Infomapper

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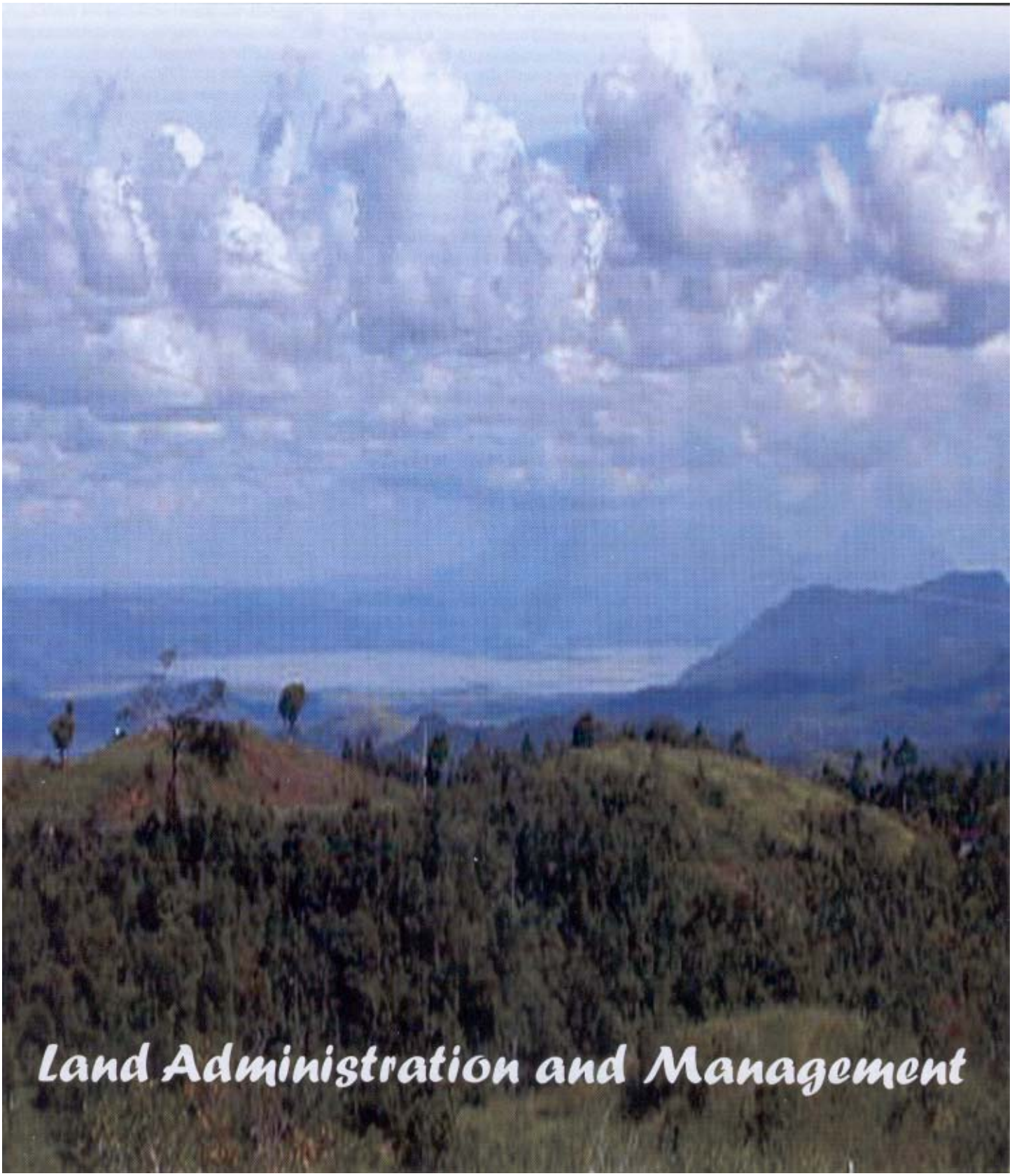

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Editors' Note: Due to space constraints, we cannot publish the references consulted for the articles for this issue. Interested individuals may avail of the lists from the authors.

Cover and spread design: Nancy M. de Jesus, Sheilah Mae G. Lopez, and Renato E. Eguia

Editorial

To a layman, land administration is usually associated with the more popular activities such as titling and ownership, valuation and taxation, and real estate markets. But to a land manager, resource planner, decision maker, or environmentalist, land administration means dealing with a wide array of both technical and practical applications and these include environment and natural resources, land use, agricultural production, urban development, natural disasters, communication, transport, education, health, political, and national security.

From a mapping and detail perspective, land administration in the Philippines is generally twofold. It is based on two fundamental but complementary "scales." One aspect deals with relatively small parcels of real property for residential, commercial, or some familiar uses and the other with vast tracts of land such as alienable and disposable (A & D) lands, land use, proclamation areas, and watersheds. To illustrate, the former relates directly to the mandates of the Lands Management Bureau (LMB) and the Land Registration Authority (LRA) while the latter indicates an utmost concern of the entire mapping industry wherein NAMRIA is a key player. For some national government agencies and local government units engaged in wide-area physical planning, development and management, the details presented by a parcel or cadastral map can give a very high level of accuracy but a medium- to small-scale base map is more valuable in terms of cost effectiveness, practical considerations, and even area coverage.

Apparently, through the years the interest of our government has focused on the modernization of land titling and registration systems to solve the problems of spurious land ownership (documents) and ultimately as a measure to improve revenue collection. This shows that the dynamism of the real estate market is quite overwhelming, such that this situation has helped cast into the background the need to generate new topographic or base maps for the whole country. The new base maps will address issues related to the half-century old base maps, newer but disparate datasets, and a non-standard database. Well, call it a national priority or budget prerogative but since its creation in 1987 and per its mandate, NAMRIA has been finding other means to produce a nationwide coverage of new topographic maps. Because of the huge amount involved, foreign funding has also been sought many times as recourse. However, the government is not very receptive to loan assistance considering the country's tight economic situation. Other schemes like grants and special Government of the Philippines (GOP) funds are still being worked out but these options do not come easily because of "competing priorities" from the other sectors of the government.

Since the late 1980s, the project proposal for new base maps has evolved to adjust to the changes in both the mapping and information technologies. The application of GIS and sourcing of data have become cost-effective. Recently, NAMRIA came out with a new version of the proposal entitled *"The Establishment of the National Common Spatial Database (NCSD) in the Philippines."* Again, due to cost implications, the project now gives priority to the updating and digitization of the 1:50,000-scale maps over a period of three years. Unfortunately, even with such priority vis-à-vis the limited annual regular appropriations of NAMRIA, this agency cannot make this "dream come true" in the context of urgency or immediacy.

The high degree of importance and necessity placed by the various stakeholders and users on a new set of base maps has put pressure on NAMRIA to aggressively look for other viable financing options. To date, opportunities seem not to run out yet in the light of interest shown by the Information Technology and Electronic Commerce Council (ITECC) and the Japan International Cooperation Agency (JICA) to provide the required assistance. These willing hands can envision the benefits of this project. They have given us a touch of hope.

For the mapping industry in general and NAMRIA in particular, we certainly recognize the returns of this investment. This investment will not just yield the kind of map as the layman would ordinarily see it—a simple tool for delineating lot boundaries or giving locational directions. It is an investment that sees the combined advantage of a comprehensive digitized national common geospatial database and the GIS technology that aims to spur national economic development. We talk of its paramount impact on the greatest number of Filipinos. We talk of poverty alleviation, sustainable development, people empowerment, and effective governance. Since we need the most basic relevant information, perhaps we also need to reorder our priorities. •

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The Issue on Small Islands

by Marlyn A. Tabuñar[1]

"High tide or low tide?" To the question pertaining to the Philippine islands, this was the memorable line of Ms. Charlene Gonzales, 1994 Miss Universe beauty pageant finalist. Interestingly, she was right in her remark. There are many small islands that can only be seen during low tide and are submerged in water during high tide. As such, most of the small islands in the country are still part of the unclassified public forest of the public domain, although some of these islands are already developed despite the absence of land classification (LC).

Land classification is the process of determining and delineating which portions of the public forest/public domain are needed for forest purposes and which are not, in consonance with the criteria specified by existing laws. The unclassified public forest is the mass of lands of the public domain which has not been the subject of the present system of classification for the determination of which lands are needed for forest purposes and which are not.

The first LC map in the country, LC-1, was classified and certified on 22 June 1920. This means that land classification activities in the country started prior to this date. At that time, lands, whether located on large tracts or were part of an island, could be classified and released as Alienable and Disposable (A & D), provided they were already improved, developed, and occupied.

One of the laws and regulations governing the proper classification and delimitation of the lands of the public domain is Presidential Decree (PD) number 705, otherwise known as the Revised Forestry Code of the Philippines. Section 13 states that *the Department Head* (of the then Bureau of Forest Development, Section 4 of PD 705) *shall study, devise, determine, and prescribe the criteria, guidelines, and methods for the proper and accurate classification and survey of all lands of the public domain*. Section 15, on the other hand, states that *no land 18% in slope or over shall be classified as A & D*. Section 16 defines the areas needed for forest purposes. The implementing guidelines of PD 705 are embodied in LC Committee Memorandum Circular number 1, series of 1975 where the restrictions in the classification of lands into A & D are reiterated and the guidelines in the zonification of A & D areas for fishpond purposes are set. These are the same guidelines used in classifying islands.

The issuance of Presidential Proclamation numbers 2151 and 2152 in December 1981 minimized the exploitation of some small islands by placing them under the categories of *wilderness areas* and *mangrove forest reserves*. Under these proclamations, there are more or less 4,326 hectares declared as wilderness areas, and more or less 74,267 hectares declared as mangrove forest reserves. With the issuance of Republic Act number 7586 (National Integrated Protected Areas System Law) on 01 June 1992, the areas covered by these two proclamations became protected areas under the administrative jurisdiction of the Protected Areas and Wildlife Bureau. There had not been any specification on the sizes of islands prior to the issuance of DENR Administrative Order (DAO) number 2000-83, which defined small islands as islands/islets with an area of not more than 50,000 hectares.

