIS model may be used for the systematic collection and arrangement of data describing such a system and for the purpose of paying the way for a broad evaluation. The evaluation framework offers an effective tool for a broad analysis of CLIS. Both the CLIS model and the evaluation framework were validated by testing in Honduras, Ecuador, and St. Lucia.

Certain general conclusions and trends can be identified as a result of the evaluation efforts of this research. A general boundaries approach is being used to circumvent many of the time, cost, and personnel problems commonly associated with a fixed boundaries approach. The graphical methods available through a general boundaries approach are providing an effective means of expanding the CLIS information base to large areas of land within a relatively short period of time. Instead of connecting surveys directly to a geodetic reference system, aerial photographs and topographic maps are being used to provide graphical control for the positioning of parcel boundaries. This graphical approach appears to be the most rational strategy in the resource-scarce environments of the developing world.

Although a graphical approach does not offer the same positional accuracy as the numeric approaches used with the fixed boundaries system, this is not seen as a problem. In the past, particularly in countries with a highly developed cadastre, cadastral accuracy and precision standards have traditionally been designed to meet the most stringent demands. In most cases, this has left little flexibility to accommodate different land uses (other than a gross urban/rural distinction), land potential, land value, and perceptions of landholders (vis-à-vis their boundaries). Drawing up such flexible standards is a difficult task, but this should not lead to the maintenance of unrealistic and overly demanding accuracy standards, for as Dale (1986, p. 6) points out, "No system is 100% perfect and often 95% reliability can be achieved for less than half the cost of attempting to achieve greater perfection."

This is particularly true in developing countries where there is neither the time nor the money to perpetuate the standards that are usually associated with cadastres in Europe. This graphical approach has the advantage of offering significant benefits to other applications. An aerial photograph or orthophotograph contains a wealth of landscape information which can be used to expand a CLIS into a more multipurpose network of LIS.

One of the major findings in this research was the weak maintainability of contemporary CLIS. The use of an information-systems approach (which treats feedback as one of four major system components) to the cadastre effectively highlighted this weakness, and it was found that maintenance had not been given

sufficient consideration. Maintenance of the CLIS information base through a feedback mechanism is essential for the system to remain up-to-date and effective. If the system does not contain current land information, there is certain to to be a loss in confidence by users and a corresponding decrease in effectiveness.

Although many countries either are in the process of computerizing their CLIS or are contemplating such a move, several issues relating to the maintenance of databases, especially those that contain spatial data, have not been adequately addressed. Computerization is still viewed as an automation of existing manual practices that will somehow solve all the updating problems. Questions with regard to appropriate database-management systems, data structures, cross-referencing, and searching capabilities need to be investigated and reflected within the conceptual design of the CLIS.

The role of the cadastral map in the legal description of land parcels needs to be expanded and defined more clearly. In many cases, this offers a far superior spatial definition of landed interests than the wordy, and often ambiguous, metes-and-bounds descriptions which have been used in the past.

The fundamental motivation behind most titling projects is the granting of secure title to small farmers as a vehicle for resolving production, credit, employment, and poverty problems. Although the creation of a CLIS and the provision of titles are steps in the right direction, these goals will never be achieved without corresponding efforts in the field of technical assistance, education, and land redistribution. Too often titling is viewed as an instant panacea instead of part of a larger program for the improvement of conditions among the rural poor.

It is important that at least some benefits accrue to title beneficiaries. Otherwise, efforts at setting up CLIS and titling will be viewed as simply another vehicle for further repression and widening the gap between rich and poor. This view was forcefully presented by a campesino leader in Honduras:

> We don't need the U.S. money. It's the rich who need the U.S. aid, not the poor. All that money does for the campesinos is divide us. [US]AID dangles some bills in front of the campesino groups to try to buy them off, to corrupt the leaders. It started this land titling program to say to some of the campesinos, "Stick with us and you'll get a piece of land. Don't worry about the others who have none." The worst thing the U.S. money does is strengthen the Honduran military. For us campesinos, this just means more repression, more human rights abuses, more disappeared [Alvarado 1987, p. 142].

