# Infomapper

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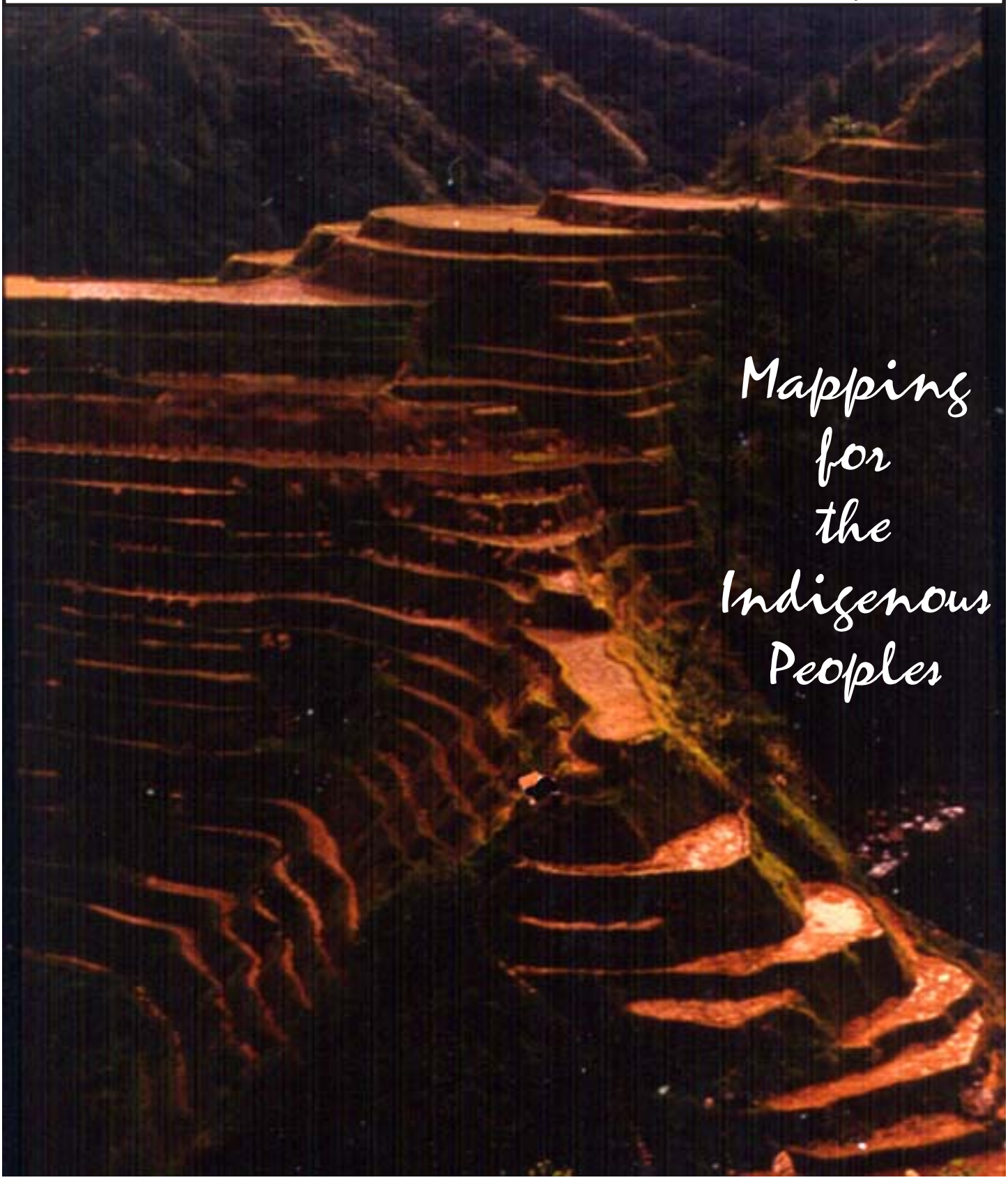

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*Editors' Note: Due to space constraints, we cannot publish the references consulted for the articles for this issue. Interested individuals may avail of the lists from the authors. A copy of the original technical paper may likewise be requested from the author.*

*Cover picture credit: Department of Tourism//Spread design: Nancy M. de Jesus & Sheilah Mae G. Lopez*

## Editorial

### Squatters no more

We often read in national dailies stories that relate the sorrowful saga of Philippine indigenous peoples in their struggle against violations of their human rights: *Agta folk in Quezon cry betrayal, Probe of abuses vs. lumads urged, Tribal folks' rights fall victim to war vs. communists*. This struggle has come a long way and still has a long way to go.