Issued on 13 November 2000, DAO 2000-83 provided the guidelines for the management and development of small islands, including their coastal areas. It required the preparation and submission of an Island Physical Framework Plan (IPFP) for each island/island group. The IPFP is to be formulated by the provincial and/or community environment and natural resources officer in consultation with other agencies, local government units, and other stakeholders. In this plan, islands/islets less than 500 hectares in area shall be classified as strict conservation areas and as such shall not be alienated nor disposed of for any purpose. Islands/islets of 500 hectares up to 5,000 hectares shall be under restricted use. Land titling shall be limited to those with pending applications on classified A & D lands, as of the effectivity of this order. Land leases/permits which are inconsistent with the IPFP shall no longer be renewed after their termination. The term for a Small Island Management Agreement may be for a period not exceeding 25 years, renewable for not more than 25 years, and subject to the approval of the DENR Secretary. Islands/islets above 5,000 hectares and up to 50,000 hectares shall be open to sustainable development and land titling may be undertaken in certified A & D lands.

Following instruction from Her Excellency Gloria Macapagal-Arroyo, during the 15th Regional Development Council-Regional Peace and Order Council +(RDC-RPOC), DENR Secretary Elisea G. Gozun issued DAO 2003-06 that revoked DAO 2000-83. This new DAO cancelled the preparation and submission of a small island physical framework plan; and also lifted the moratorium dated 06 July 1999 on the disposition and granting of any title, concession, permit or lease on all small islands nationwide. Hence, all applications for land titling in classified A & D lands and the issuance of leases/permits over public lands in small islands, whether new or renewed, or any extension of the same, shall now be processed in accordance with existing administrative/operational procedures.

It should be noted that the present LC teams of NAMRIA are still following the criteria for LC as specified in PD 705 and its implementing guidelines. Lands that are covered by presidential proclamations, executive orders, and other legal issuances; and those that are protected areas are automatically excluded from LC. However, small islands that are still part of the unclassified public forest of the public domain are still subject to the usual LC system and should meet the minimum criteria for their classification and release as A & D.

With DAO 2003-06, NAMRIA has been receiving requests for the release of small islands as A & D, for example, Ditaytayan and Cagayancillo Islands in Palawan, and Nauai Island in Guimaras.•

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The Philippine Reference System of 1992: A Spatial Framework for Surveying and Mapping towards a Sustainable Land Administration and Resource Management

by Lt. (sg) Rudolfo G. Brandes, Jr.[1]

Land is the primary resource of our society and the government. It is the basic foundation for all human needs such as food and shelter. It is a source for mineral extraction and a catalyst for the upliftment of human conditions. Long-term utilization of land provides the government avenues for economic growth following an increase in banking, commercial, and other land-related activities.

Man's relationship to land is dynamic. This relationship changes through the course of time, constantly changing depending on the requirements of a developing community. Vital as it is, land becomes defined and limited as it answers the demands of a growing population. Nowadays, the ratio of land to man in terms of area is decreasing and the threat of scarcity and depletion of our land resources is very alarming. The mutual need between man and his physical environment should be given focus. It is for this reason that the government and the people should collectively administer and manage our land, including the resources derived from it to be able to meet and sustain the demand.

As defined, land administration refers to the processes of recording and disseminating information about the ownership, value, and use of land. These processes include mapping and surveying; identification of alienable and disposable lands; original land titling; transfer of title, land information, and records; taxation; and land valuation. Over the years, the government exerted much effort to create sound and effective ways of administering and managing our land. Different laws and policies were promulgated and enacted, and various land governing agencies were established to maximize the capacity and capability of this vital resource.

Mapping and surveying, as one of the processes involved in land administration and management, plays a very important role in providing a perspective view for better planning and monitoring of land and its resources, and for more efficient land administration policies. It should be in itself effective, complete, and accurate; and should be carried out with a single standard. It is imperative that to strengthen a structured and integrated approach to national surveying and mapping, a national geodetic network must be present. It is in this framework that other processes involved in land administration, that require accurate mapping and surveying (i.e., land titling, land use, land classification, and integrated rural land development), will be effectively implemented. The ideal function and role of a national geodetic network was vaguely portrayed in the past. This is due to the limited capability of geodetic surveying instruments then. Geodetic surveying instruments with sufficient capability are of paramount importance in establishing an accurate and homogenous geodetic network as a spatial foundation for the integration of land-related data and information.

Time and man have given the world innovations in almost all facets of life. In mapping and surveying, the advent of new technology has modernized the processes involved in acquiring and representing facts about land data and information. Satellite and space technology has unlocked the information floodgate and facilitated the flow of vital data to improve land administration and resource management processes. Moreover, with the Global Positioning System (GPS) technology, the concept of geodesy and geodetic surveying has been revolutionized and the paradigm has been answered of an accurate spatial framework to support the surveying and mapping needs towards a sustainable land administration and management process.

The Dilemma of the Past

Prior to 1991, the existing Philippine Geodetic Network, consisting of narrow chains of coastal triangulation, was established primarily to provide controls for the hydrographic surveying, charting, and mapping needs of the country. Geodetic surveys were carried out using the method of triangulation. Its fundamental principle is to measure precise angles of well-proportioned geometric figures such as triangles and quadrilaterals. They are linked together like chains, resulting in a network of points established on the ground and relatively connected to a point of origin or a geodetic datum. In geodesy and geodetic engineering principles, a geodetic datum is defined by three surfaces (i.e., a spheroid or an ellipsoid, a geoid and the topographic surface). An ellipsoid/spheroid is a mathematical representation of the earth brought about by its irregularity in shape and uncertainty of its true measurement. A geoid represents the equipotential or gravitational surface of the earth in which height measurement is referred to and the plumb line of surveying instruments is normal due to the gravitational pull of the earth. The topographic surface represents the factual features drawn in the maps and survey plans. In theory, in a point where the mathematical expression of these three surfaces is known, a regional and homogenous geodetic network may be established, from which the representation of man's physical environment may be drawn using basic map projections and algorithms.

With the Philippine Geodetic Network, computations are made in the Luzon datum, with the spheroid (Clarke 1866) and geoid made tangent, and correspondingly marked on the ground by a control point in Boac, Balanacan, Marinduque with coordinates of latitude 13° 33' 41'' and longitude 121° 52' 3''. Thence, the science of geodetic engineering principles is carried out to define the national geodetic network. In the past, geodetic control points were established in an elevated space to permit a clear line of sight and a longer range to adjoining triangulation stations (trig stations). The whole process back then was very tedious and difficult, time-consuming, and costly. Thus establishments of geodetic control points by the officers and men of the Coast and Geodetic Survey Department (CGSD) (formerly the Philippine Coast and Geodetic Survey) were only selective and were done to cater to the need for hydrographic surveying and charting.

The need for a geodetic network also emerged in the provincial and municipal lev-

[1]*Senior Geodetic Engineer, Geodetic and Geophysics Survey Division (CGSD)*

els, to control the relative positions, extent, and orientation of land parcels; land classification and forest delineation; and municipal and provincial boundaries delineation and delimitation. In these levels, geodetic and plane surveys were carried out using the method of triangulation and traverse (measurement of distance and angles) to establish a local datum for each municipality interrelating adjoining municipalities. With the local networks, each municipality has defined its own local datum and from there derived the relative positions of different features of the municipal and provincial levels.

In viewing this scenario in the past, the established local networks were supposedly connected to the national network of the PCGS (now CGSD-NAMRIA). This anticipated link is in consonance with the philosophy of a network establishment, that *establishing a geodetic network is analogous to the design and creation of a jigsaw puzzle. Without an initial framework design and concept, it is very difficult to reconstruct the pieces of the puzzle.* The PCGS put up the Philippine Geodetic Network, however, because of the limitation of surveying instruments in the past, limited coverage of the national geodetic network and the rugged nature of the terrain, local networks were not connected or were unreliably connected to the national network. This situation led to ambiguous boundaries where overlays and gaps inevitably occurred. This resulted in a series of land-related problems such as land disputes between and among the society and local governments, land partition cases, and the proliferation of fraudulent or fake titles.

Seemingly, the dilemma of the Philippine Geodetic Network in the past can be traced to the utilization of an incoherent network due to the absence of a link between the national network and local networks. This scenario pictured a network that is not homogenous and was contrary to the definition given by D. R. Larden that *the geodetic network provides a common coordinate base which uniquely defines the interrelationship between different layers and levels of information*.

The Philippine Reference System of 1992

In 1987, the Aquino Government envisioned the country's sustainable management and development of the environment and natural resources. By virtue of Executive Order (EO) number 192, the Department of Environment and Natural Resources was created as the umbrella department encompassing different land and land resource governing agencies. The same executive order mandates NAMRIA to establish a nationwide geodetic network that serves as a common reference system for all surveying and mapping activities in the country. One of the prime projects to support this vision was the Natural Resources Management and Development Project, an Australian-assisted project that aimed to improve the country's economic status through better land administration and resource management. With the NRMDP, different components were instituted to focus on the different issues involved, one of which was the geodetic survey component.

With the geodetic survey component, the Philippine Geodetic Network was upgraded using the GPS technology. With the use of this state-of-the-art technology, the existing inadequate triangulation network was replaced with the world-standard, high-precision geodetic network that will support the surveying, mapping, and land information needs of the nation in the 21st century.

Among the survey activities undertaken by the NRMDP geodetic component were the development of a geoid model for the Philippines, evaluation of the Philippine Geodetic Network (Triangulation Network) and the transformation parameters to relate the GPS satellite datum (WGS84) to the Luzon datum. Whenever possible, existing triangulation stations were recovered and occupied by GPS receivers to determine the difference in the coordinates. However, analysis between the computed distance from the triangulation stations and GPS measurements revealed large errors in parts of the old network (up to 56 meters in latitude and 80 meters in longitude), proving the doubtful quality of the old network. This justified the decision to establish a new network based on a high-precision GPS network. Moreover, there were results obtained from the gravity surveys, 1000 kilometers of geodetic leveling, and observation from 25 tidal stations for the development of a geoid model of the Philippines. These led to the adoption of a more realistic geoid/spheroid separation value of 0.34 meters rather than to the assumption of a tangent or zero geoid/spheroid value.

The new set of coordinates for the geodetic control points established, based on the GPS network survey and computed on the Clarke 1866 spheroid and the modified Luzon datum, is known as the Philippine Reference System of 1992 (PRS '92).

By virtue of EO 45, PRS '92 became known as the standard reference system for all surveying and mapping in the Philippines. All new surveys and maps shall be referred to the new network and all old surveys shall be integrated into it, including the adjustment of the coordinates of the corresponding maps. PRS '92 supports a broad spectrum of spatial referencing such as mapping and surveying, hydrographic and nautical charting, civil engineering works, seismic and offshore exploration, and other related activities. It is now the mechanism for quality control and integrity of the Philippine land administration and management system.