While the lack of accompanying assistance has severely limited titling benefits among the private sector, titling projects can provide substantial public-sector benefits. The three CLIS created through these projects offer new opportunities for the improvement of public planning, resource management and development, taxation, agrarian reform, collection of census data, and land registration. Management of the "public good" forms a large part of the man-land equation, and a CLIS can provide information for better decisions relating to questions of land stewardship.

8.2 Factors Influencing Evaluation

Based on the evaluations of the systems in Honduras, Ecuador, and St. Lucia, the following factors (positive and negative) which affect the efficiency, cost, maintainability, quality, complexity, and utility of a CLIS have been identified.

8.2.1 Efficiency

Factors influencing efficiency include:

1) incentives for the implementing institution to meet project deadlines;

2) support given to the project by the government and agencies with an interest in the resulting land information;

3) landholders' cooperation and support (including that of representative bodies such as campesino organizations);

4) nature of the terrain;

5) the clarity with which existing boundaries are demarcated and the ease with which they can be identified on aerial photography or related products;

6) work ethic of a particular culture;

7) extent of promotion prior to and during project implementation;

8) level of expertise and experience of the field personnel;

9) stoppages due to computer installation and institutional restructuring;

10) usefulness and scope of information base that existed at the start of the project;

11) delays caused by price negotiations for items such as aerial photographs that are essential for the continuity of the project;

12) the efficacy, management capability, and structure of field teams;

13) parcel size and boundary complexity;

14) effectiveness of project training programs and understanding of project procedures and policies;

15) formation of an experienced follow-up team to deal with difficult and unusual delineation cases;

16) complexity of mapping and titling procedures (are maps digitized, how many offices are required to examine and approve title applications);

17) the extent to which the existing public record is usable;

18) stoppages and delays caused by general elections and changes in government;

19) the use of general boundaries and graphical surveys for documenting parcel boundaries.

8.2.2 Cost

Factors influencing cost include:

1) the extent of required monumentation;

2) the requirement that property surveys be connected directly to the geodetic reference framework;

3) the use of general boundaries for demarcating parcels and the extent to which these can be identified on aerial photographs and related products (for example, orthophotos, line maps);

4) the size and composition of field teams;

5) recovery of revenue through land sales or titling fees;

8.2.3 Maintainability

Factors influencing maintainability include:

1) the scope and success of informal land markets;

2) the land taxation system;

3) positive incentives for landholders to report tenure changes;

4) the maintenance of the spatial database, which depends on:

   a) the ease with which boundaries can be identified,
   b) the permanence of boundary indicators (fences, trees, markers, and the like),
   c) in a digital environment, the database structure, the database management system, and editing capabilities.

5) the support given to the system by the legal, surveying, banking, and other related institutions;

6) the availability of promised benefits such as credit to titleholders;

7) tenure arrangements;

8) availability of hardware/software maintenance services either in-house or through vendors;

9) the complexity of the titling procedure;

10) personnel and financial constraints;

11) relationships and protocols between institutions that use land information;

12) the extent to which the system is linked to the legal registry system.

8.2.4 Quality

Factors influencing quality include:

1) existence and effectiveness of quality-control measures;

2) provision of incentives to produce work that meets the required quality standards;

3) completeness of coverage;

4) the function of the cadastral map (does it serve as the legal description of parcels or merely as a rough index);

5) the stability of the boundary indicators (trees, fences, pegs, and the like);

6) the method of acquiring spatial data (graphical/numerical);

7) spatial perceptions of landholders.

8.2.5 Complexity

Factors influencing complexity include:

1) the extent to which complex technology-dependent tasks are contracted out to local and international companies;

2) the number of steps in the titling procedures;

3) the extent to which existing tenures have been registered;

4) whether or not rights-of-way and private servitudes or easements have to be registered;

5) the contribution of the public record to the adjudication process;

6) whether or not titling involves a transfer of ownership as opposed to simply confirming and formalizing existing rights;

7) level of computerization.