In a recent visit to assess the situation concerning the country's indigenous peoples, Professor Rodolfo Stavenhagen, the United Nations (UN) Special Rapporteur for the Human Rights of Indigenous Peoples, found out the severity of such transgressions. Notable of his findings were accounts of summary executions, rape, and forced recruitment on account of militarization. Other inferences from his 11-day mission in December last year included marginalization, limited access to government social services or the justice system, low development standards, and territorial conflicts between development projects and tribal groups.

Bloodthirsty barbarians. Savages. Illiterates. Non-Christians. These are just among the derogatory names given to indigenous peoples. They are oftentimes the butt of jokes. Throughout history, they are the most endangered groups of people. All forms of oppression are inflicted on them. As results, they are displaced, pushed to the hinterlands, and traded in the name of development.

Yet, indigenous peoples are an integral part of our society. Their influence to national culture is wide-ranging: from staple foods to language, and even medicines. They play a vital role in retaining and restoring our society's cultural legacy and environment amidst rapid development and modernization.

In December 1994, the International Decade of the World's Indigenous Peoples was launched, following the Year of the Indigenous Peoples in 1993. The UN General Assembly committed to improve the situations of the more than 300 million indigenous peoples worldwide. Improvements in their condition depend on actions taken on many issues that confront them. These issues dwell on land rights; self-government and self-development; resources and environment; culture, language, and education; and health and socio-economic conditions.

In the Philippines in 1996, a national decade for the indigenous peoples was declared to call attention to government's sustained efforts to come up with a national program that will give them due recognition. The following year, a landmark law was approved to recognize, protect, and promote their rights, and for other purposes. A component of the government's social reform agenda, this piece of legislation came to be known as Republic Act (RA) number 8371 or more popularly, the Indigenous Peoples' Rights Act of 1997.

Sought to be recognized, promoted, and protected are the rights of indigenous peoples to their ancestral domains and lands, self-governance and empowerment, social justice and human rights, and cultural integrity. Their rights of ownership and possession to their ancestral domains include the rights to: (1) develop and manage lands and natural resources, (2) stay in the territories, (3) resettlement in case of displacement, (4) regulate the entry of migrants, (5) claim reservations, (6) safe and clean air and water, and (7) resolve conflicts though customary laws.

*...continued on page 14*

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# The Importance of Hydrography and Nautical Charting in the Philippines and its Relation to the UNCLOS

*by Lt. (sg) Rosalino C. delos Reyes*[1]

There is an extreme difference between delimiting land and water boundaries. Demarcation of land properties, boundary negotiations, and all issues related to territorial claim and integrity can be conceptualized and examined in an exact location to settle disputes. But in the marine environment this is rarely possible. On land, survey monuments established by means of conventional and modern methods of surveying are enough proof of ownership and extent of territory. There are also supporting documents and legal titles clearly defining the exact coverage of the property. In the marine environment, it is the combination of either demarcation, delineation or delimitation to establish and define a territory.

The Philippine territory is clearly defined in the Constitutions of 1935, 1973, and 1987; the Treaty of Peace between the United States and the Kingdom of Spain, widely known as the Treaty of Paris in 1898; the United States and United Kingdom Treaty in 1930, delimiting the boundary between the Philippines and the State of North Borneo (Sabah); RA 3046 (1961) as amended by RA 5446 (1968), which defines the baselines of the Philippines; Presidential Decree (PD) number 1596, defining the extent and coverage of the Kalayaan Island Group (KIG); and PD 1599, defining the 200- nautical-mile Exclusive Economic Zone (EEZ).