To complete the network, PRS '92 must be densified into the micro level. With the establishment of 330 first-order geodetic control points by the NRMDP in 1991, only a skeletal framework with a nominal spacing of 50 kilometers was provided. Thus, there is a need for densification to bring the network at the micro level by establishing a second and third order connected to the hierar-

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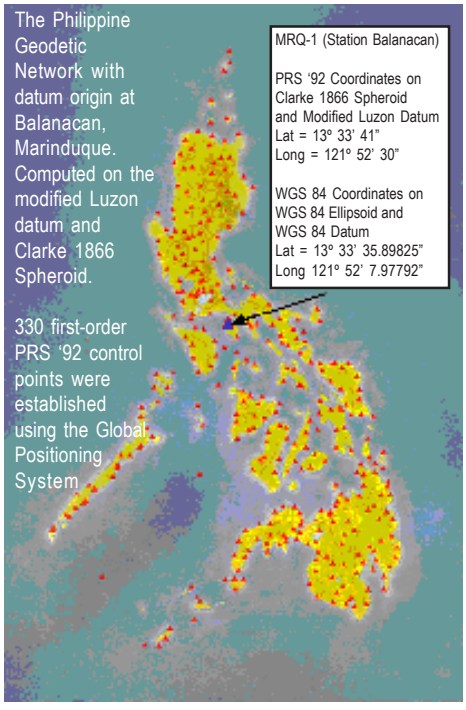


THE NEW DEFINITION OF LUZON DATUM
(MODIFIED LUZON DATUM)

- *CLARKE 1866 SPHEROID*
- *DATUM ORIGIN – BALANACAN, MARINDUQUE with*
  - *Latitude N 13 deg 33 min 41.00 seconds*
  - *Longitude E 121 deg 52 min 3.00 seconds*
  - *Geoid/Spheroid separation of 0.34 meter*

Updates on DENR Banner Program for Forest Protection

by Jesus L. Gerardo[1]

Still ongoing is the delineation and establishment of permanent forestland boundaries, which was launched as the banner program of DENR in calendar year 2000. The program effectively brought to realization the constitutional provision mandating Congress to fix the specific limits of forestlands. Coverage shall be all lands of the public domain already classified as forestlands by the DENR and forestlands yet to be surveyed and classified out of the remaining unclassified lands/public forests under the land classification program. The final map outputs to be prepared by NAMRIA, comprising sets of 1:50,000-scale digital maps, shall be the bases of Congress for enacting the specific laws for each province. The established permanent forestlands of each province are considered by other sectors as the local forest estates.

The program serves as the overarching framework for rationalizing equity of access, protection, sustainable development, and management of forest resources. This is likewise pursuant to and consistent with the need to have a balanced ecosystem. It also highlights the critical environmental functions especially of forests, not only within the uplands but also for downstream stakeholders, e.g., agriculture, industries, settlements, and others.

The authority to fix the specific limits of permanent forestlands comes from the following: Section 4, Article XII of the 1987 Philippine Constitution; Executive Order number 192; Republic Act (RA) number 3092 (amending Section 1826 of RA 2711, otherwise known as the Administrative Code of 17 June 1961); Presidential Decree number 705, as amended, likewise known as the Revised Forestry Reform Code of the Philippines of 19 May 1975; the National Integrated Protected Areas System Law (RA 7586); and EO 318, dated 09 June 2004, "Promoting Sustainable Forest Management in the Philippines."

Guidelines and Implementation

For operational and implementation purposes, the DENR issued the general guidelines through Administrative Order number 2000-24, dated 09 March 2000. NAMRIA actively participated in the initial drafting of the guidelines.

The DENR regional offices are the key implementers with the following as their initial priority target provinces, namely: R-1, La Union; R-2, Quirino; R-3, Bulacan and Nueva Ecija; R-4, Oriental Mindoro; R-5, Catanduanes; R-6, Aklan; R-7, Cebu, Siquijor, and Bohol; R-8, Biliran; R-9, Zamboanga del Sur; R-10, Camiguin and Bukidnon; R-11, Davao del Sur; R-12, South Cotabato; and R-13, Surigao del Norte.

Even prior to the DENR banner program, NAMRIA, for its part, initiated the relocation survey of the forestlands. The results of its pilot activities conducted in the provinces of Zamboanga del Sur and Nueva Vizcaya served as initial inputs of DENR in planning for the nationwide implementation. Moreover, the National Technical Working Committee (NTWC) is co-chaired by the NAMRIA administrator and has among its members the respective directors of the agency's RSRDAD and CGSD. The NTWC is supported by a technical working group (TWG), five members of which are from the Remote Sensing and Resource Data Analysis Department (RSRDAD) (2), CGSD (1), MD (1), and the Plans and Operations Division (1). They have expertise in integrated surveys and mapping which are the critical component activities of the program. Three became regular members of the technical team organized by DENR to monitor and evaluate regional accomplishments from calendar years 2000 to 2002.

The Primary Activities

The relocation survey and monumenting are done along boundary lines and corners that define the alienable and disposable lands and timberlands/forestlands depicted in LC maps. These LC maps, which number about 3,600 map sheets and include many pre-war produced maps, serve as the official references for the program.

Important corners situated at about one-km intervals are considered as primary corners and are marked with reinforced concrete monuments with dimensions of 30 cm x 30 cm x 200 cm with footing (Figures 1a, 1b, and 1c). Embedded on the ground is 100 cm, while secondary corners at intervals of about 250 meters are marked with concrete parallelipiped 15 cm x 15 cm x 60 cm. In-

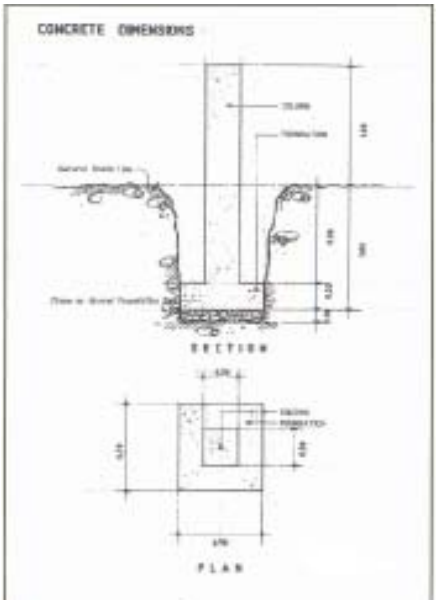


Figure 1a

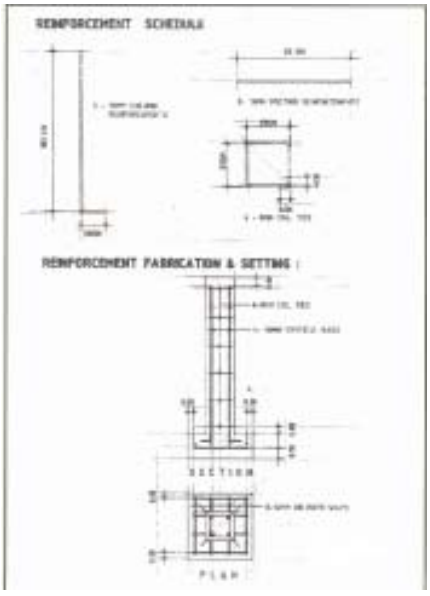


Figure 1b

[1]*Supervising Remote Sensing Technologist and Officer-in-Charge, Land Resources Division (RSRDAD)*

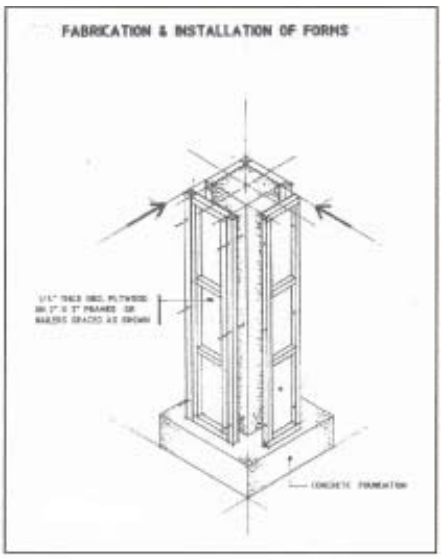


Figure 1c

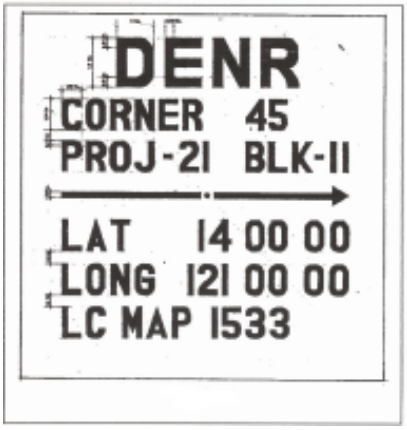


Figure 1d

scribed on the top face of the primary corners are standard information such as the geographic position of the corner (Figure 1d).

Among the many operational/implementation problems encountered especially by DENR regional implementers during the initial year were the lack of/non-familiarity with LC maps and base maps, lack of prescribed survey instruments, lack of PRS '92/ GPS points, misidentification of LC points/ corners, improper monumenting and marking, inadequate/lack of supervision by regional officials of field activities, and lack of funds. To address them, the DENR central office initiated intervention measures through its respective service units for human resource development and policy studies. For one, various orientation trainings were conducted in several regional venues for mid-level regional management staff, including surveyors and cartographers. The aforementioned three TWG members from NAMRIA also became regular resource persons.

Accomplishments and Current Status

Based on a most recent, available official source, the DENR 2003 summary report of accomplishments for calendar years 2000-2002, only eleven provinces have so far been completed, insofar as survey and monumenting is concerned, namely: R-2, Quirino and Isabela; R-3, Bulacan and Zambales; R-4, Laguna, Marinduque, and Romblon; R-6, Aklan; R-8, Biliran; and R-13, Agusan del Norte and Sur. This is not the case with some regions and their priority provinces due to peace and order problems. As contained in the guidelines, NAMRIA shall finalize the regional map output which shall be the basis for the draft bill to be prepared and submitted by DENR to Congress. No map has yet been finalized by NAMRIA since no region has submitted any map output. Figures 2a, 2b, and 2c exemplify actual relocation survey and monumenting activities while Figure 3 features the sample proposed final map layout with the scale of 1:50,000.