In an automated system, complexity will depend on:

1) amount of data captured,

2) demand for integrating or merging different data sets,

3) demand for analyzing one or more data sets,

4) editing and updating requirements,

5) skills required to use the hardware and software,

6) type of data to be processed (textual or spatial).

8.2.6 Utility

Factors influencing utility include:

1) institutional arrangements and relationships;

2) the awareness of the existence and potential utility of the CLIS information base;

3) competition from other agencies with similar information bases and mandates;

4) the geographical coverage of the information base;

5) political opposition which may undermine the credibility and perceived usefulness of the CLIS;

6) accessibility (cost, convenience, publicity);

7) commitment to a broad, distributed network approach.

8.3 Recommendations

One of the major constraints on the evaluation work in this research was the sparsity of relevant data and the restrictive way in which available data were portrayed. In order to overcome these problems and thereby improve future CLIS design and evaluation efforts, the following recommendations are offered:

1. Maintenance must be recognized as a primary activity in CLIS development and, as suggested by Laroche and Hamilton (1986), costs should be resolved into: (1) initial cost of creating the CLIS, and (2) maintenance costs.

2. A methodology needs to be developed for the re-establishment of general boundaries that have been recorded on a cadastral map but are no longer visible on the ground.

3. There is a need to distinguish between actual and budgeted costs.

4. A general conceptual model of the final LIS network should be drawn up in order to guide implementation and insure compatibility between the major nodes of the network.

5. Post-project training and promotion should be considered to improve the utility of the CLIS and prevent a lapse into pre-project practices.

6. Data relating to cost, efficiency, maintenance, quality, utility, and complexity should be supplied to the funding agency on a regular basis by the implementing institution (public or private). This could form part of the routine progress reports currently required by many development agencies.

7. A CLIS model should be used as a structure for studying existing and proposed systems. This facilitates the systematic arrangement of descriptive data for subsequent evaluation purposes.

8. A study of the maintenance capabilities of the institutions supporting the CLIS should form part of the system design and development phase. These capabilities can be enhanced by improving private incentives, minimizing hardships and costs involved in the registration of new information, and facilitating the adaptation of the system to changing needs and requirements.

9. Every effort should be made to share information and develop a compatible network of LIS that provide a broad information base which can more effectively address the land problems in developing countries.

10. Data describing a CLIS should include details about the existing land tenure situation, institutional arrangements, the extent and content of the existing information base, demarcation, delineation, cadastral and parcel mapping, deed/title registration, and feedback.

11. The quick "band-aid" solutions envisaged by many titling projects are in most cases inadequate for the accomplishment of the long-term goals associated with tenure security. It is recommended that a long-term program mentality be adopted in place of the short-term project counterpart which is characteristic of current CLIS implementation efforts.

8.4 Closing Statement

With our current population trends, we are unlikely to see a decrease in demands for land resources within the near future. On the contrary, it is almost certain that we will continue to experience increases in competing demands for these resources, particularly in developing countries where population pressure is increasing at an unprecedented rate. A CLIS can provide a valuable service through supplying reliable and up-to-date information for

planning, administration, and management functions. Information is a fundamental resource in these functions, and if better information leads to better decisions about the land, we should be focusing more attention on systems such as the CLIS. After all, land remains the platform of all our activity and the means of our continued survival on earth.

