

NAMRIA's compilation of land use and land classification statistics and maps for the whole country is expected to deliver to all sectors of society the information requirements needed for land evaluation as well as for the management and development of the country's natural resources.



Land Use and Land Classification of the Philippines

EDITORIAL

Within a span of 14 months, four major natural disasters struck the country. The devastating earthquake in July 1990, typhoon Ruping three months later, the eruption of Mt. Pinatubo in June this year, and just recently, typhoon Uring and its killer floods left thousands dead and rendered hundreds of families homeless. The destruction of bridges, roads, buildings and other infrastructure has aggravated the present state of the economy.

The initial hue and cry that followed each of these calamities have simmered down. And while the affected populace are trying to rise from the devastation, pick up the pieces and build lives anew, the monumental task of rehabilitation has yet to be completed.

One of the departments currently involved in the government's rehabilitation efforts is the Department of Environment and Natural Resources (DENR). Through the NAMRIA, the Department has provided up-to-date and accurate information on the extent of damage caused by the eruption of Mt. Pinatubo. Satellite remote sensing technology has indicated the areas most likely to be affected or reached by the lahar in the years to come.

Satellite remote sensing data validated by field surveys have also provided the government with the most recent statistics on the country's forest cover. SPOT imagery compared with Landsat data obtained about ten years earlier helped DENR in disproving allegations that the major cause of the Ormoc City flooding was denudation due to recent illegal logging activities.

NAMRIA's acquisition of Synthetic Aperture Radar (SAR) data of some 1.3 million hectares in Northern Luzon after the killer quake in 1990 has been used to assess environmental and natural resources damages. Through the use of SAR imagery, geologic features which may indicate deep seated faults are interpreted and analyzed. Verified by ground surveys, information obtained could identify areas which may be hazardous to life and property.

Through the Global Positioning System (GPS), a satellite surveying technology, NAMRIA re-surveyed the areas affected by the '90 quake to determine if the geodetic points previously established have been displaced.

Maps and other related information have also been generated using Geographic Information System (GIS). GIS makes information generation less tedious for it allows the integration of textual data and geographic information from various sources into a system which makes it possible to store, retrieve, analyze, and present these data for different types of users.

NAMRIA is steadily building a reputation for itself as an agency in the forefront of ENR-related and mapping technology and an active participant in disaster rehabilitation as well. Through these state-of-the-art techniques and systems, it is hoped that the agency will be able to serve the needs of the government, the private sector, the academe, and the public in general, as a source of relevant information. ●

Jose G. Solis
Administrator

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The National Cartography Center Project

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On 11 June 1978, Presidential Decree No. 1588 created the National Cartography, Photogrammetry and Remote Sensing Center (NCPRSC) as the central mapping agency of the government. It was given the function of initiating, developing and implementing a continuing and integrated program of aerial photography and base mapping. Almost three years later, on 12 April 1981, Executive Order No. 677 was promulgated amending P.D. No. 1588 by renaming NCPRSC as the National Cartography Authority (NCA).

The NCA was mandated to monitor, coordinate and integrate all mapping activities of government agencies and to formulate and implement a National Mapping Program which will serve as a master plan for all mapping activities in the country.

Prior to the signing of P.D. 1588 and E.O. 677, the Philippine Government has already established technical and financial cooperation projects with the Federal Republic of Germany (FRG). Implementation of these projects was further strengthened when a loan agreement for DM 6.5 million was signed. The loan proceeds were to be utilized for the acquisition of various mapping and survey equipment, as well as for technical assistance, training and the conduct of aerial photography. The Philippines' contribution to the project was the construction of a building to house the equipment and the employment of qualified personnel to be trained in operating said equipment.

To complement the mapping equipment capability of the NCA, Letter of Instruction No. 147 was issued on 1 March 1984 integrating the topographic mapping functions of the former BCGS with that of the NCA. It also provided for the physical transfer of all mapping equipment of BCGS procured under a UNDP-assisted project to the NCA building then under construction.

Initial delivery of the loan-funded mapping equipment started on 28 March 1984. However, the equipment were not immediately installed since construction of the printing building was still ongoing.

For its pilot project, the NCA had originally planned for the **orthophoto**[†] and **cadastral map**[†] production (scale 1:4,000) of the municipalities of Dimiao

and Bilar in Bohol. The aerial photography project was undertaken by a local contractor in 1982. The project was not completed as planned due to delays in building construction and equipment installation.

Developments After the February 1986 Revolution

Under the new administration, organizational development and personnel recruitment were given emphasis. Immediately after the NCA building was completed, mapping equipment and personnel were transferred from the old to the new building. In-house training of personnel in the fields of photogrammetry, reprography and surveys under the tutorial supervision of German experts was intensified. Six more personnel were later sent to Germany and other countries in 1987, for technical training and conferences. Pilot projects in addition to the primary functions of NCA were undertaken. These were:

1. Orthophoto map production at scale 1:5,000 for three cities of Bicol Region: Naga, Iriga and Legaspi;
2. Duplication of reproducible of the new base map series of 1:50,000 initiated by the U.S. Defense Mapping Agency (USDMA). These reproducible are stored at the Armed Forces of the Philippines Mapping Center (AFPMAC);
3. Continuation of the map revision project of the new topo series (scale 1:50,000) initiated by USDMA, which completed only about 25% of the country (mostly Luzon). This left 75% of the remaining area for NCA to undertake. The initial projects undertaken were those of the provinces of Albay and Sorsogon; and
4. Orthophoto and topographic mapping of Bondoc Peninsula in support of the Bondoc Peninsula Area Integrated Development Project.

Government Reorganization

With the 1987 merger of the NCA with three other government agencies performing mapping functions, personnel and equipment of the merged agencies were transferred to the new building. The merged agencies became the NAMRIA, which is today the central mapping agency of the government responsible for integrated surveys, mapping, charting, oceanography, aerial photography, remote sensing, management of resource information and research development.

Extension of the NCA Project Agreement

In April 1981, the Philippine Government and the Federal Republic of Germany agreed under the framework of bilateral technical and financial cooperation to implement the National Cartography Center Project.

The NCA Project Agreement was to have expired on 31 December 1986. However, a three-year extension was granted on 14 July 1987 to cover the period from 1 July 1987 to June 1990. And it was extended again up to 30 June 1992.

As a result, German experts in the fields of **photogrammetry**[†], **geodesy**[†], cartography, printing and reprography were able to continue their training programs for NAMRIA personnel. Additional training slots were scheduled for technical as well as for management personnel. This was augmented by the local training of personnel at University of the Philippines' Training Center for Applied Geodesy and Photogrammetry (UPTCAGP).

Under the extended agreement, both governments agreed to continue cooperating towards upgrading the capabilities of NAMRIA. Thus, German Agency for Technical Cooperation (GTZ) experts will continue to conduct in-house trainings. NAMRIA personnel will be trained abroad under a 220 man-month program. In addition, three survey vehicles and micro-computers will be added to the assistance package. Recently, a KLIMSCH REPROGRAFIKA P reprographic process camera, a computer-assisted high precision equipment for map production was installed for the Reprography and Printing Division of the Mapping and Reprography Department.●

References:

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CONTRIBUTIONS

The National Surveys, Mapping, and Resource Information Technology Quarterly (Infomapper) is accepting contributions for its forthcoming issues. Manuscripts should be typed, double-spaced and must indicate the author's name, position, and office/home addresses. Photographs and illustrations with captions are also welcome.

The Editors reserve the right to edit materials submitted.●

[†]Marked terms in bold type are defined in the Glossary of Terms on page 16.

Vessel Traffic Separation Scheme (TSS)

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The Philippines, being an archipelago, depends largely on sea-borne vessels for transportation among its islands. Majority of domestic inter-island travellers, particularly the low and medium income group, rely heavily on cheaper water transportation because of the high cost of air travel. This is specially true for trade and commerce. Thus, safe and economical sea transportation is the lifeline of sea-borne trade which is a vital factor in economic development.

The occurrence of major marine accidents in the country, such as the MV DOÑA PAZ - MT VECTOR tragedy in 1987 which resulted in the heavy loss of life and property, has brought an urgent need for government authorities concerned about maritime affairs to review and devise ways to improve and ensure safe sea travel.

One outstanding move is the introduction of the *Vessel Traffic Separation Scheme (TSS)*. It is a system wherein a congested navigable water area is divided into two opposing lanes similar to that of a road. It gives a vessel utilizing a lane the exclusive right to proceed to her destination unimpeded since no other vessel, as far as practicable, should cross her way, much less obstruct her path when undertaking sea activities like fishing and anchoring.