Figure 2a

Figure 2c

Last March 17 during an inter-bureau/ agency meeting at the Forest Management Bureau (FMB) to review/assess the implementation, DENR formally conveyed its intention to transfer administrative supervision of the program from the Office of the DENR Secretary to FMB which the latter accepted in principle.

To date, the program continues to be implemented in some regions mostly in the densification of PRS '92 points, while others appear to have token activities due either to lack of funds or lack of clear direction. This shall likely be the scenario until FMB officially assumes total jurisdiction through a DENR administrative issuance.•

Figure 2b

Figure 3

Integrating Cadastral and Orthophoto Information

by Nicandro P. Parayno[1]

Background

This article presents the concept for integrating cadastral and orthophoto information. Land parcels in 2D vector models are described with graphical and textual data during visualization. All relevant legal facts such as designation, location, size, use, plus the boundaries are based on cadastral surveys.

Photogrammetry supported by computer graphics is in the process of fast evolution. Integrating 2D and 3D vector models is very possible. For visualization purposes, raster images are corrected for perspective distortion, scaled, geo-referenced, and draped up on the vector models.

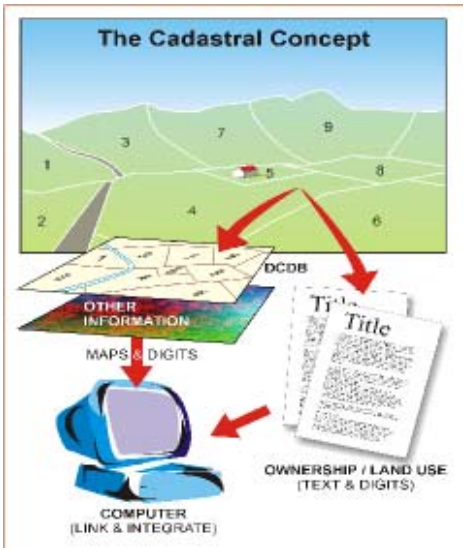
The Cadastral Concept

Cadastral surveying and mapping is a geodetic engineering task, the main purpose of which is to subdivide large parcels of lands into smaller ones for titling. Land use information obtained during the cadastral process is gathered not only for economic development purposes but also for additional information in support of tenure or legal hold.

Every parcel of lot in the coverage area of a cadastral survey project is assigned a lot number. This shall be done consecutively and without duplication. An assigned lot number in one *barangay* cannot be assigned to a certain lot in another *barangay* of the coverage municipality.

A cadastral project is divided into cases. One case is equivalent to one *barangay* which is made up of around 1,000 lots. The Lands Management Bureau (LMB), which is mandated to complete at the soonest possible time the cadastral surveys in the country, has allowed the contracting out of the cadastral projects to private surveyors by module, wherein one module consists of one *barangay*. A municipality with 16 *barangays* may have 16 cadastral survey module contractors. All the said modules will bear the same cadastral survey number.

In a regular case, one title covers only one lot. There are, however, instances when a single title encompasses two or more lots within the same *barangay*, and more often the said lots are adjoining. The titles contain, among others, the tie point where the survey is connected to, the technical description of the lot itself, the metes and bounds, the area, and the adjoining man-made and natural features.



The Cadastral Mapping System

There are two types of cadastral systems in the Philippines, one is *graphical cadastre* and the other is *numerical* or *regular cadastre*. These two systems can be executed either by ground method or by aerial photogrammetry. Numerical cadastre is basically associated with surveying; graphical cadastre, with mapping. The numerical cadastre produces bearings and distances of boundary lines of lots with areas up to the hundredths of a meter (derived from computations). On the other hand, the graphical cadastre simply gives the shapes of the lots, with the distances of the boundary lines derived from scaling the lines on the maps and the area determined by scaling. The graphical cadastre was eventually discontinued in favor of the more accurate numerical cadastre.

Cadastral lots and other details of the cadastral surveys are plotted on reproducible materials. These include a 0.003 inch drafting film with polyester or mylar encompassing areas within a spheroidal quadrangle of one minute of arc in latitude and one minute of arc in longitude (approximately 1.8 km by 1.8 km), and drawn on the Philippine Plane Coordinate System (PPCS). Cadastral map sheets are approximately 54 cm x 54 cm in size and carry a standard scale of 1:4,000.

Sectional cadastral maps are drawn on larger scale such as 1:2,000; 1:1,000; and 1:500 on the same size as the standard cadastral maps to show tracts of lands which appear too small on the standard scale of 1:4,000. These lots are usually residential lots in the *poblacion* or town proper.

Cadastral maps are being used as projection maps in the different DENR regional offices, which enable them to be periodically updated. Cadastral maps which are not updated are the incomplete ones resulting from pre-war cadastral surveys. The DENR regional offices use blank 54 cm x 54 cm tracing paper as projection maps in lieu of the cadastral maps.

The number of concrete monuments and the description of lot corners are indicated on cadastral maps. The names of claimants are also included except when there are space limitations. The respective lot numbers are normally indicated in consecutive and regular order. Forestlands, reservations, and other non-alienable lands are also treated as individual lots but with remarks such as *Forestland* and *Military Reservation*.

The cadastral maps also show the names of claimants adjoining the project boundaries, as well as the lines between the adjoining claims which are drawn in dashed lines. The lots from the cadastral maps and their corresponding survey numbers, and the names of the claimants indicate approved adjoining surveys.

Local names of natural features such as mountains and all bodies of water such as rivers, *esteros* (creeks), *arroyos* (brooks), etc., are indicated on the cadastral map. The names of *barangays* are also indicated within their respective boundaries. Easements are indicated either by 3, 20, or 40 meters, depending on the classification of land.

When the cadastral lot is equivalent to a previously approved survey, both the cadastral number and the number of the previously approved survey are indicated.

Grid lines and plane coordinates, graticule lines and geographic coordinates, survey control stations and traverse lines, po-

[1]*Engineer IV, Photogrammetry Division (MD)*

A sectional cadastral map shown at scale 1:4,000

litical boundaries and monuments, and reference/location monuments are also indicated.

The Concept of Digital Ortho Photographs

A digital orthophoto is a raster image file stored in a format that can be used by computer systems with capability of handling an enormous amount of data. A digital orthophoto, which is a raster, is simply a grid of information with an array of pixels corresponding to the information as seen on the ground. A raster is therefore made up of a number of rows and columns of pixels, which have an intensity value assigned to them called *digital numbers.* The values vary from 0, which is black through 256 shades of gray; to 255, which is white. The images do not have to be simply black and white for they can also be in color. This means, however, that each color image is made up of a composite of three raster files with intensity values for each of the primary projection colors: red, green, and blue.

The digital orthophoto raster image constitutes a fully rectified base map with X and Y (or east and north) coordinates for each pixel. This means that measurement of distances, areas, or angles in the image will be precise and correct. In addition, there is a corresponding digital terrain model which comes with the product.

Cadastral Map Integration to PRS '92

The Need for Integration

In spite of the introduction of computers in the operations of several government activities, the retrieval, updating, and tracking of cadastral maps and other data are still being done manually. The land sector, through the years, has experienced a remarkable increase in clientele and in the number of records to manage. It cannot, however, cope with the current situation due to several reasons such as funding constraints, lack of manpower and technical capability.

The proliferation of fake survey plans and land titles is becoming a problem of the government. Since most of the documents pertaining to land are in hard copies, it will be easier for syndicates to fabricate duplicate copies, thus enabling them to secure ownership and occupancy of the property. In addition, the absence of an updated reference data such as orthophoto and other cadastral information on file with the DENR LMB/ Regional Lands Management Services (LMS) makes it harder to detect such spurious documents.

Converting cadastral maps into digital form and integrating them to PRS '92 will enable the development of a Cadastral Land Information System. At present, the Development Studies and Standards Office of NAMRIA is spearheading efforts to upgrade and implement PRS '92. One of the major component activities assigned to the Research, Development, and Extension technical working group created for the endeavor is the preparation of a standard and a specification for cadastral map integration to PRS '92. The chairman of the task group, Director Jose Galo P. Isada Jr. of the NAMRIA Mapping Department, has identified relevant activities required in determining a new set of transformation parameters needed in the integration process. Once the standard and documentations have been produced, a fully computerized system can then be developed for the national government agency concerned which will achieve, among others, the following: (1) the land/cadastral/ orthophoto information can be shared with other government offices as well as the requesting public as quickly as possible; and (2) the system can be used in expediting processing of documents, verification and approval of public land application, and subsequent subdivision/consolidation surveys.

Conversion to Digital Cadastral Map

As of December 2002, the status of cadastral surveys in the Philippines is as follows: (1) from a total of 1,496 municipalities, there are 827 with approved cadastral survey, 321 are in progress, 280 are partially surveyed, 65 are still not surveyed, and 3 are abandoned; and (2) out of 114 cities, 89 are with approved cadastral surveys, 16 are in progress, and 9 are partially surveyed.

Cadastral surveys that are in progress are either with ongoing fieldwork or the survey returns are being verified with the DENR Regional LMS. Partially surveyed municipalities have a previously approved public land subdivision, group settlement survey, and/ or town-site reservation subdivision. This survey covers only a certain portion of the city or municipality, unlike the cadastral survey which encompasses the entire municipality.

The municipalities and cities with approved cadastral surveys cover 4,487,311 lots with a total area of 17,848,035 hectares, roughly 59% of the total area of the country. However, the data stored in the different regional offices of DENR are all still in hard copies but there are some regions with their cadastral maps already converted into a digital format and integrated to PRS '92.

The conversion of cadastral maps from approved cadastral surveys to digital format will enable current coordinates used to be integrated to PRS '92 and will provide users with a powerful visual and management tool for any land information system. The conversion to digital format will facilitate management of information such as records of legal ownership, land assessments, tax records, boundary descriptions zoning, ground cover classification, and infrastructure.

Vectorization and Transformation

In order to vectorize the cadastral map from an analog format, it is necessary to scan to a suitable resolution that will result in an image data wherein line, point, and area features can be easily identified. This is an important factor in generating a digital cadastral database since the accuracy of the data will highly depend on the scanning resolution used. The higher the scanning resolution in terms of pixel size numerical value, the sharper the features which will be identified on the scanned image.