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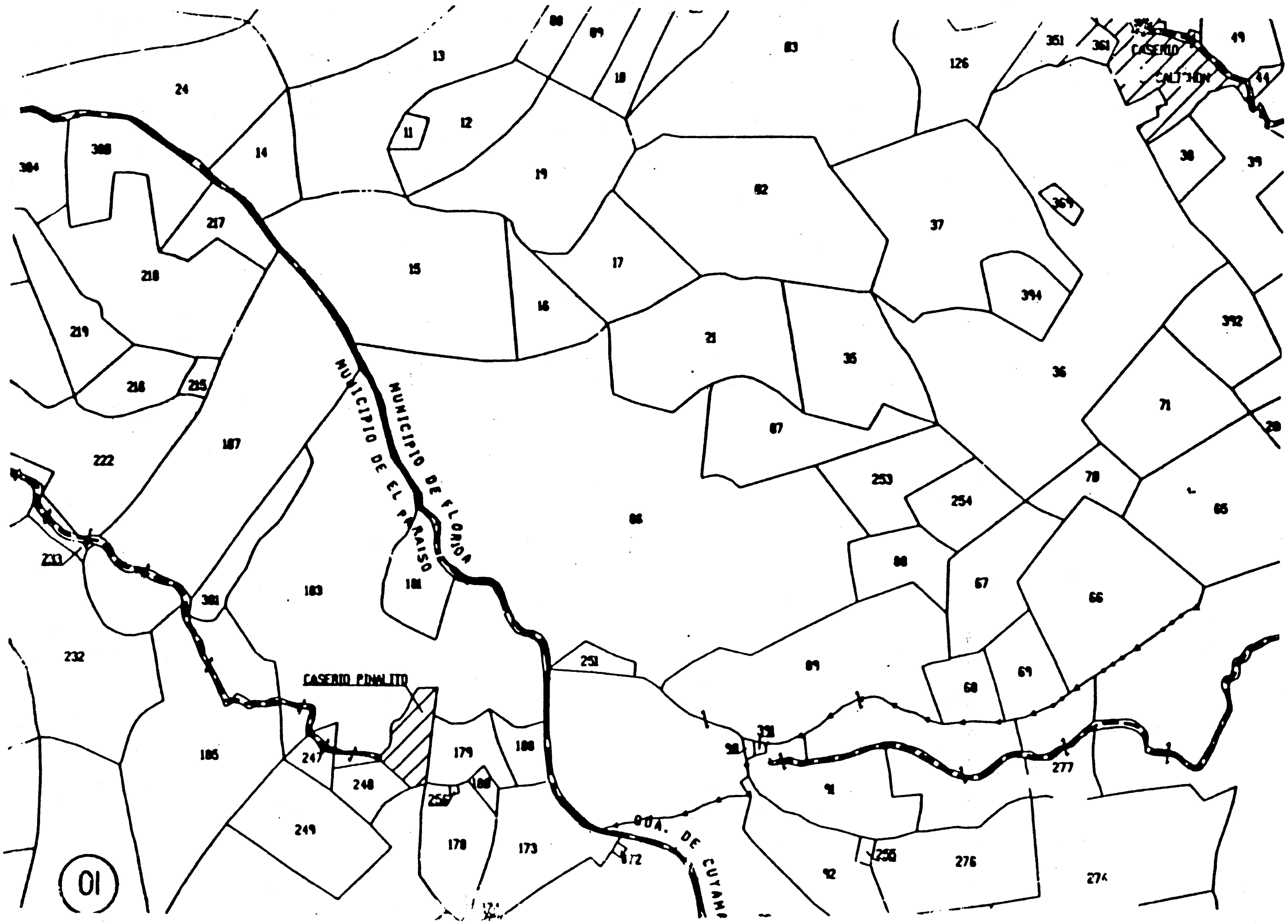
APPENDIX A

The Honduran Cadastral Map


CASERIO
MUNICIPIO DE FLORIDA
MUNICIPIO DE EL PARAISO
CASERIO PINALITO
QDA. DE CUTAM
01

APPENDIX B

Instrument of Conveyance in St. Lucia

INSTRUMENT NO.

LAND REGISTRATION ACT 1984

SECTION 58

TRANSFER OF LAND (BEFORE PROCESSING)

REGISTRATION SECTION	BLOCK	PARCEL
GROS ISLET	1057B	84

I/WE

PETER JAMES

In consideration of EC$50,000.00.