The establishment of the TSS along with the designation of sealanes is in accordance with the International Regulation for Preventing Collisions at Sea which was last revised thru a convention held in London in October 1972. It was organized by the Inter-Governmental Maritime Consultative Organization (IMCO) of which the Philippines is an active member. This revised Regulation commonly referred to as "Rules of the Road" was enforced on 15 July 1977 and was subsequently amended by the IMCO twelfth regular session on 19 November 1981. It contains provisions which make the observance of TSS mandatory.

TSS is normally applied in marine-traffic congested areas such as channels, straits and constricted passages. This is designed to monitor and control movement of all vessels, whether private, government, commercial or naval entering or leaving congested sea routes. It is also expected to minimize, if

not prevent, collisions and loss of life and property along existing and future sealanes. However, several requirements and activities have to be undertaken before this measure could be implemented and enforced. First, designated sealanes must be free of dangers and obstructions or hazards to navigation. Thus, there is a need for an extensive hydrographic survey of the area. Second, adequate aids to navigation like buoys, beacons and lighthouses must be provided to help and guide mariners in steering thru their designated lanes. Finally, limits of the scheme, defined and promulgated, must be reflected in the published nautical charts of the area.

As the principal charting agency of the government, the NAMRIA is responsible for the execution of a *Sealane Hydrographic Survey*, wherein all relevant data in the preparation of updated nautical charts are gathered. Other field activities include bathymetry, bottom sampling, tide and current observations, topographic survey, magnetic observations, coast pilot and revision of sailing directions. Aside from delineating TSS boundaries, the survey aims to locate navigational hazards, provide aids to navigation and update hydrographic and topographic data.

NAMRIA's five-year program on hydrographic surveys has initially envisioned the surveying of 15 sealanes in consonance with the implementation of the TSS starting with the most con-

gested areas. Presently, only four areas, namely: Tablas Strait in Romblon, Hinatuan Passage in Surigao, Verde Island Passage in Batangas, and Balabac Strait in Palawan have been surveyed.

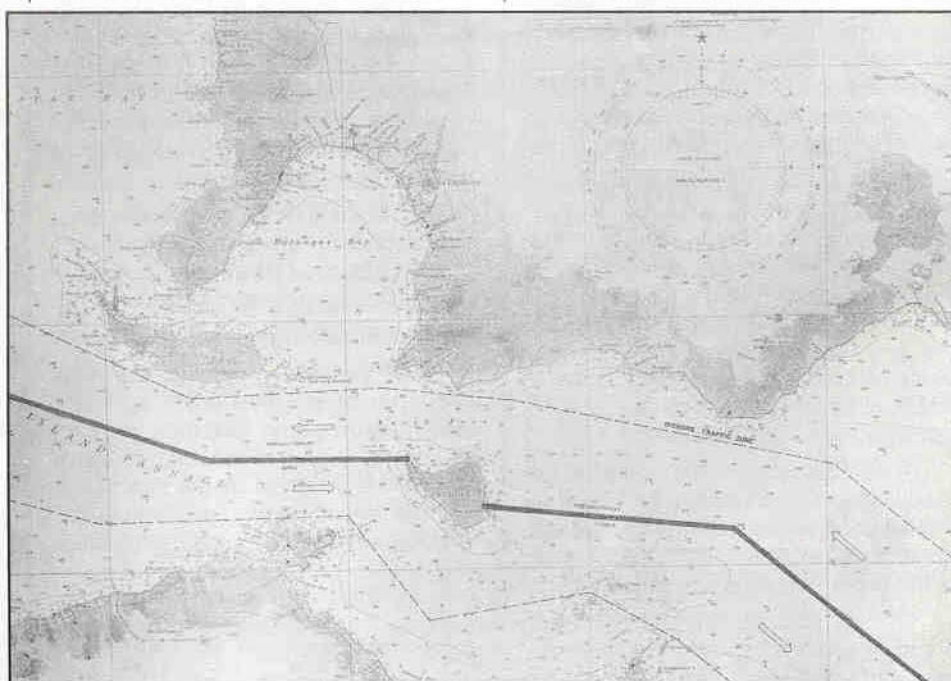
Like many other government programs, budgetary constraints have greatly affected the progress of this project. Another key factor is the non-availability of a modern hydrographic survey vessel to undertake these surveys. It is a sad note that hydrographic charting ranks low, if not the lowest, in the priorities of the government. This can be gleaned from the fact that to this date, NAMRIA is still operating and utilizing three old survey ships of the former Bureau of Coast and Geodetic Survey (BCGS) which were acquired through a grant-in-aid from the Australian Government in the early 60s. Maintaining the seaworthiness of these old survey ships has been very costly due to frequent breakdown of their engines and other appurtenances.

Surely, the acquisition of a new survey ship by the government for NAMRIA will help a lot in promoting and enhancing navigational safety at sea in the country. •

References:

COLREG. International Regulations for Preventing Collisions at Sea, 1972.

PCG Memorandum Order No. 01-88 dated 02 March 1988.



Portion of nautical chart of Verde Island Passage showing TSS.

NAMRIA's Role in CARP

In her speech during the signing of the Comprehensive Agrarian Reform Program (CARP) Bill on June 10, 1988, President Corason C. Aquino emphasized that although the main responsibility for the implementation of CARP lies with the Department of Agrarian Reform, all government departments are expected to be as deeply involved and as committed to the program's success.

One of the departments rendering support services to CARP is the Department of Environment and Natural Resources (DENR) through NAMRIA's Land Classification Division. Twelve land classification (LC) teams were formed to implement the DENR-CARP Land Classification Component Project. The objective of this project is to classify, survey and map lands of the public domain to be declared as Alienable & Disposable (A & D) lands for distribution to settlers and other qualified landless beneficiaries.

Land classification segregates areas to be released as A & D for disposition under the Public Land Act, areas suited for fishpond development, and areas to be retained for permanent forest purposes. Non-forest lands include areas for fishpond purposes and A & D lands. A & D lands are those whose slopes are below 18%. Upon classification, these arable lands are to be earmarked for the CARP.

One basic step in the land classification process is the identification of the areas to be classified. Possible targets are listed down and these areas are then determined if they are to be classified or reclassified as A & D lands.

When the target areas have been identified, field verification teams proceed to the site to determine if they are possible CARP

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sites. Topographic characteristics are tested to ascertain that these conform to the set criteria for A & D lands suitable for agriculture.

If the area has been previously classified as forest land, but after field verification has been ascertained as possible A & D land for CARP, all previous records of the area will be compiled. However, if the area is still unclassified, new data such as topography, soil type and other information will have to be gathered.

After coordinating with the local government agencies for the acquisition of additional information about the target area, the LC teams conduct reconnaissance surveys[†] on the target site. Basic tools such as the Japanese compass transit which gets bearings or directions are used, along with steel tapes or calibrated chains and the stadia for measuring distances.

Monumentation is then performed by planting square concrete monuments on established boundary corners between A & D lands and forest land. These monuments weigh approximately 35 - 40 kilos and measure .15 x .15 x .60 meters. On each concrete monument, the letters NCL, meaning NAMRIA Land Classification are written along with the index and station number. A flat head with an arrow indicates where the next marker is.

The number of monuments to be placed depends on the size of the area and the distance from one monument to another which varies from 250 meters between artificial or manmade boundaries, and 200

meters along natural boundaries such as rivers and creeks.

Other activities undertaken include the collection of soil samples complete forest inventory. The data derived from these activities will be used as a basis in the preparation of the preliminary LC map and as reference in the future.

After field work, the LC Teams document all activities undertaken in the area. The report includes a justification for the recommended classification of the area.

The report is evaluated by the Land Classification Board of NAMRIA and the National Land Classification Committee (NLCC). Directors from the Land Management Bureau, Mines and GeoSciences Bureau, Forest Management Bureau and the Bureau of Fisheries and Aquatic Resources make up the NLCC. Upon evaluation, the report is then submitted to the DENR secretary for approval.

Once approved, a Department Administrative Order is drafted to allow the classification of the area as recommended in the LC report. Final approval of the new classification will be decided by the DENR Secretary, after which he will sign the Administrative Order.