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LAND ADMINISTRATIO

LMB

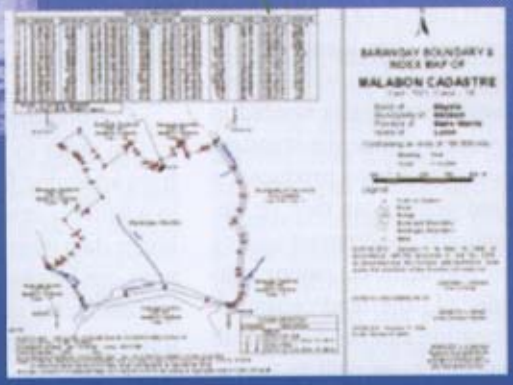
Cadastral Survey

LRA

Register of Deeds

Titling of the National Land owned by the Government and the Private Sector

Cadastral Map
(Blueprint)



Cadastral Map
(Digital)

Transfer Certificate of Title

Government offices working together for a better management in order to improve the economic and social

N AND MANAGEMENT

DENR-CARP

Projects deliberated by DENR Technical Working Group

Approval of the LC Map by the DENR Secretary thru Issuance of Department Administrative Order.

Office of the President
(endorsement to Congress)

Congress
(to confirm the classification of land)

APPING

1. Answers the mapping needs of concerned government agencies through the preparation, updating, printing, production, and reproduction of topographic maps at various scales.

NAMRIA

LAND SURVEYS

Conducted are integrated and periodic surveys such as:

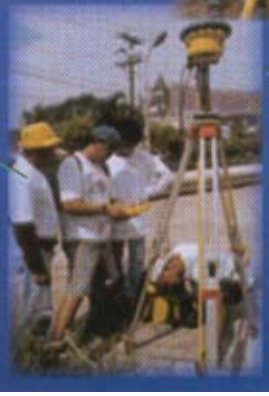
1. Geodetic and Geophysics Surveys
2. Magnetic Surveys
3. Topographic/Planimetric Surveys

LAND CLASSIFICATION AND EVALUATION

1. Classifies for the DENR the remaining unclassified public forests to segregate and demarcate forest lands from non-forest lands.

2. Lands found suitable for agricultural purposes and declared as Alienable and Disposable (A & D) are then slated for distribution to settlers and landless qualified beneficiaries of the government's Comprehensive Agrarian Reform Program (CARP).

3. Conducted are land use assessment/evaluation and land classification and certification of land classification status.



land administration and conditions of our countrymen

The Philippine Reference ...

from page 5

chy of accuracy standards. Once densification is attained, systematic and more accurate land information will be delivered even to the most remote locality. As a result of unified land records, what may also be forecasted is an improved access to national land information within the government agencies and for the public. Furthermore, the existence of a standard method in surveying and mapping can lead to a more comprehensive and just land valuation. Payment of land property taxes will be systematic, leading to an increase in our country's revenue, and a projected economic growth is probable. Through a homogenous and accurate national geodetic network, a systematic land administration and management enables higher productivity of our land by giving the community land tenure. In effect, a soaring food production activity is expected, making banking and commercial transactions more promising.

Global Positioning System

NAVSTAR (NAVigation Satellite Timing And Ranging) GPS, more commonly known as *GPS*, is an all-weather, high-precision, with worldwide coverage, satellite-based positioning system. GPS provides three-dimensional positions in which computation is comparable to resection surveying and the principle of an Electronic Distance Measurement.

The accuracy of GPS depends on the satellite geometry, type of receiver, stationary or dynamic positioning, autonomous or relative positioning, duration and number of observations, type of **ephemerides*** used, radio frequency utilized, and the methodology used in acquiring a fix. Generally, its accuracy and uses can be categorized into three: navigational, mapping, and surveying.

GPS coordinates are provided in the WGS84 ellipsoid and WGS84 datum. These coordinates must be transformed to a specified geodetic datum of each country. In the Philippine context, coordinates derived from this system must be made compatible with PRS '92.

TRANSFORMATION PARAMETER
FROM WGS84 TO PRS '92
Translation Parameters:
Delta X = 127.62195 meters
Delta Y = 67.24478 meters
Delta Z = 47.04305 meters
Rotation Parameters:
Rotation X = -3.06762 seconds
Rotation Y = 4.90291 seconds
Rotation Z = 1.57790 seconds
Scale parameter: 1.06002

It should be noted, however, that the parameters provided by the NRMDP are only true and accurate when transforming satellite-derived coordinates to PRS '92 or vice versa. They do not apply to stations, maps, and plans that have been derived from the old triangulation network or control points coordinated using astronomical observation.

Challenges Posed to PRS '92

As the country seeks to alleviate poverty and improve economic status through better administration and management of land, an accurate and homogenous geodetic network such as PRS '92 is not the immediate solution. It is only a mainstream leading to a spectrum of downstream projects associated with it. These include production of accurate maps and identification of lands for agriculture and ecological balance, improving the security of land tenure, and solving the problems associated with lost and incomplete cadastral survey records and delays in the issuance of land titles.

Eleven years after EO 45 was signed into law stipulating the utilization of PRS '92 as the standard reference system for all surveying and mapping activities in the country, only 7,417 PRS '92 control points have been established out of a projected 95,525 control points for the whole archipelago. Moreover, the integration of old maps and survey plan was barely undertaken.

Apparently, the task ahead is gargantuan that focus should be given to the full implementation of EO 45. DENR, as the umbrella agency, is now given this challenge but the task of integration, densification, and transformation is not exclusive to the Department. The cooperation of geodetic engineers, local and regional authorities, and other land governing agencies is required to ensure operational effectiveness.

DENR through the NRMDP has put up a stage in the form of PRS '92. A typical presentation would need, among others, actors and actresses, props, lights, crew, audience, and budget. Metaphorically, these can be equated with the needs of the government to complete and maximize the utilization of this geodetic network. Sufficient and accurate tools are needed to continue densification. Manpower training must also be extended to ensure competence. An adequate number of personnel and skilled men should be deployed not only for surveying and mapping, but also for maintenance, monitoring, and planning. Uniform and standard operating guidelines and a technical manual should be provided for a solid and unified result. People and agencies under this project should extend utmost concern and assume extreme supervision. Coordination among the concerns and other implementing units should be likewise adopted. Just like any stage presentation, a director, who serves as the overall seer must be designated to supervise all aspects of field surveys, research and data management, trainings, and policies. Most importantly, provision of financial resources and budget allocation for this project should be extended but must be viewed in terms of the benefits that the government and the people will receive.

EO 45, as amended by EO 280, stipulates full compliance to PRS '92 by the year 2005, barely a year and a half from now. With the enormous task ahead, can the public assume full compliance or will a third extension be set? Will our economic status be improved and poverty be alleviated by having an effective land administration with the use of PRS '92? Should we expect change in land administration by sanitizing land records and eradicating fake or fraudulent land titles? Will there be no more land disputes? Or would this be another quixotic dream of our government? And with PRS '92, should we further delay this precious opportunity? The answers lie in us.•

***Ephemeris** (*pl.* **Ephemerides**) - *is a list of coordinates defining the orbital position of a satellite at various times. All GPS measurement processing techniques require the input of ephemerides for the time span of the observations in order to determine a ground receiver's position, either absolute in the point positioning mode, or relative when deployed in a differential mode.*
(Source: King, R.W., E.G. Masters, C. Rizos, A. Stolz, and J. Collins, 1985. *Surveying with GPS*, Monograph 9, School of Surveying, The University of New South Whales, Kensington, N.S.W., Australia.)

Integrating ...

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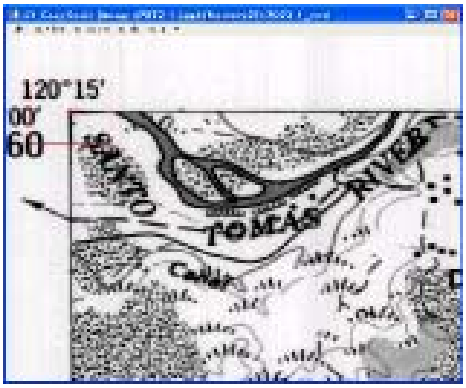
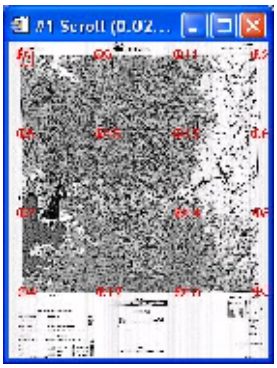
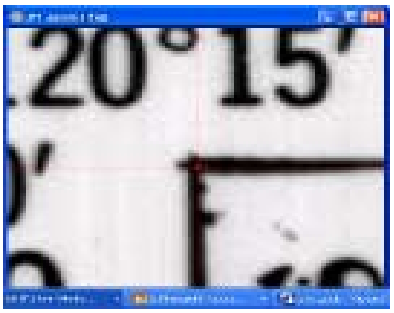
As a standard procedure, it will be more convenient for a mapping practitioner to transform a scanned cadastral map first before digitizing 2D features. This means that once the map has been transformed/geo-referenced, all the features within the map will have geographical positions defined by its ground coordinates.

The transformation and geo-referencing routine usually starts with the selection of points from the map to be used as "controls." Map corners represented as grid ticks are the usual control points used and these are initially digitized since they have known geographic positions in terms of latitude and longitude and are converted into plane grid (X, Y) coordinates. The more control points to be used, the higher the level of accuracy to be attained in transformation.







Typical Screen Setup of a Data Transformation Session

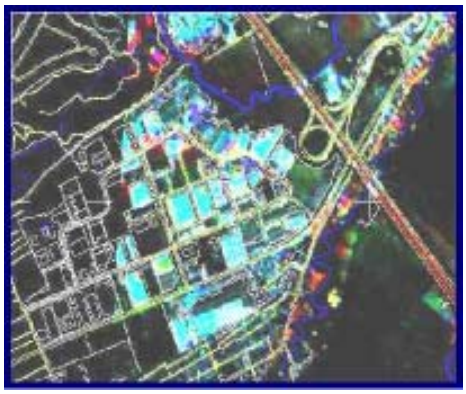
Applications of Integrated Digital Cadastral and Orthophoto Maps

Development of Ortho-LIS

The importance of digital cadastral and orthophoto maps is growing as a consequence of the increasing possibilities for handling large amounts of data. Land investors, and even ordinary citizens across the nation, want to know the value of their real property and the taxes levied against them. Real estate companies, insurance underwriters, lending institutions, land developers, and even politicians are also interested in the value of particular parcels of property. Their corporate information requirements are tightly integrated with business requirements. Companies and individuals like them often employ personnel whose sole task is to research information at the city or municipal assessors' office.