(the receipt whereof is hereby acknowledged) HEREBY TRANSFER

to JOHN JOSEPH

of P.O. Box 308, Castries, St. Lucia.

the land comprised in the above mentioned title.

* ~~The transferees hereby declare that they hold the land as proprietors in common in the following undivided shares:~~

Dated this 27th day of December, 1986

Signed by the Transferor in the presence of:- Peter James
Notary Royal

Signed by the Transferee in the presence of:- J Joseph
Notary Royal

*Delete. If not applicable

FOR OFFICIAL USE ONLY

I, the Registrar of Lands in Saint Lucia hereby certify that this document was received by me for registration on the ....day of .... 198..... and that stamp duty assessed/adjudicated by Treasury at EC.$....... and Land Registry fees at EC.$......... relating thereto have been paid.

....
REGISTRAR OF LANDS

REGISTERED

THIS DAY OF 198

....
REGISTRAR OF LANDS
SAINT LUCIA

APPENDIX C

St. Lucian Register Folio (Front)

Source: K. Syrett, "The St. Lucia Land Registration and Titling Project," in Proceedings of ACSM-ASPRS Convention, Washington, D.C. (Falls Church, VA: American Congress on Surveying and Mapping/ American Society for Photogrammetry and Remote Sensing, 1986).

SAINT LUCIA

LAND REGISTER

Edition 1
Opened 13TH JULY 1985

A - PROPERTY SECTION

~~CROWN~~ / PRIVATE	APPURTENANCES	No 6852 B42
Nature of title: ABSOLUTE/~~PROVISIONAL~~		Registration Quarter MOUNT RULE
Particulars recorded in para. 6 of adjudication record (provisional title only)		Parcel No. 6852 B42
Origin of title FIRST REGISTRATION 13-7-85 MUTATION No.		Name of Parcel. Approx. area. 0·12 Hectares 0·30 Acres.

B - PROPRIETORSHIP SECTION

ENTRY NO	DATE	INSTRUMENT NO	NAME AND ADDRESS OF PROPRIETOR(S)	SIGNATURE OF REGISTRAR
1	13/7/85	A. RECORD	PETER JAMES P O BOX 916 CASTRIES	[signature]

FRONT

178

APPENDIX D

St. Lucian Register Folio (Back)

Source: K. Syrett, "The St. Lucia Land Registration and Titling Project," in Proceedings of ACSM-ASPRS Convention, Washington, D.C. (Falls Church, VA: American Congress on Surveying and Mapping/American Society for Photogrammetry and Remote Sensing, 1986).