The Administrative Order, which releases the area as A & D land suitable for agriculture, is then transmitted to the Land Management Bureau (LMB) for final disposition. ●

References:

- Comprehensive Agrarian Reform Program, Quezon City, 1987.
- NAMRIA. Land Classification/Reclassification Activities of CARP.

NAMRIA Participates in Nationwide Effort to Help Indigenous Cultural Minorities

By Claro P. Lopez III
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Consider the following: existing cultural minorities number 7 million all over the country.

These minorities inhabit land areas in about 32 provinces, 20 of which are identified by the DENR as having "ancestral lands of national cultural communities." Of these provinces however, only six have proclaimed reservations[†] intended for cultural minorities. These are Nueva Ecija, Pangasinan, Zambales, Agusan del Norte, Cotabato, and Davao del Norte. Compounded by the recent displacement of some minority groups as a result of the Mount Pinatubo eruption, these realities are but a part of the grim picture of the plight of endemic cultural communities in the Philippines.

In an attempt to improve this situation, NAMRIA has embarked on a project aimed at identifying areas occupied by existing indigenous communities. It will also recommend those areas that are suitable as national reservations.

More specifically, the project focuses on: (1) conducting research on the needs,

habitat and cultural heritage of upland cultural communities; (2) assessing, evaluating and determining suitability of areas occupied by these communities and surrounding vicinities using the application of remote sensing techniques and mapping; (3) conducting perimeter surveys[†] and mapping of areas determined to be suitable for proclamation as national reserve; (4) monumenting boundaries of suitable areas, and (5) recommending the proclamation of these as national reserves suitable for the cultural tribes.

For the initial phase of the project, two target areas were identified, namely, Brooke's Point and Kasibu located in the provinces of Palawan and Nueva Vizcaya, respectively.

Among the main activities covered in the implementation phase are:

1. Identification of and research on cultural tribes, heritage and study sites;
2. Acquisition of secondary data such as topographic maps/control base maps, aerial photographs, soil maps, and land use maps;
3. Preliminary compilation and mapping;
4. Manual or digital interpretation of aerial photographs/SPOT, Landsat data and other remote sensing images;

5. Field validation and surveys including collection of the primary biophysical and socio-economic data of the target area, perimeter surveys, and monumentation of suitable dwelling sites; and
6. Final mapping (perimeter map[†] with technical description).

For the year 1991, preliminary data has been collected covering the province of Palawan at Brooke's Pt., and in Kasibu, Nueva Vizcaya. Likewise, frequent and intensive consultations/meetings were conducted with the different tribal leaders and groups to discuss the various issues related to their land problems.

The identification and delineation of ancestral domain/land within the two provinces is considered a positive response of the government to the long-felt need of indigenous cultural communities for tenurial security within their ancestral lands. More importantly, this project symbolizes an initial attempt to meet the growing urgency of the indigenous people's struggle for recognition in their ancestral domain. ●

References:

- Department of Environment and Natural Resources Administrative Order 104
- National Council of Churches in the Philippines

By Charmaine C. Aviquivil
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Metropolitan Manila. A bustling conglomeration of cities and municipalities situated at the heart of the country. The Philippines' premier commercial and industrial center with a 1990 population of 7,928,867 (roughly 13% of the country's total population) and still growing.

How long can Metro Manila's land area, which amounts to only 636 sq. kms., accommodate its burgeoning population with an average annual growth of 2.8%? Already, it is the region with the highest density amounting to more than 12,000 people per square km. And until when can it support its rapidly growing industries?

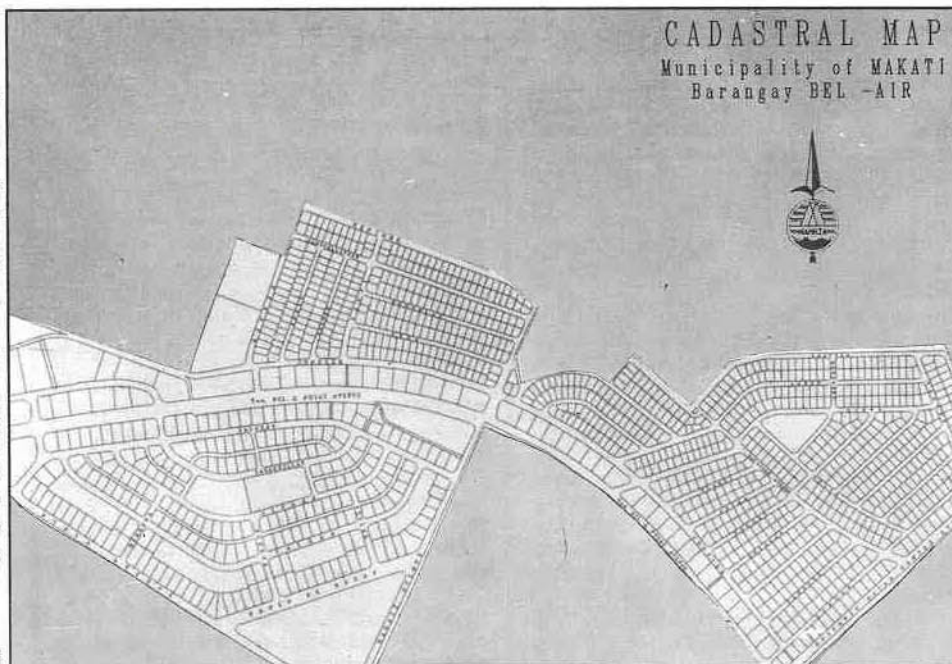
Metro Manila's Land Use Patterns

Ideally, metropolitan areas should have set land use patterns which facilitate urban planning and management. Unfortunately, this cannot be said of real-life situations where the rapid industrialization and urbanization of cities especially during the latter part of this century have led to a lack of order with regard to actual land use.

This is true of the National Capital Region (NCR), which is characterized by mixed and conflicting land use patterns. According to the Metropolitan Manila Authority (MMA), the changes in NCR's land use patterns over the past few years include:

1. An increase in the number and density of squatters;
2. The rise of middle and upper class residential subdivisions in the peri-urban areas where land is less expensive;
3. The development of high-rise condominiums and townhouses in the main urban areas for the upper and middle classes;
4. The conversion of fishpond and agricultural areas into residential and/or commercial uses;
5. The development of high intensity commercial activities along major transport routes;
6. The emergence of intensifying suburban commercial nodes at major transport route intersections; and
7. The location of new and relocation of existing industries at cheaper northern, eastern, and southern sites along major transport routes.

These existing land use patterns have contributed to the major problems



Digitized cadastral map of Bel-Air, Makati.

Urban Planning through ZIS

of Metro Manila. Rapid development is occurring in blatant disregard of the constraints posed by the inherent characteristics of the land, thus aggravating urban environment deterioration.

Furthermore, Metro Manila is expected to grow especially in the major urban areas, with a projected population of 8.7 million in 1995, and 9.6 million in the year 2000. An increasing outward expansion initiated by the private sector is also anticipated.

Need for Zoning

The chaos resulting from a less than ideal mix of land uses such as that existing in Metro Manila can be minimized through *zoning*. Zoning divides or segregates particular areas into sections or zones reserved for specific uses/activities. It specifies the patterns, nature, and characteristics of uses and provides density and environmental regulations according to approved development plans and strategies as well as land use policies and objectives of the community.

Zoning classifications determine the predominant uses of specific areas. These include:

1. Major Zones
 - a. Residential - low, medium, and high density;
 - b. Commercial - major, minor, and metropolitan;
 - c. Industrial - light/non-pollutive/non-

hazardous and medium/pollutive/hazardous;

2. Special Zones - institutional, agricultural, and others.

A *Comprehensive Zoning Ordinance for Metro Manila* was promulgated in 1978. It contains land use and zoning regulations, delineates zones, and states the permissible uses, activities, and restrictions within these defined zones. For instance, residential zones should contain housing units and various types of dwellings; commercial zones should be characterized by commercial and trade activities such as the operation of retail outlets, service shops and eateries; and industrial zones should contain manufacturing industries. General district requirements such as those on building structure use, height regulations, dumping sites, etc. are also included in the Ordinance.

All government projects as well as individuals or organizations from the private sector applying for business and license permits are required to obtain *locational clearance* (LC) from the Metro Manila Zoning Administration (MMZA) which is under the Office for Planning of the MMA. The LC ensures the lawful use of buildings, structures, or land based on the zoning regulations contained in the Ordinance.