With the integration of digital information from cadastral and orthophoto maps, the development of an Ortho Land Information System (Ortho-LIS) will be possible and will provide valuable real property information and more, without even requiring us to leave our homes or offices. These can be done by overlaying transformed digital cadastral maps that have information such as lot numbers, lot owners, and property boundaries onto the ortho photographs, which depict natural features and actual use and occupancy of a land. Furthermore, a central database of all land owners and claimants in a certain cadastral project can be linked with objects in the integrated information. A table can also be created with records such as property owner, location, area, assessed value, and even current land use.

Once an Ortho-LIS has been developed, a mouse-click on a particular parcel will provide a legal description, the actual size of the property showing the image, the owner, the most recent valuation, and the current appraised value. If knowledge is needed about the adjoining parcel, for instance, one just needs to move the mouse over and click. The integrated data is up-to-date, reflecting boundary and ownership changes, or property values that may have been recently adjusted.



Orthophoto fused with vector cadastral data

Recommendations

Large-scale aerial photographs are the basic sources of information used in the production of orthophoto maps. For highly urbanized areas, they may sometimes be used for the densification of the geodetic control network for cadastral surveying projects. In order to be able to integrate cadastral and orthophoto maps in the digital domain, it will be more economical to undertake large-scale aerial photography to maximize their usefulness. Once integrated, the development of the Ortho-LIS will be possible. The Ortho-LIS will address the needs of the agencies concerned and the private sector, as well as settle land-related issues and concerns. •

A Proposed Vision and Options for the Future Philippine Cadastre: A Geodetic Engineer's Perspective[1]

by Engr. Randolf S. Vicente[2]

The Situation

The Philippines is currently undergoing a rapid change brought about by a diverse range of factors that include a growing population that puts pressure on the land, a scarce and finite asset. The current situation that shows the major structural defects and deficiencies that ail the current land administration system have resulted in insecure property rights, uncoordinated development, poor planning and management of land and its use, the increasing vulnerability to disaster and environmental degradation, and other serious problems besetting the relationship between land and people. To prevent further deterioration of the existing situation and achieve a balance between exploitation and conservation of land resources, there should be a just land resource management policy and program.

The above issues comprise the areas of concerns that strategies on sustainable development need to address. Without sound land administration, sustainable development is not attainable. It is important, therefore, that a good land administration system must be designed, established, and institutionalized to ensure that it meets the needs of future generations and major stakeholders.

Today, the growing awareness of the issues, better understanding of the consequences of actions, and the use of relevant information are helping to bring about an effective land administration in the country. Some modes of intervention that were made in the past are now being tried out to address these issues but the current situation reveals inadequacies in some respects.

This article aims to discuss and explain the proposed vision and alternative options towards reinventing and improving the current cadastral system. Major stakeholders are defined and their respective roles and aspirations are clearly elucidated. A framework for the reformed cadastral system will be illustrated.

Land Administration and Cadastre

The term "land administration" used here is based on a definition adopted by the United Nations Economic Commission for Europe (UNECE). It refers to "*the processes of recording and disseminating information about the ownership, value, and use of land and its associated resources*." Such processes include the determination (sometimes known as the adjudication) of rights and other attributes of the land, the survey and description of these, and their detailed documentation and the provision of relevant information in support of land markets. Land administration is part of the overall process of land management (Dale and Mclaren).

Land administration includes the functions involved in regulating the development and use of the land, gathering revenue from the land (through sale, lease, taxation, etc.), and resolving conflicts concerning the ownership and use of the land (UNECE). According to Dale (1999), land administration functions may be divided into four components: juridical, regulatory, fiscal, and information management. He also cited that such functions of land administration are traditionally organized around three sets of agencies responsible for surveying and mapping, land registration, and land valuation.

Based on the guidelines on land administration of the International Federation of Surveyors (FIG), an understanding of the broader aspects of land management is essential to proper land information management. Land administration is concerned with three commodities—the ownership, value, and use of the land—within the overall context of land resource management.

A cadastre is similar to a land register in that it contains a set of records about land. FIG defines cadastre as *"normally a parcel-based and up-to-date land information system containing a record of interests in land (e.g., rights, restrictions, and responsibilities)."* It usually includes a geometric description of land parcels linked with other records describing the *nature of interests*, the *ownership* or *control of those interests*, and often the *value* of the parcel and its *improvements*. It may be established for fiscal purposes (e.g., valuation and equitable taxation), for legal purposes (conveyancing), to aid in the management of land and land use (e.g., for planning and other administrative purposes), and to enable sustainable development and environmental protection.

The cadastre is an information system consisting of a series of maps or plans showing the size and location of all land parcels, together with text records that describe the attributes of the land (UNECE). In a cadastre, the data are organized around the cadastral parcel. This is generally the proprietary land unit, but it can be any tract of land that is part of an estate and has a separable identity (Dale, 1988).

A cadastre may be classified according to the information it contains or the primary purpose for which it has been developed. As such, three categories of cadastre are commonly recognized: the *juridical cadastre*, which serves as a legally recognized record of land tenure; the *fiscal cadastre*, which was developed primarily for property valuation; and the *multipurpose cadastre*, which encompasses both the fiscal and the juridical with the addition of other parcel-related information. Among the three categories, the multipurpose cadastre is the closest to the universal concept of land information system.

Conceptual Framework

The design of the relevant, complete, efficient, and sustained cadastral reforms depends on the recognition of the major stakeholders in a cadastral system. In this article, three major stakeholders are identified. These include the government, beneficiaries, and professionals. On the one hand, their roles and aspirations must be taken into consideration whenever an attempt to improve the system is necessary. On the other hand, it is likewise important that weaknesses of the current system must be looked into in

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[1]*This is a condensed and modified version of the original paper, with the same title, a copy of which may be requested from the author.*

[2]*Planning Officer V and Assistant Officer-in-Charge, DSSO-NAMRIA (the author is the holder of a Diploma in Land Use Planning and a Master of Science degree in Remote Sensing)*

order to define the core problem towards building up public advocacy for reform and appropriate solutions and strategies. Figure 1 shows the diagram illustrating the Framework for Reform in Cadastral Systems.

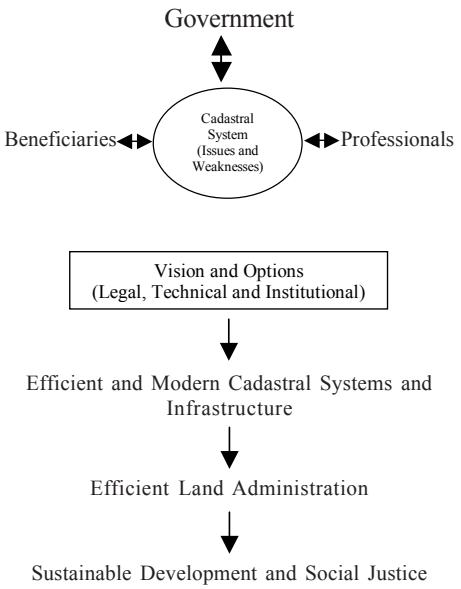

Figure 1 – Framework for Reform in Cadastral Systems

The land business of the government may be simplified and explained by the following questions: Who owns it? Where is it? What is its worth? What is on it? What are its boundaries? Who can use it? What can be done with it? How can we improve it? Answers to these questions may not be available instantly unless one has access to a good land information system or cadastre. The efficient and effective administration of land and its associated resources depends upon the availability of good land information as it serves as the bedrock of good decision making and good governance. Government intervention is more concerned with the promulgation of the appropriate national land policy and other related initiatives that are necessary to address the structural dysfunctions on cadastral systems.

The beneficiaries (individual settlers, realtors, banks, and other financial institutions) comprise the stakeholders who are presently affected by the current problems and who potentially benefit directly from the reforms in the cadastral system. Their needs and aspirations may include evidence of land ownership, which a cadastre provides along with security; and the reduced and eliminated risk of eviction, which is thus an enhanced incentive to invest in the land or property. Once these are adequately addressed, the influence on investments will in turn give higher output or benefit as well as higher income and value, ultimately resulting in the improvement of the economy.

Professionals in land cadastral operations are considered as major stakeholders because their practice enables the public to formally obtain and keep legal rights to their properties and conduct land transactions correctly and expeditiously. Their practice is formally recognized by government agencies and bounded by existing rules and procedures so they can serve as important sources of information regarding the technical nature of problems in the existing system. Because of their expertise, professionals have the ability to work with the existing system despite its problems. As licensed professionals they operate mainly to protect the interests of property owners despite the deficiencies and ambiguities in the system that impose constraints on their efficiency.

Having recognized the three major stakeholders and the issues and weaknesses of the system, a vision and options can then be defined which may be classified into legal, technical, and institutional. These items, however, will be discussed in the latter part of this article.

The lower part of Figure 1 connotes that if proposed options were adopted, efficient and modern cadastral systems and infrastructure would be inevitable and result in an efficient land administration, i.e., efficient land and property markets and secured tenurial rights that support economic development. Under such conditions, sustainable development and social justice are foreseeable which in turn depend on other factors.

Definition of the Problem

When does a cadastral system become a problem, or under what condition will governments be compelled to reinvent the current inefficiencies in the cadastral system? Obviously, it becomes a problem and a priority for improvement if issues and weaknesses exist in quite a number of conditions. These are: the identification of rights in land, especially rights of occupancy and use; the security in buying, selling, mortgaging, inheriting, leasing, renting, and enjoyment of easements over land; the control of national and local authorities over ownership and use rights, respectively; the restrictions and responsibilities relating to the individual parcel and access to information by the land owner or user; the illegal occupation of government or private land that results from the infringement of formal land use controls; the long established settlement that has not been brought within the formal registration system; the vacant lands subject to unproven claims; the inability of the cadastral system to keep pace with urban growth; the forms of tenures to cover from informal to formal systems; the definition of land parcel and a common system of land parcel referencing; the responsibility of different organizations over the recording of ownership and use rights; the exchange and compatibility of data among different organizations; the recording rights over land and those concerned with land administration and management; the integration of the land title registry and cadastral systems and their link with other land administration and management activities such as valuation and planning; and the cadastral system's support to effective land markets, increased agricultural productivity, sustainable economic development, environmental management, political stability, and social justice.