PARCEL NO.
6852 B42

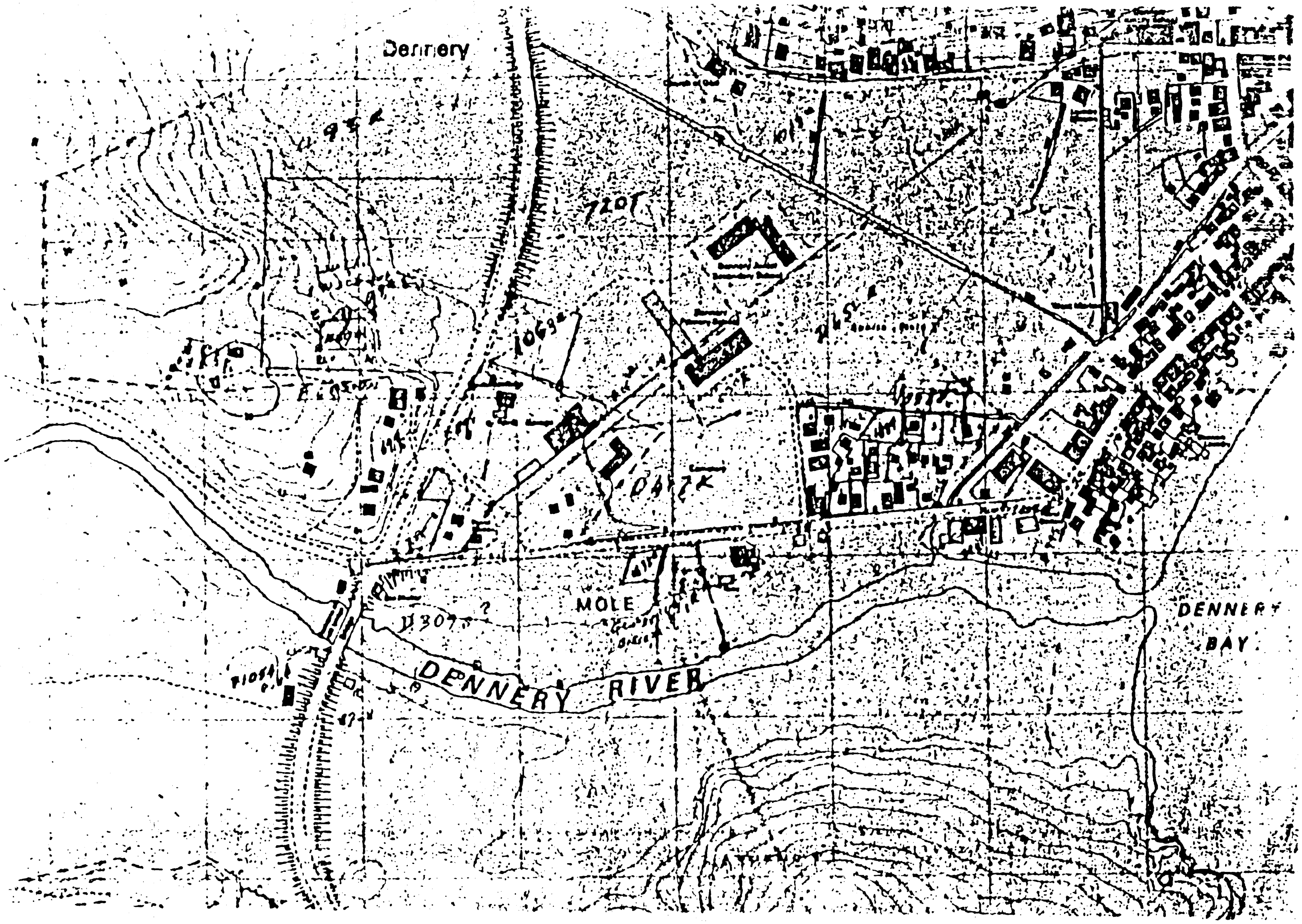
C - INCUMBRANCES SECTION

ENTRY NO	DATE	INSTRUMENT NO.	NATURE OF INCUMBRANCE	FURTHER PARTICULARS	SIGNATURE OF REGISTRAR
1	13/7/85	A. RECORD	SERVITUDE	A PEDESTRIAN RIGHT OF WAY AS SHOWN ON REGISTRY MAP	[illegible signature]