It is not sufficient, however, that such an ordinance exists. Proper land use can only be successful when regula-

tions are implemented and complied with. Again, we find that the actual situation is not congruent with the ideal set-up where zoning regulations are followed to the letter. Site visits and actual land use maps show commercial enterprises encroaching upon sites planned for residential use only, mixed industrial-residential sites areas, and other conflicting land uses.

Zoning Information System

The NAMRIA has come up with a tool which will enable the MMA to effectively implement the regulations contained in the Ordinance. The *Zoning Information System* or *ZIS* is being developed under an R & D project entitled "Research on the Application of GIS in the Generation of Land-based Statistics". The ZIS is the second GIS application project to be conducted by the Agency, the first being a *Geographic Information System for Makati* implemented in 1990 covering streets, lots, buildings, and business establishments.

The ZIS is a system designed for monitoring and regulating land use to effectively implement zoning regulations. Specifically, it aims to:

1. Facilitate the processing of application for LCs and ensure compliance with existing zoning ordinance;
2. Facilitate the updating and production of land use and zoning maps for monitoring and management purposes;
3. Generate reports on the issuance of LCs and filing/processing fee collection; and
4. Provide answers to inquiries regarding land use and on zone restriction, use and ordinance.

System Configuration

The ZIS includes the following:

1. *Inputs* - graphical data such as zoning and cadastral maps as well as non-

graphical data such as zoning regulations and restrictions, information on LC, etc.;

2. *Hardware* - PC AT with 640 RAM and 70 MB hard disk, 80386 Micro-processor, 80287 Math Co-processor, a 1.2 MB 5.25" drive and a 360 KB 5.25" drive, an AT I/O card, and a 14" color monitor with 640 x 200 resolution; and
3. *Software* - the system uses Simple Macro Language (SML) for the maintenance of graphical files, queries involving graphical display, and plotting of maps; DBase III for report generation and updating and editing non-graphical files; and a GIS software called ARC/INFO for integrating graphical and non-graphical files.

System Modules

This system has five modules:

1. *Database Creation* - provides screen input formats to facilitate data entry;
2. *File Maintenance* - updates records in graphical and attribute files;
3. *Process Application* - assesses applications based on Ordinance requirements. Information on type of activity or project, lot and block numbers, nature of application, project location, floor area and height of building, open area in a specific lot, products to be manufactured, raw materials to be used, employment size, and industrial waste are checked for conformance to zoning regulations. The system then generates a report on deviations from specifications which will serve as a guide for evaluation. Land uses may be graphically checked and displayed using the GIS buffer zone function;
4. *Process Inquiries* - permits inquiries on allowable uses of lots, restrictions, applications for LC, and other relevant information; and

5. *Output Generation* - creates a plot file to be used for producing hard copies of zoning maps or produces statistical reports on locational clearance applications, issuance and fee collections.

Outputs

The expected outputs of the ZIS are:

1. Updated zoning maps;
2. Evaluation report for LC applications;
3. Reports on issuance of permits and fee collection; and
4. Query system for allowable uses and restrictions associated with lots.

The NAMRIA team working on this project is currently in the programming stage. Data entry and the digitizing of maps are simultaneously being performed. The completed system is expected by December 1991.

The utilization of the Zoning Information System for more efficient land use, zoning, and re-zoning processes in Metro Manila will hopefully pave the way for the development of similar systems appropriate for other regions or cities in the Philippines. ●

References:

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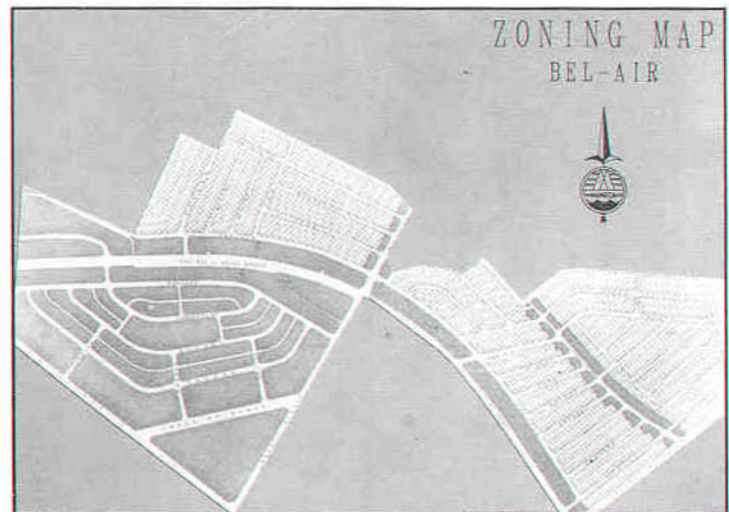
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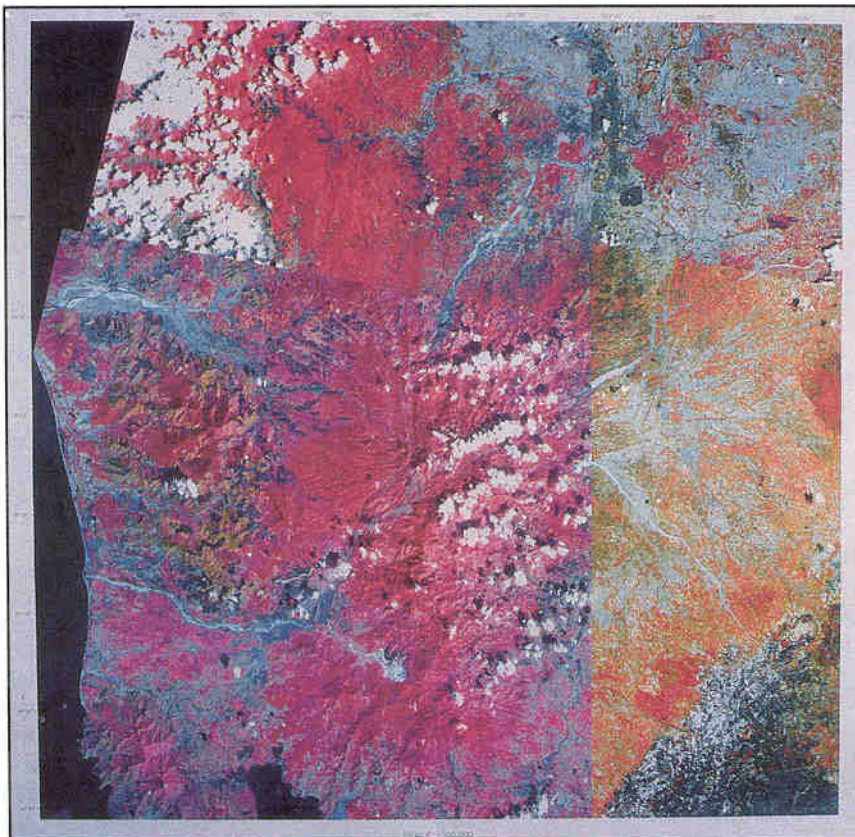


Sample output showing different zoning categories of the same area.

Photo Essay

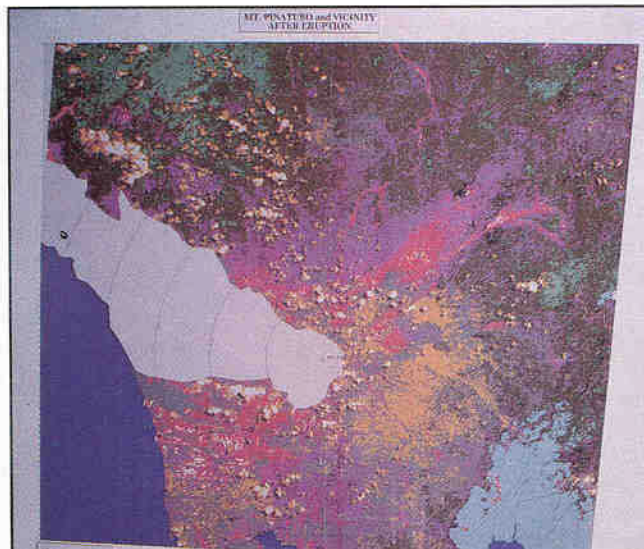
Soon after Mt. Pinatubo's fury was felt in Luzon, devastating most of Region III, the NAMRIA involved itself in activities supporting government efforts to rehabilitate the affected areas. Through the use of mapping and related technologies such as aerial photography, satellite remote sensing, and GIS, the NAMRIA has provided reliable and timely information on the extent of damage caused by the volcano's eruption. Among the inputs for the further analysis of the data obtained as well as outputs are:

SPOT satellite mosaic of Mt. Pinatubo before eruption taken in February, April, May and June 1988 at scale 1:100,000. This was processed and printed at the NAMRIA Remote Sensing Center (NRSC).