Such conditions are real and make up the scenario in the country today. They can characterize the country's existing cadastral system. In addition, other predicaments can be cited: weaknesses under the current practice of cadastral surveying; lack of support from the implementing agency; inadequacies in implementing structure, mechanisms, strategies, policies, and guidelines; technological innovations unexplored in some areas; lack of qualified and competent manpower complement; and poor supervision and management by the implementing agency/unit. Such problems signal the need for an improved cadastral system to achieve the vital reforms in land administration.

A look at the most recent status of cadastral surveys affords us with a different perspective of the problem. The first cadastral project conducted was that of the Pilar Cadastre which was carried out in 1909. As of 2001, the cadastral survey of 917 cities/municipalities are already approved, 337 surveys are in progress, 291 localities are partially surveyed, and 68 are still unsurveyed. The percentage accomplished is shown in Table 1. As of December 2001, about 9.3 mil-

turn to next page

lion hectares or 66% of the 14.1 million hectares of alienable and disposable lands had been titled either administratively or judiciously.

Table 1 – Percentage Accomplished on Cadastral Surveys

STATUS	NO. OF CITIES / MUNICIPALITIES	% OF TOTAL
Approved	917	56.9
In progress	337	20.9
Partially Surveyed	291	18
Unsurveyed	68	4.2
Total	1,613	100

Source: LMB, *Cadastral Survey Profile: Technical Bulletin No. 7*

Table 1 reflects the magnitude of work yet to be accomplished. A cadastral system does not stop at the survey level. If it supplies records of interests in land, then it should transcend up to registration, valuation, and utilization of the land. It should be seen as a system that supports effective land markets, agricultural productivity, sustainable economic development, environmental management, political stability, and social justice. Justifiably, the cadastral survey is not an end in itself. It is just part of the whole cadastral system.

Disjointed Interventions

The present land administration system was the subject of several studies conducted in the past. Recognizing the magnitude of land-related problems, the Government of the Philippines (GOP) made several attempts in collaboration with other donor countries. These are: a review and pilot program development on cadastral survey, titling, and registration activities (USAID, 1979); geodetic surveys and piloting of registration and records management activities (AusAID: Natural Resources Management and Development Project, 1989-1994); the preparation of a Land Resource Management Master Plan (DENR, 1993); and support for LGUs in six rapidly growing cities to implement their responsibilities under the Local Government Code which included the development of a computer-based GIS for tax mapping and property assessment (AusAID/ADB: Philippine Regional Municipal Development Project, 1999-2001). While such initiatives sought to address critical issues in land administration and cadastral systems, the implementing agencies failed to gain support of government and donors to continue the programs and only few of the activities are sustained to date. Whatever their contributions to land administration and cadastre have yet to be assessed. Their focus, however, is on specific problem areas and issues and the need for a unified institutional approach to the delivery and management of land administration services is not addressed.

A Unified Intervention

The *framework* for the long-term Land Administration and Management Program (LAMP) was set out by the GOP/World Bank (WB) Fact-finding Mission in 1998. The overall goal of the program is to alleviate poverty and enhance economic growth by improving the security of land tenure and fostering efficient land markets in rural and urban areas, through the development of an efficient system of land titling and administration which is based on clear, coherent, and consistent policies and laws and is supported by an appropriate institutional structure. It was designed as the first step towards the implementation of the proposed long-term (15-20 years) LAMP of the GOP. The first phase will be implemented over a 30 to 36-month period with the following planned outputs: (a) agreement on the policy changes necessary to implement the long-term LAMP, supported by draft legislation as appropriate; (b) successful implementation of the two prototypes – the land titling and administration and land records and information management; and (c) the detailed design and costing of the first phase of LAMP, which will scale up the procedures developed in Phase I. The project has four components. These are Land Policy and Key Issues Studies, Prototypes, Institutional Development, and Preparation of Subsequent Phases.

LAMP Phase I came out with certain key legal, technical, and institutional recommendations related to the cadastral system. For a medium-term horizon, the legal recommendation is the amendment of DAO 98-12, on the Manual for Land Surveying Regulations in the Philippines, to provide a more appropriate framework for modern survey practices. Technical recommendations include, among others, the introduction of digital orthophoto maps and satellite imageries for validation of old surveys. Institutional recommendations include, among others, the client-focus shift through the establishment of One-Stop-Shops (OSSs) and the development of their internal systems and procedures.

For a long-term horizon, the legal recommendations include, among others, the rationalization and codification of laws on public land disposition and land registration. Technical recommendations include, among others, the formulation of manuals for the detection of fake titles, office validation, field validation, and Cadastral Index Map production. Finally, the institutional recommendations include the creation of Special Adjudication Teams; the setting up of the *Barangay* Advocacy Group; and the creation of an autonomous Land Administration Authority which has a clear mandate to lead and manage long-term reforms in the land administration system.

Given the above recommendations, the following questions are raised. Do the key recommendations address the current issues/concerns/problems on land administration or cadastral system? Are the reforms introduced in the current system relevant, appropriate, and complete? Will there be an efficient system to support the land business of the government? Do they offer innovations that allow professionals to protect the interests of the beneficiaries? By the time the project terminates, are the land rights of individual settlers protected? What will be the contribution of the program to land development and its impact on land and property markets?

The program, which is an integrated/unified approach towards a reformed land administration system, must see to it that the indicators of success as reflected in its Logical Framework Matrix are satisfied. It will be too early, however, at this time to answer such questions and draw conclusions as the program has not yet reached its completion stage. Nonetheless, much is expected from this initiative of the government. Future phases or plans (e.g., LAMP Phase II) should be designed based on adoptable or replicable innovations and lessons learned. Practically speaking, the success of the program, specifically in the area of cadastre, is not dependent on the technical sophistication, but whether it encompasses genuine legal and institutional reforms that satisfy the needs and aspirations of the major stakeholders in land administration and management.

Proposed Vision and Options for the Future Philippine Cadastre

What were discussed in the previous sections of this article are generally the necessary preliminary steps to allow us to assess and think of a better solution to the current inefficiencies in cadastral systems. Figure 2 illustrates the methodical steps for defining the visions and options for a reformed system.

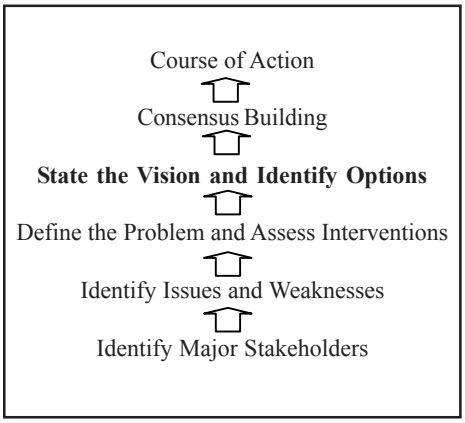

Figure 2 – Stages of Framework Implementation

In the previous section the major stakeholders and their needs and aspirations, weaknesses of the present cadastral system, and gaps under past and current initiatives were identified. Taking these and considering other factors, the proposed vision can be stated as, *"An efficient and modern cadastral system and infrastructure that provides good land information, protects land rights, underpins sustainable land use and development, facilitates efficient land and property markets, supports the land business of stakeholders, and sustains long-term administration and management of land and its associated resources."*

The future state of the country's cadastre must satisfy its function of providing reliable and up-to-date information on matters about land ownership, value and use. It must be an instrument in adequately protecting rights over land. It is also envisioned that the system and the infrastructure appurtenant to it should serve as regulatory mechanisms for utilizing and developing land in a sustainable manner. The future state must also focus on the economic utility of the land as a scarce resource. It must also be responsive to the needs of the different stakeholders and play its role to ensure efficient land administration and management, ultimately realizing sustainable development and social justice. These conditions may be realized if appropriate modes of intervention and/or options are drawn in addition to what had already been initiated.

While the basic justification for cadastral systems are economic development, environmental management, and social stability, different countries will place greater importance on different areas at different periods of their development. Developing countries like the Philippines are more concerned with economic growth, the protection of land rights, and the reduction of land and boundary disputes. Unlike in western developed countries and those moving from a command economy to a market economy, they tend to be more concerned with increased efficiency and micro-economic reform, and the rapid creation of a new system in support of economic development and efficient land markets, respectively. In all countries, however, there is the concern that cadastral systems support social justice.

With the present stage of the country's development and the corresponding meager resources, what options do we have and steps to re-engineer the current system to satisfy these conditions and realize the envisioned cadastral system?

In order to facilitate the planning and development of a national cadastral infrastructure which will satisfy the escalating needs of a greatly increasing population, several options may be adopted. First is the formulation and development of a National Land Policy, which defines the rule of the law and how land can be owned and used. It generally relates to economic development, social justice and equity, and political stability.

The cadastre can support land policies by providing a legal framework for administering land rights. A land right framework supports, among others, structural change, environmental protection and sustainable management, and control of natural resources and environment. It also provides tools for the implementation of land policies such as land consolidation, resolving land disputes or compulsory acquisition of land.

Technical options for the development and maintenance of the cadastre depend on the needs of the country and its stage of development. Any move towards the adoption of a program for computerization should be subject to the availability of trained staff or service providers, access to maintenance and support staff, adequate communications and a suitable storage capability. The move for computerization should bring security to the cadastral system, greater accessibility to information, and overcome the deterioration of records in paper form.

As far as institutional options are concerned, there is a variety of alternatives in selecting the most appropriate structure for managing the cadastre. These are: a combination of land registration, cadastral surveying, and mapping functions; a decentralized system; establishment of strong linkages among different authorities responsible for maintaining records on the ownership, value, and use of land; commercialization, corporatization or privatization of cadastre; extensive participation by private Geodetic Engineers in a state-run cadastre; harnessing the role of professional bodies and non-governmental organizations and the administration of Professional Regulatory Boards; regulation of responsibilities, accountability, and quality assurance; ensuring funding arrangements for the creation or development of a cadastre; implementing education, training, and continuing professional development; research and development; and strengthening international cooperation.

With the question as to when the vision can be realized, based on Figure 2, the next step is consensus building. That is, there has to be an agreement on whether to adopt the above-cited vision or to accept the various options presented. Finally, courses of actions should be identified and rationalized prior to plan formulation. These steps, however, would require another article to discuss and explain these downstream activities.

Conclusion

Sustainable development depends on good land administration and good land administration depends on efficient and modern cadastral systems and infrastructure. This means that development efforts, whether government or private, must consider the parcel affected by them.