BACK

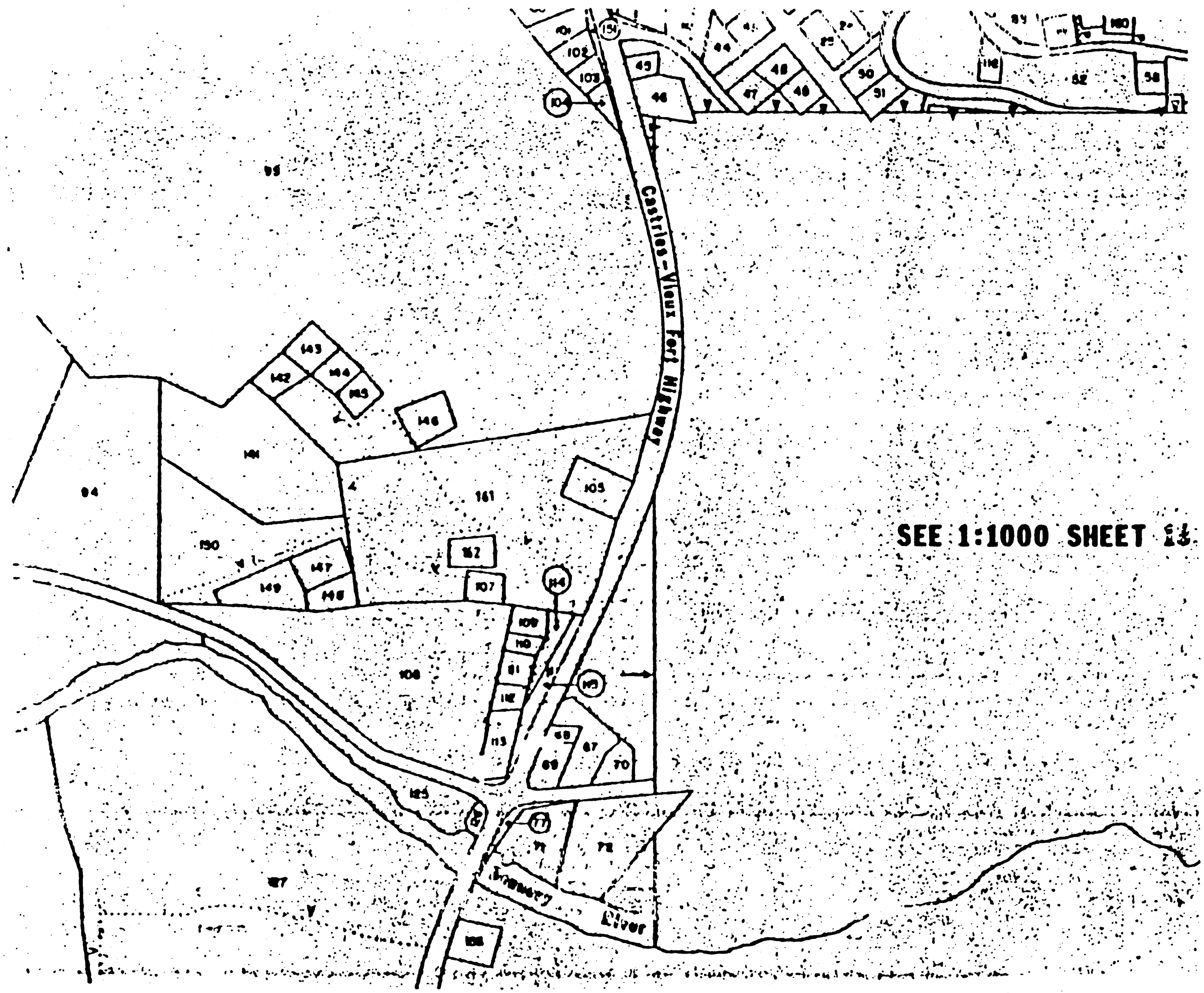
APPENDIX E

The St. Lucian Base Map


Dennery
MOLE
DENNERY RIVER
DENNERY BAY

APPENDIX F

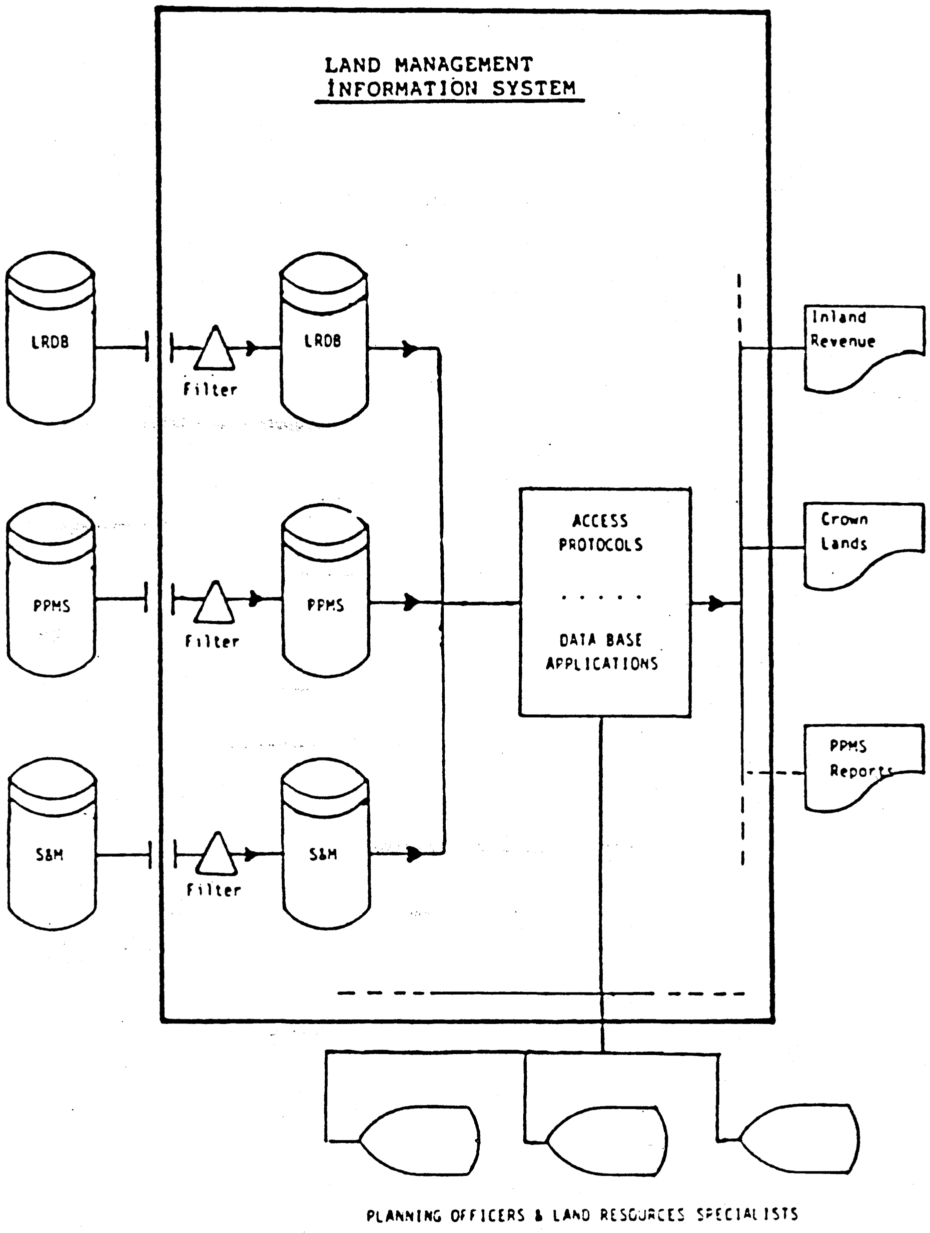
The St. Lucian Cadastral Map


Castries–Vieux Fort Highway
SEE 1:1000 SHEET
River

APPENDIX G

Proposed Land Management Information System in St. Lucia

Source: C.J. Paul, "An Integrated Land Management Information System for St. Lucia," Progress report (Phase 1) submitted to the Organization of American States, Castries, St. Lucia, 1987.


LAND MANAGEMENT
INFORMATION SYSTEM
LRDB
Filter
LRDB
PPMS
Filter
PPMS
S&M
Filter
S&M
ACCESS
PROTOCOLS
DATA BASE
APPLICATIONS
Inland
Revenue
Crown
Lands
PPMS
Reports
PLANNING OFFICERS & LAND RESOURCES SPECIALISTS