Raw MOS-1 MESSR image of Mt. Pinatubo and vicinity taken on 5 July 1991 processed at NRSC.

Data Source: National Space Development Agency (NASDA) through the Bureau of Soils and Water Management (BSWM).









Classified image of Mt. Pinatubo & vicinity taken on July 5, 1991 processed at NRSC.

Data Source: NASDA through BSWM.

The map shows the Cordillera Occidental region of Luzon, Philippines. Key locations labeled include Igarate, Nueva Ecija, Zambales, Bataan, Pangasinana, and Marikina. Contour lines are drawn across the terrain, and a shaded area indicates the distribution of the Philippine Eagle. The map is oriented with North at the top.

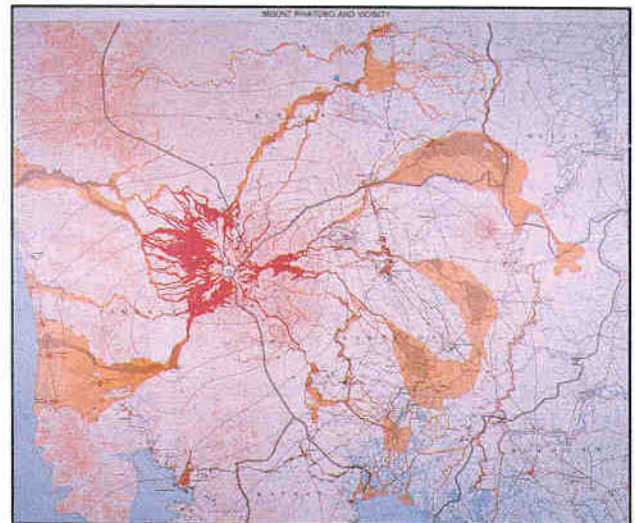
Legend:

-  Pyroclastic Flow Deposit
 Mudflow Prone Area
 Mudflow Affected Area
 as of September, 1991
 Isopach Lines for
 Deposits in Cm.
 River Network
 Provincial Boundaries



0002121. Medicine General Reg. Volume 1011
Issue 1100.004. Pathogenic Infections of
Neurology and Neurology. MSY

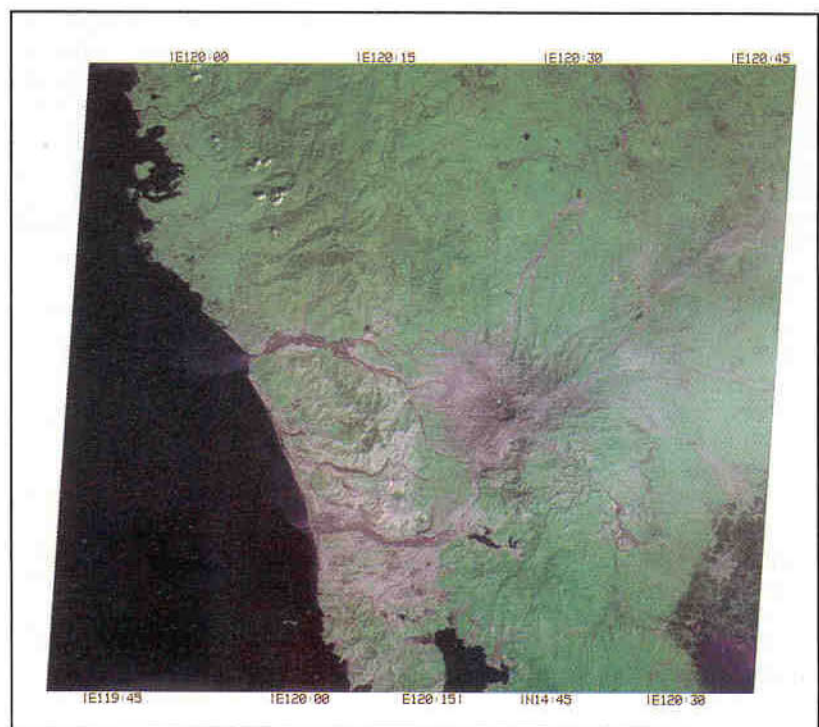
Data Source: Mudflow Hazard Map of Mt. Pinatubo and vicinity (1:100,000 scale).



Mudflow Hazard Map of Mt. Pinatubo and vicinity as of 1 October 1991 at scale 1:100,000 printed and published by NAM-RLA with data from Philippine Institute of Volcanology and Seismology (PHIVOLCS), Mines and Geosciences Bureau (MGB), United States Geological Survey (USGS) and University of Illinois, Chicago Department of Geological Survey (UIC-DOGS).

Post-eruption MESSR image of Mt. Pinatubo and vicinity as of 9 November 1991.

Data Source: NASDA



Land Use and Land Classification of the Philippines

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Remote Sensing and Resource
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Table 1 - Land Classification Status as of December 31, 1990
(in hectares)

Region	Total Area	A&D	Total Forest Land	Unclass. Public Forest (UPF)	Total Classified Forest (CF)	Forest Reserves	Timber-Land	National Parks	Military Reservation	Civil Reservation	Fishpond Dev't.
CAR	1829368	340656	1488712	21135	1467577	804795	655321	6907	554	0	0
Region 1	1284019	810062	473957	33155	440802	226846	199140	12999	288	923	606
Region 2	2683758	960132	1723626	146305	1577321	209288	1331213	26388	412	8931	1089
Region 3	1823082	1051908	771174	26874	744300	166104	422729	32780	117019	804	4864
Region 4	4756016	2209496	2546520	175048	2371472	455395	831455	1029501	3835	45278	6008
Region 5	1763249	1222060	541189	29873	511316	69939	412996	25276	0	63	3042
Region 6	2022311	1408782	613529	1606	611923	135344	428939	23505	0	235	23900
Region 7	1495142	959223	535919	69555	466364	49407	397450	15054	4	114	4335
Region 8	2143189	1023715	1119454	38925	1080529	51508	1018238	4108	176	862	5637
Region 9	1599734	762252	837482	26871	810611	424924	370288	2607	46	2611	10135
Region 10	2832774	1067348	1765426	50732	1714694	314816	1326548	55734	0	6209	11387
Region 11	3169275	1212440	1956835	116774	18400661	217841	1546706	53643	0	19127	2744
Region 12	1437274	546828	890446	49631	840815	122346	608674	20552	7996	80789	458
ARRM	1160829	542827	618002	94673	523329	24359	465684	31943	0	0	1343
Grand Total	30000000	14117729	15882271	881157	15001114	3272912	10015381	1340997	130330	165946	75548

The NAMRIA has recently come up with a compilation of land use and land classification statistics and maps for the whole country. It presents the latest available information on the status of land use/land cover and land classification status for the whole country by region and by province. This will be the first national compilation of land use and important information for the public which will be updated by NAMRIA from time to time, with the LC status updated after December 31 every year.

This as yet unpublished "Land Use and Land Classification Statistics and Maps of the Philippines" is divided into two parts: 1.) Consolidated Land Use derived from the results of two surveys: the Second National Forest Resources Inventory conducted by the former BFD (now the Forest Management Bureau) from 1979-1988 with the assistance of the Food and Agriculture Organization (1978-1983) and the Federal Republic of Germany (1984-1988) and the Mapping of the Natural Conditions of the Philippines, a project conducted by the Swedish Space Corporation utilizing SPOT data of 1987-1988 under the support of the World Bank; and 2.) Land Classification Status of the Philippines as of December 31, 1990.

The consolidated data was used in the Master Plan for Forestry Development which is a joint project of DENR, Asian Development Bank (ADB) and the Finnish International Development Agency (FINNIDA). The purpose of the project was to provide the government of the Philippines with a team of plan-

ners to assist in preparing a long term plan for the development of the forest resources and the forestry sector of the country.

Land Classification is the process of demarcating, segregating, delineating and establishing the best uses of forest lands. Specifically, it involves the segregation of areas to be released as alienable or disposable for disposition under the Public Land Act, areas suited for fishpond development, and areas to be retained for permanent forest purposes. Land classification formally started in 1920, whereby LC Map No. 1 was certified on June 22, 1920 under Project No. 1 located in the municipality of Labo, Camarines Norte. Since then, LC activities have continued.