The author believes the concept that *"a cadastral parcel is the basic unit of human activity."* Each parcel of land occupies a unique physical relationship with every other parcel of land. This is because in ev-

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News

PRS '92 mandatory implementation for extension

by Concepcion A. Bringas

NAMRIA Administrator, Usec. Diony A. Ventura addresses participants during the Focused Group Discussion for Metro Manila and Southern Luzon.

DENR Secretary Elisea G. Gozun has sought the approval of Malacañang for the extension of the mandatory full implementation of PRS '92 from 2005 to 2015. In a memorandum to the President dated 07 May 2004, the Secretary cited the poor compliance to PRS '92 as the reason for the extension. As of February 2004, there was only 10.3% accomplishment. Out of the national target of 108,364 geodetic control points, only 11,159 geodetic control points were established, and no complete integration of survey and maps to the system has been done for any municipality. The low level of accomplishment was attributed to inadequate funds and shifting of priorities of different administrations.

The request also included the granting to DENR the authority to allocate funds for the activity and to designate an agency to monitor the compliance. The Secretary has also issued guidelines for the implementation of PRS '92 to the DENR concerned units: NAMRIA, LMB, FMB, the Mines and Geosciences Bureau (MGB), the Parks and Wildlife Bureau (PAWB), and the offices of the Regional Technical Directors for Lands. The LMS/ Field Network Survey Party (FNSP) under the Regional Technical Director's office shall establish and maintain a minimum of three geodetic control points in every *barangay* in 3rd and 4th orders. NAMRIA shall establish and maintain the 1st to 3rd orders of PRS '92 geodetic control points.

NAMRIA and LMB shall implement a program for the transfer of GPS and other PRS '92-related technologies to LMS. NAMRIA shall continue to evaluate GPS survey data until the time the LMS technical staff can perform the job with competency. The calibration and certification of GPS receivers registered with LMB shall be done either by the two agencies before their dispatch to the field.

The order also requires the transformation into PRS '92 of all surveys, ENR maps and all previously established reference monuments such as PBMs, CBMs, MBMs, BBMs, BLLMs, BLLMs, BLBMs and project controls. NAMRIA shall provide a developed set or sets of transformation parameters for the whole country.

In compliance with the department directive, the NAMRIA Data Analysis Task Group headed by Mapping Department Director Jose Galo P. Isada Jr. is gathering preliminary data in the cities of Butuan, Surigao and Davao for the development of guidelines for the integration of existing surveys into PRS '92. The Information,

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NAMRIA project receives endorsement from NEDA

by Benjamin P. Balais[1]

The NAMRIA-proposed project entitled "Improvement of the LGU Coastal Management Process Using Remote Sensing and GIS" was finally endorsed by the National Economic and Development Authority to the Swedish International Development Cooperation Agency (Sida) for funding assistance on 16 January 2004. A Sida representative, Mr. Arne Carlsgard, arrived in the country on 21 March 2004 for the assessment and refinement of the proposal.

The undertaking is a complementary effort to the initial assistance provided by NAMRIA in an earlier project on the development of GIS for the local government units LGUs). In this undertaking, LGUs will be further assisted in the use of advanced technologies, GIS and Remote Sensing technologies, particularly in the development of an application system to help their strengthen and enhance their coastal resources planning and management.

Bataan, Batangas, and Bohol LGUs are the pilot project areas. The pilot LGUs, at the completion of the project, are expected to have respectively created a digital databank containing, among others, the biophysical characteristics of the aquatic resources, habitats and ecosystem of the pilot areas; and socio-economic profile. The expected outputs are customized GIS-based profiling system on municipal and provincial levels and application development addressing coastal management issues of the pilot areas.

The proposed two-year project is scheduled to commence in the early part of 2005.•

[1]*Information Technology Officer II, Database Management Division (Information Management Department)*

Junior GEs benefit from RA 9200

by Nicandro P. Parayno

Junior Geodetic Engineers may now upgrade their position to Geodetic Engineer without having to take the board examination for Geodetic Engineers, by virtue of Republic Act (RA) number 9200. RA 9200 amended the Philippine Geodetic Engineering Act of 1998 or RA 8560 and its implementing rules and regulations took effect in January 2004.

Under RA 8560, the certificate of registration and the professional license were issued only to successful GE board examinees. The conduct of the Junior GE board examination was stopped and incumbent Junior GEs were required to finish the BS GE course and take the licensure examination within five years.

Under RA 9200, all incumbent Junior GEs shall be issued a certificate of registration and a professional identification card without having to take the GE board examination. The provision applies to incumbent Junior GEs who have been in the active practice of the GE profession for at least three years and are Bachelor of Science degree holders in Geodetic or Civil Engineering or are Associates in Geodetic Engineering or Surveying.

Junior GEs qualified for upgrading to GE without examination are required to file their application for upgrading within three years from the effectivity of the law. They are also to update their knowledge of the profession through continuing professional education or appropriate distance learning, as prescribed by the Professional Regulation Commission, within three years upon approval of their application. RA 9200 requires duly registered Junior GEs to continue to practice as such until their application for upgrading as GEs shall have been acted upon by the existing Professional Regulatory Board of Geodetic Engineering, but not beyond three years from the effectivity of the law. There are presently about 5,774 Junior GEs in the country.•

Geo-hazard mapping

by Benjamin P. Balais

Geo-hazard mapping to produce landslide (triggered by rainfall and earthquake) susceptibility maps was undertaken by four government agencies, namely: NAMRIA, MGB; the Philippine Institute of Volcanology and Seismology (PHIVOLCS); the Bureau of Soils and Water Management; and the Philippine Atmospheric, Geophysical, and Astronomical Services Administration.

The collaborative undertaking came in the aftermath of the landslide tragedy that hit Panglao Island in the province of Southern Leyte in December 2003. The national government acted on the directive of the President to organize an inter-agency working group that would produce the landslide susceptibility maps for the country.

These maps will provide indicative information in identifying the areas in the country where landslide-related disasters may occur, based on the criteria and ratings used by the collaborating agencies.

The initial phase of the work was started in January covering Regions 5, 8, and CARAGA. The activity included data collection of relevant information contributed by the participating agencies. The dataset came in graphical format which was processed and analyzed using GIS technology. Outputs for the phase was presented at DENR last 15 January. NAMRIA led by Administrator Diony A. Ventura presented the hazard map for rainfall-triggered landslides. MGB presented the hazard map for floods while PHIVOLCS presented an earthquake-triggered landslide susceptibility map.

The technical working groups were able to develop the hazard assessment and susceptibility analysis methodology based on the expertise, functions, and mandates of member agencies. The GIS technology was adopted in the compilation and integration of outputs as well as in the analytical procedure. Indicative and preliminary results were due to the use of criteria maps at scale of 1:250,000 to generate the composite hazard maps.

The second phase which commenced in March 2004 covered the National Capital Region; Regions 1, 2, 3, 4, 6, and 7; and the Cordillera Administrative Region.

Evaluation, field verification, and refinement of outputs will be undertaken in Phase 3. PHIVOLCS and MGB shall take the lead in the development of an interactive, user-friendly, real-time, and GIS-based geo-hazard monitoring system.•

Engr. Randolf S. Vicente (fifth from right) holds the trophy awarding the Geodetic Engineers of the Philippines (GEP)-NCR as the Most Outstanding Regional Division for FY 2004 in ceremonies held on 17-19 June 2004 at the Oasis Country Resort, San Fernando City, La Union. This is the second time for GEP-NCR to be given such an award, the first being in 1993. With Engr. Vicente are the GEP Board of Governors and the GEP-NCR participants. Also last year's winner, Engr. Vicente himself was given his second award as Most Outstanding GEP Regional President, this time for FY 2004.

LC survey of Culion, Palawan completed

by Marlyn A. Tabuñar

The LC survey of Culion, Palawan, covering a total area of 37,084.52 hectares, was recently completed by the Land Classification Division of NAMRIA. Classified were 10,758.43 hectares for agricultural purposes (alienable and disposable); 23,927.11 hectares for forestland (upland); and 2,398.98 hectares for forestland (mangrove). The boundary between areas for forestland purposes and those for agricultural purposes was monumented at an interval of every 250 meters.

The collaboration of DENR, NAMRIA, and the local government of Culion to fast-track the LC survey of the municipality is in compliance with Republic Act number 9032, an act expanding Culion's area of jurisdiction. The survey, which was started in December 2002, took more than a year for its completion. There was the lack of funds after the conduct of the initial survey. The undertaking was continued with the financial assistance of DENR in the estimated amount of P819,908.00. The densification of LC monuments and Ground Positioning System control points were conducted in January and March 2004.

When finished, the survey project report and the corresponding map will be presented for review and evaluation to the National Sub-classification Secretariat, which serves as the Technical Working Group of the National Technical Evaluation Committee (NTEC). It is the NTEC that endorses the final documents to the DENR Secretary for the approval and issuance of the relevant Department Administrative Order. With the effectivity of the DAO, the LC map of Culion, Palawan becomes official and can be utilized specifically in the preparation of the cadastral map and the survey by the LMB.•

A Proposed ...

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ery community, there exists a variety of land uses. Each parcel is the focus of a complex but singular set of space relationships with the social and economic activities centered on all other parcels. It is therefore important that administration and management of this unit of human activity must be given priority attention.

The framework illustrated in this article somehow provides a better understanding of the significance of why there should be a need to reinvent and improve the current cadastral systems and infrastructure. Initiatives that are being carried out and those that will be taken in the future must consider the *stakeholder-oriented vision* to ensure that upcoming undertakings will be legally, technically, and institutionally sound. Lessons learned from past and ongoing efforts must be responsive to the needs of the society and in harmony with local conditions.•

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Education, and Communication Task Group chaired by Information Management Department Director Linda SD. Papa has lined up for the year a series of trainings on GPS for the LMS/FNSP. The training for the first batch was held on 21- 25 June 2004.

The DENR's favorable action on the PRS '92 issue has supported the NAMRIA and LMB positions which were based on the results and agreements reached during the regional focused group discussions (FGD) conducted on 19 February-02 March 2004. Discussions were held in Baguio City for Northern Luzon; Manila for Metro Manila and Southern Luzon; Cebu City for Visayas; and Davao City for Mindanao. The FGD activity was initiated by NAMRIA through the Development Studies and Standards Office, in cooperation with LMB.•

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