Land use mapping, a complementary activity to Land Classification, is defined as the specified land utilization type practiced on a given land unit. The first land use maps covering the whole country are the Forest Resources Condition Maps (FRCM) of 1969 extracted from the aerial photos taken from 1965 to 1969.

Table 1 shows that the remaining unclassified Public Forest (UPF) is 881,157 hectares (ha). The total classified forest is 15,001,114 ha while total A&D land is 14,117,729 ha.

Table 2 shows the rate at which LC has progressed. In 1965, the remaining UPF was about 9.8 million ha which is equivalent to 32.86% of the total area of the Philippines. As of 31 December 1990, only 881,157 ha or 2.94% of the total area remained as UPF. This means that the average yearly rate of land classification is 559,500 ha. It is however, noticeable that from 1988 to 1990, the total UPF did not change. This was attributed to the non-issuance of DENR Administrative Order establishing forest land or certifying A&D lands due to DENR's interpretation of the CARP law. This does not mean, however, that LC

Table 2 - 25 Year National LC Statistics
(in hectares)

Year	Total Area	Ttl. Classified Area	Total A&D	Total CPF	Total UPF
1965	30000000	20154043	12365413	7788630	9845957
1966	30000000	20395745	12422178	7973567	9604265
1967	30000000	20154043	12446041	8095995	8845857
1968	30000000	20587828	12473508	8114320	9412972
1969	30000000	20697241	12498778	8198463	9302759
1970	30000000	21110100	12572435	8637665	8889900
1971	30000000	21435628	12652473	8783115	8564372
1972	30000000	21598592	12747516	8851076	8401408
1973	30000000	21744525	12807993	8936532	8255475
1974	30000000	21967887	12917083	9050804	8032113
1975	30000000	22085420	12971282	9114118	7914800
1976	30000000	22105800	12975861	9129961	7894178
1977	30000000	22125926	12991758	9134168	7874074
1978	30000000	22217554	13060840	9147714	7782446
1979	30000000	22421822	13093263	9328559	7678178
1980	30000000	22947510	13269340	9705170	7025490
1981	30000000	24153361	13327630	10825731	5846839
1982	30000000	24273876	13359243	10914433	5726324
1983	30000000	24939861	14467592	10472269	5060139
1984	30000000	28172665	14515393	13657272	1827335
1985	30000000	28680206	14659760	14020446	1319794
1986	30000000	28813425	13852398	14961027	1186575
1987	30000000	29118703	14094950	15023753	881297
1988	30000000	29118843	14117753	15001090	881157
1989	30000000	29118843	14117729	15001114	881157
1990	30000000	29118843	14117729	15001114	881157

Table 3 - Consolidated Land Use/Cover of the Philippines as of December 1988*

Region	Total Area (in has)	A R E A (in thousand hectares)								Total Forest	
		Mossy	Pine	Old Growth	Residual	Grass Land	Extensive Land Use	Other	Lake/IW	Ha	%
CAR	1,805.50	202.00	210.00	155.20	143.10	274.50	697.00	121.90	1.80	710.30	39.34
Region 1	1,251.80	15.60	21.30	16.30	27.30	172.90	469.90	524.80	3.70	80.50	6.43
Region 2	2,626.10	341.10	14.60	311.30	411.60	263.40	590.30	689.70	4.10	1,078.60	41.07
Region 3	1,810.90	74.10	2.00	30.40	183.70	281.30	374.30	858.30	6.80	290.20	16.03
Region 4	4,754.00	315.40	1.10	254.20	624.80	179.80	1,559.30	1,694.80	124.60	1,195.50	25.15
Region 5	1,732.50	12.00	0.00	10.50	54.60	100.40	460.10	1,089.10	5.60	77.10	4.45
Region 6	1,998.70	38.70	0.00	0.00	64.40	78.20	954.70	881.00	1.70	103.10	5.16
Region 7	1,425.40	21.70	0.00	0.00	10.20	75.50	806.00	511.00	1.00	31.90	2.24
Region 8	2,095.40	26.00	0.00	64.80	338.40	11.10	1,108.90	546.20	0.00	429.20	20.48
Region 9	1,583.40	11.40	0.00	17.10	187.40	7.70	636.70	722.10	1.00	215.90	13.64
Region 10	2,725.00	178.90	0.00	138.60	445.90	161.10	1,065.20	717.60	17.70	763.40	28.01
Region 11	3,219.70	185.40	0.70	154.50	684.50	98.90	1,122.60	971.90	1.20	1,025.10	31.84
Region 12	1,380.50	57.20	0.00	18.70	203.50	21.30	477.90	578.90	3.00	279.40	20.54
ARMM	1,190.30	89.20	0.00	6.40	131.00	46.00	475.50	396.00	46.20	226.60	19.04
	29,579.20	1,568.70	249.70	1,178.00	3,510.40	1,772.10	10,798.40	10,283.50	218.40	6,506.80	22.0

*Islets less than 100 hectares not included

activities were suspended. Surveys, data processing and final mapping continued but the signing of the administrative orders were held in abeyance.

Table 3 shows the figures for the country's remaining forest cover which is about 6.5 million ha or 22% of the total land area of the Philippines. Forest cover includes pine forest, mossy forest, old growth forest and residual forest. Of all the regions, Region 2 has the largest percentage of total forest covering 1,078,600 ha or 41.07% of its total land area while Region 7 has the least with 2.24% or 31,900 ha.

The consolidation of the land use data was undertaken by NAMRIA with consultation from the SSC. The methodology used included: 1) manual coding of the two sources of land use data

using a 1 km x 1 km grid; 2) inputting of coded data to a software called RASTA (Raster Analysis) with a program for consolidation; and 3) importation of consolidated data to the TYDAC-SPANS to produce the statistics and maps. The program used in the consolidation was prepared basically by SSC and was refined and improved by NAMRIA personnel. The TYDAC-SPANS was used because of its capability to generate statistics and maps by province, region and by country and the overlaying of other thematic information.

With the computerization of these two basic types of information, NAMRIA hopes to deliver to all sectors of society all requirements needed for planning the development of our natural resources. Presently, these data are very important

in land evaluation especially in the government's efforts to revegetate the country's open and denuded areas. Also, land evaluation is necessary to determine the biophysical suitability of certain lands as basis for decision-making by our policy makers. ●

References

- Holmgren, P. **Consultant Report : Geographic Information for Forestry Development in the Philippines**, Makati, April 4, 1980.
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Conduct of aerial photography around Mount Pinatubo

An aerial photo mapping of Mt. Pinatubo and vicinity is being conducted to determine the exact lahar deposits on the volcano and their locations at waterways.

Aerial photographs taken within a 40 km. radius from the peak of Mount Pinatubo will be used in producing 20 sheets of topographic maps at scale 1:10,000 covering the towns of Bamban, in Tarlac and Mabalacat, Magalang, Dau, Porac, Sta. Rita, Floridablanca, Bacolor, Guagua and Angeles City in Pampanga.

Approximately 90% of the area has been covered to date by CERTEZA. When completed, aerial photography will cover around 502,500 ha of heavily damaged area detailed as follows:

Eastern Block 2337 m ASL 590 line km
Western Block 4116 m ASL 1325 line km
Total: 1915 line km

The areas photographed were the geological boundaries of Botolan, Zambales on the western part; Olongapo City and Subic Naval Base on the southern portion; and Tarlac, Tarlac on the northern part which have a flight line altitude of 4116 meters. The areas of Orani in Bataan, Angeles City and Mexico in Pampanga, and Capas and Concepcion in Tarlac on the eastern side have a flight line altitude of 2337 meters.

The ultimate objective of the project is to provide a graphical documentation of the damaged areas in the form of updated maps and newly acquired photographs and to provide baseline data for volcanic activity analysis,

development planning, formulation of hazard zoning laws and environmental impact assessment.

The mapping component includes the rectification and enlargement of aerial photographs which will be done on the SEG VI Standard Rectifier and topographic mapping which will make use of photogrammetry. This component also involves stereo compilation, field editing and cartographic activities.

Newly surveyed control points will be tied up to the previously established geodetic control point network using the Global Positioning System (GPS). Activities in this phase are designed to establish a network of horizontal and vertical control points adequate for mapping purposes covering the project area. ●

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Flood-prone areas in the country identified

One hundred coastal towns and low-lying areas in Metro Manila and 27 provinces have been identified as prone to flooding where an increase of one meter in mean sea level (MSL) will occur during high tide.

This was disclosed by Administrator Jose G. Solis during his paper presentation on Tidal Phenomenon/Ocean Dynamics at the Asia-Pacific Climate Change Summit held in Manila recently.

Records of NAMRIA tide stations in Manila, Davao, Cebu, and Legaspi covering two periods from 1951 to 1969, and 1970 to 1980 indicated that there has been an increase in Mean Sea Level (MSL). Manila appears to have the highest increase at more than 31 cm. for the last 40 years with an average annual increase of 1.75 cm.

Zapote, Las Piñas, Parañaque, Malabon and Navotas covering a total of 1,508 square kilometers are the endangered areas in Manila.

The other areas are in Ilocos Norte, Ilocos Sur, Cagayan, La Union, Pangasinan, Zambales, Aurora, Quezon, Cavite, Bulacan, Leyte, Samar, Bohol, Negros Occidental, Mindoro Oriental, Davao del Sur, Davao Oriental, Surigao del Norte, Capiz, Iloilo, Cebu, Agusan del Norte, Misamis Oriental, Misamis Occidental, Camarines Sur, Negros Occidental, and Maguindanao.

The Inter-governmental Panel on Climate Change of which NAMRIA is a member estimates that the present level of the world's oceans could rise by about 20 cm. by the year 2030, and about 65 cm. by the end of the year 2100.

The rise in MSL could be attributed to the increased volume of sea water as a consequence of global warming, where the world's oceans would expand and rise due to an increase in temperature; land subsidence as a result of excessive withdrawal of ground water by

deep wells, seawater surges[†] and wind set-ups[†] due to storms and typhoons, among others.

On the same occasion, NAMRIA set up an exhibit with the theme "Monitoring and Assessment of the Effects of Global Change" at the lobby of the Batasan Pambansa building. It displayed maps showing flood prone areas in the country, SPOT satellite data of Mt. Pinatubo (pre-and post-eruption data), mudflow hazard map, topographic map and SPOT image of Ormoc City, nautical chart, and land cover map, among others.

Other participants of the exhibit were the Department of Public Works and Highways, Environmental Management Bureau, Bureau of Soils and Water Management, Philippine Volcanology and Seismology Office, Geothermal Office, Metro Manila Authority, PAGASA and the Earth Savers, a non-governmental organization. ●

Thai Princess visits NAMRIA's Remote Sensing Center



Thai Princess Maha Chakri Sirindhorn tours NAMRIA with DENR Secretary Fulgencio S. Factoran Jr., IMD Director Linda S.D. Papa, and NAMRIA Administrator Jose G. Solis.

Princess Maha Chakri Sirindhorn of Thailand visited the NAMRIA Remote Sensing Center (RSC) last 28 August 1991 as part of her week-long stay in the Philippines to receive the Ramon Mag-saysay Award for public service.

Her Royal Highness was awarded a

Plaque of Recognition from the NAMRIA for her invaluable support in promoting remote sensing (RS) technology in the ASEAN Region. The plaque was presented by the Department of Environment and Natural Resources Secretary Fulgencio S. Factoran Jr. and Administrator Jose G. Solis.

A poster and photo exhibit was displayed at the Lecture Hall and at the RSC featuring various map outputs utilizing RS and GIS technologies. This was followed by a demonstration of RS and GIS facilities at the RSC and a tour of the agency's mapping facilities.

The Thai Princess has been actively involved in promoting RS technology and has initiated several projects for environment and natural resources assessment for her country. Through her efforts Thailand is now in the forefront of this state-of-the-art technology. Various remote sensing facilities were established in her country such as a ground receiving station of Landsat, SPOT, and other geographic satellites.

Thailand has also provided host facilities for the Economic Social Commission for Asia and the Pacific (ESCAP) Regional Remote Sensing Programme and offered trainings at the Asian Institute of Technology for many Filipino remote sensing practitioners.

Ambassadors Sarasin Viraphol of Thailand and Mack Williams of Australia, Mr. Conrad Cappel, Charge d' Affaires of the Federal Republic of Germany, representatives from the Thai Embassy, some diplomatic dignitaries and other top government officials graced the event. ●

Manila Bay Vessel Traffic Service to be charted

The NAMRIA will be depicting the Manila Bay Vessel Traffic Service (VTS) scheme in charts as soon as the Philippine Coast Guard (PCG) issues the "Final Memorandum Circular" legitimizing the depiction of the VTS on existing nautical charts.

The VTS, a scheme designed to monitor the flow of vessels entering or departing Manila Bay, is part of the Traffic Separation Scheme (TSS) being implemented by the government through the 5-year Sealanes Hydrographic Survey Project of NAMRIA. This is designed

to review and devise navigational safety measures to ensure safe sea travel.

Prior to this, a hydrographic survey of the Manila Bay is necessary to comply with the requirement of the International Maritime Organization (IMO) which stipulates that the area be adequately surveyed to modern standards to ensure the safe passage of vessels. Other safety measures include the provision of navigational aids to guide mariners in steering through their designated sealanes, as well as the publication of the TSS limits on the charts. The promulgation from the PCG supported by the

compliance of IMO requirements will lend legitimacy to the program.

Steps are currently being undertaken for the release of funds for the survey of the North and South Channels of Manila Bay. Last year, the survey of Verde Island passage was completed with the TSS currently being incorporated on affected charts based on a promulgation announced earlier by the PCG. Other sealane surveys already conducted by NAMRIA are those of Balabac Strait, Hinatuan Passage and Tablas Strait. ●

NAMRIA opens sales office in Iloilo City

The NAMRIA has opened a sales outlet in Iloilo City to service the city's map and chart requirements and that of Panay, Negros Occidental and the Guimaras Island.

Second Statistical Month celebrated

The second National Statistical Month (NSM) was celebrated in October this year through various activities participated in by more than 30 government agencies from the 13 regions of the country and a number of non-government organizations (NGOs). The month-long celebration consisted of meetings

Local Civil Registrars on October 22 to 24 at the Celebrity Sports Plaza. A five-year agenda for local civil registration and a study on vital registration conducted by NSCB in Basilan were presented and discussed at the convention.

Technical Report

Forest Cover Survey and Mapping of Aurora Province

INTRODUCTION

A significant component of the Aurora Integrated Area Development Project (AIADP) is the Watershed Protection and Forestry Study, which involves the conduct of a watershed protection and management study and the implementation of pilot/scheme demonstration programs on watershed rehabilitation and upland stabilization. It is in this context that the AIADP and the NAMRIA entered into a Memorandum of Agreement to pool their resources in conducting a forest cover mapping and survey of Aurora province.

The study involves the review of land classification status, present boundaries of resource areas, present location and extent of agricultural areas and other land uses. It shall also determine the validity of previous forest inventories and the potentials for minor forest products.

OBJECTIVES

The objectives of the study are:

1. To determine the different vegetation and land use/cover of the province that will support the formulation of land use planning policies;
2. To determine the remaining forest resources in terms of standing volume of timber in Aurora;
3. To map the extent of forest cover and determine soil depth in each strata;
4. To provide a comprehensive database for resource managers and land use planners; and
5. To provide detailed data requirements for the provincial Masterplan for Forestry Development and to support the plan's complementary programs.

PROJECT AREA DESCRIPTION

Aurora formally became a separate province from Quezon on 13 August 1979 by virtue of Batas Pambansa Blg. 7 with Baler as its capital. The province lies between East longitude 121°31'2" and 122°01'30" and North latitude 15°31'43" and 16°31'00", located on the mid-eastern coast, of Luzon 231 kilometers from Manila.

It has a total land area of 309,737 ha divided administratively into eight municipalities and 151 barangays. Elevation ranges from 2 - 1,901 meters

above sea level while slope and topography ranges from 0 - 3% (level to nearly level) to above 50% (very steep hills to mountainous areas).

Land classification status shows that about 76% or 236,813 ha were classified as forestland while 24% or 72,924 ha were classified as A&D lands. Land use categories, on the other hand, show forest land uses (254,733 ha) and extensive/intensive land uses (55,004 ha).

Population is placed at 141,996 (1988 projection) with agriculture, forestry and fisheries as important sources of income.

METHODOLOGY

The forest cover mapping and inventory of Aurora province involved:

A. Training

Technical staff from the Provincial Environment and Natural Resource Office (PENRO) of Baler, Aurora and of NAMRIA's Remote Sensing and Resource Data Analysis Department were trained on aerial photo-interpretation, satellite remote sensing, forest dendrology or tree identification, and forest inventory techniques;

B. Pre-fieldwork Activities

Information from 1989 panchromatic aerial photographs with an average scale of 1:22,500 and from 1987-1988 SPOT imageries at scale 1:100,000 were extracted to come up with major land cover classifications based mainly on Forest Resources Condition Maps of 1969 and 1984. For land use classifications, the Land Condition Map legend of the Palawan Integrated Area Development Project was adopted.

Base maps at scale 1:50,000 showing road network, drainage systems, and municipal boundaries were prepared. All information gathered from the aerial photographs and satellite imageries mentioned earlier were transferred to the base maps as preliminary outputs;

C. Fieldwork

Fieldwork or actual ground truthing validated vegetative cover interpretation. Six teams, each composed of a team leader, foresters, and laborers, gathered forest data such as growing stock, diameter, and tree quality as well as tree species, diameter, and height from sample plots. As per MOA stipulation, the procedure adopted for field activities

was that used in the RP-German Forest Inventory Project;

D. Data Processing and Analysis

Computer-aided programs expedited the statistical analysis of the voluminous data obtained. Programs for data encoding, data sorting, timber volume computation, and analysis of standard error were made using Quick-BASIC software.

GIS software such as ARC/INFO for data input and TYDAC-SPANS (Spatial Analysis System) for data transformation and output were also utilized; and

E. Final Mapping and Report Writing

Aside from the technical report of this study, other outputs include various maps such as slope maps (raster), legal status maps (raster), vegetation cover map (raster), geologic map of Aurora, and watershed unit maps of Aurora (raster) as well as forest statistics.

RESULTS AND DISCUSSION

The significant findings are as follows:

1. *Vegetative Cover* - The Aurora forests are mostly dipterocarp with residual stands occupying 148,680 ha or 48% of the entire province. This connotes that most of the Aurora forests have already been logged except for a few portions of old growth stands in Casiguran, Dilasag, and San Luis. Land cover details are as follows:

Forest Cover	229,575
Breakdown:	
Old growth	
dipterocarp	27,530
Residual dipterocarp	148,680
Sub-marginal forest	6,909
Mossy Forest	46,151
Mangrove forest	305
Brushland	25,158
Other land use	55,004
Total land area	309,737

2. *Slope Analysis* - The province is generally mountainous and very prone to erosion due to its rugged terrain. About 50% or 125,207 ha of Aurora's forest areas have slopes greater than 50% which should be banned from logging activities;
3. *Legal Status* - More than 3/4 or 76.46% of the province is forestland and the remaining 23.54% is A&D. San Luis has the most forestlands

while Maria Aurora has the most A&D lands;

4. **Major Forest Products** - Although major forest products such as common hardwoods and construction and furniture wood abound in the old growth and residual forests, logging in the residual forest will not be economically feasible in the near future since majority of these hardwoods belong to the less than 15 cm. diameter class;
5. **Minor Forest Products** - The dominant minor forest products such as rattan, bamboo, and palm can support cottage industries; and
6. **Watershed Units** - There are 243 watersheds in Aurora with the largest located at Dipaculao (19,638 ha).

RECOMMENDATIONS

1. Catchment/Sub-catchment areas or portions occupied by forest oc-

cupants with a dominant slope of 30% and below should be considered under the Integrated Social Forestry Program (ISF);

2. Environmental balance should be enhanced in the denuded/degraded watershed areas by awarding contract reforestation projects with Forest Land Management Agreement to families, communities, and corporations;
3. The rights of indigenous cultural minorities in these areas should be recognized and protected;
4. Residual forests below 50% slope which are not covered by existing national parks, watershed reservation areas, wilderness areas, and other protected areas may be opened to community logging with proper guidance from the government;

5. Buffer zones should be maintained on the perimeters of existing national parks, wilderness areas, and other protected areas;

6. Owners of underdeveloped or idle A&D lands should be encouraged to go into firewood production for household and industrial use; and
7. A&D lands which are covered with natural forest but are classified as A&D by virtue of their Spanish titles should be looked into and be properly classified.●

Source: Report on Forest Cover and Survey of Aurora Province,
Department of Environment and Natural Resources
Remote Sensing and Resource Data Analysis Department, NAMRIA
Aurora Integrated Area Development Project

Project Profile

Environmental Studies of Marshes Utilizing Satellite Data

This regular project which was started in 1988 is concerned with the inventory and assessment of the status and conditions of selected **marshlands**[†] in the Philippines using satellite remote sensing data. Two of the areas chosen for the study were Lake Bato in Camarines Sur and Taal Lake in Batangas.

The study used the 1956 Bureau of Coast and Geodetic Survey (BCGS) topographic maps at scale 1:50,000 as bases in evaluating the changes that have occurred since then. These were compared with recent remote sensing data. Manual interpretation/analysis of aerial photographs and 1987-1988 SPOT satellite data were performed. Imagery of Lake Bato and Taal Lake were extracted from Computer Compatible Tapes (CCTs) of SPOT scenes, displayed on a TV monitor at a scale of approximately 1:150,000 and were digitally classified and analyzed. Ground surveys were also undertaken to validate manually/digitally analyzed data.

Results of the study showed that some portions of marshland areas in barangays Agos and Buga in Camarines Sur are now filled with water lily and other vegetable crops. In the 1956 topographic map, the total marshland area was about 387.88 hectares. The 1988 SPOT data, however, showed that this has been reduced to 150.40 ha, with an areal extent change of 237.48 ha. Likewise, the water area in 1956 was approximately 2,594.44 ha while the SPOT data revealed a total water area of 2,000 ha, thus registering an areal extent change of 594.44 ha. On the SPOT imagery, the Bicol River is seen as a source of **effluents**[†] as it carries materials from the upland and adjacent areas, specially during the rainy season.

Changes in the Taal lake study area likewise revealed that some portions of the marshland have been filled with sediments. From 146 ha in 1956, the marshland area in the SPOT data has been reduced to 110 ha. Thus, approximately 36 ha of the area have un-

dergone changes. The total water area of 23,424 ha in 1956 has likewise been reduced to 23,000 ha. This means that 424 ha were detected by the SPOT data as the areal extent change. The original wet portion which has receded through the years is non-existent in the 1988 SPOT imagery. The Pansipit River and lava are also seen as sources of effluents on SPOT imagery.

The results of the study indicate the great utility of remote sensing in assessing the changes in the areal extent of marshes and in the monitoring of siltation and sedimentation patterns which are major environmental factors that affect a lake. Such information can be useful to various users like planners, resource managers, environmentalists, and others in planning and decision making.●

Source:

Technical Report on Environmental Studies of Marshes Utilizing Satellite Data, 1990.

Glossary

Cadastral map - shows the boundaries of subdivisions of land, usually with the bearings and lengths thereof and the areas of individual tracts, for purposes of describing and recording ownership. A cadastral map may also show culture, drainage and other features relating to the value and use of land.

Effluents - the outflow of a sewer, septic tank, etc.

Geodesy - is the science which determines the size and figure of the earth (geoid) by such direct measurements as triangulation, precise traverse, trilateration, gravimetric observations, satellite triangulation and doppler methods.

Marshlands - are tracts of wet, soft land that are usually characterized by grasses.

Orthophoto map - an aerial photograph with the qualities of a map such as constant scale. It show contours and color-enhanced cartographic treatment, presented in a standard quadrangle format and related to standard reference systems.

Perimeter map - represents the boundary of a piece of land, indicating the nature of distance between and direction of boundary markers according to a chosen scale without relating to any established local reference system.

Perimeter survey - a survey of a piece of land undertaken in accordance with accepted standards in order to determine the nature of, distances between and directions of its boundary markers.

Photogrammetry - the interpretation and measurement of photographic images to obtain sizes, shapes, positions, and other useful characteristics of

physical features or objects (from the American Society of Photogrammetry).

Proclaimed reservations - refer to the public domain proclaimed by the President for specific uses.

Reconnaissance survey - an exploratory or preliminary survey; inspection or examination made to gain information; geological survey of a region; a survey of a region (as in preparing for triangulation) designed especially to yield information about its general natural features.

Surge - a large change in sea level generated by extreme meteorological events such as storms or typhoons.

Wind set-ups - the vertical rise of sea level caused by the wind blowing over the surface of the water.

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