In addition to the above-mentioned laws, RA 8550, otherwise known as the Philippine Fisheries Code of 1998, empowered the local government units to delineate their municipal waters up to the 15-kilometer limit from the coastline. Although RA 8550 is not in any way related to the UN Convention on the Law of the Sea (UNCLOS), all of these laws demonstrated the current state of the country in describing the limits of the marine territory. All laws cited above are explicitly stated in their proper context and the medium that is best suited to view the various limits defined in these laws is through the nautical chart, a product of hydrography.

## *Hydrographic Survey of the EEZ as Expressed Within the UNCLOS*

The UNCLOS can be considered as one of the most important treaties in history as it attempts to regulate virtually all activities related to the world's oceans. It took almost over ten years for about 150 nations to prepare and consolidate all the provisions of the UNCLOS, compromising between competing nations with varied interests, political or otherwise, and producing a carefully crafted set of guidelines.

NAMRIA through its Coast and Geodetic Survey Department (CGSD) is the agency of the government responsible for hydrographic charting and bathymetric surveys, portraying these in ways convenient to the users, traditionally, through the nautical charts and bathymetric maps. Hydrographic surveys, which provide the basic data for navigational charts formed the initial marine program of many nations. Hydrography includes the establishment of shore control stations either by the traditional conventional survey method or the state-of-the-art Global Positioning System (GPS), the measurement of depths, the description of the coastlines, and the study of tides and currents. In order to produce a chart of high quality, the standards and specifications set by the International Hydrographic Organization (IHO) must be satisfied. Hydrography also provides a large part of the information needed in maritime boundary delimitation and disputes.

The acquisition of the two multidisciplinary survey vessels by NAMRIA in the late nineties provided the opportunity for the country to survey its EEZ and some of the proposed sealanes traversing the archipelago. Relative to the requirement of the UNCLOS to establish and delimit the country's claim of its maritime territory, the data generated in the hydrographic survey of the Philippine waters are processed and analyzed for the revision and updating of existing charts. These nautical charts will form part of several documents to be submitted to the UN. As part of the UNCLOS requirement, the Philippines will be responsible in mapping, defining and also designating its archipelagic sealanes; and surveying the extent of coverage to ensure the safety of watercraft transiting these passages. All states party to the UNCLOS will be obliged to establish their respective environmental and control mechanisms for efficient and expeditious passage along their waters.

As in the case of the many coastal states worldwide, the Philippine government will rely mainly on only one government agency, CGSD-NAMRIA, and mostly from the inputs and technical expertise of its management team composed mostly of hydrographers, scientists aboard survey ships, oceanographers, geophysicists, and other key personnel knowledgeable about hydrography and oceanography in the preparation of their territorial claims, according to the UNCLOS requirements.

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[1]*Senior Hydrographic Engineer and Officer-in-Charge, ENC Development Unit, Hydrographic Survey Division CGSD-NAMRIA*

These personnel will have to consolidate their efforts and knowledge not only on how to gather, process and analyze the data but also on how to establish the accuracy of these measurements. In addition, the methods and procedures undertaken should be properly documented and comply with the scientific and technical provisions set forth in the UNCLOS guidelines.

Provisions in the UNCLOS with direct relevance to hydrography are: Part II - *Territorial Sea* (12 nautical miles from the baselines) and *Contiguous Zone* (24 nautical miles from the baselines), Part V- *Exclusive Economic Zone* (200 nautical miles from the baselines), Part VI - *Continental Shelf*, and Annex II - *Commission on the Limits of the Continental Shelf*. Under Article 48 of UNCLOS, the breadth of the territorial sea, the contiguous zone, the exclusive economic zone and the continental shelf shall be measured from the archipelagic baselines drawn in accordance with article 47. Under the UNCLOS provision, coastal states have the right to claim a 12-nautical-mile territorial sea, 24-nautical-mile contiguous zone, and a 200-nautical-mile EEZ. UNCLOS also permits qualified coastal states to claim or submit a claim for an extended continental shelf up to the maximum limit of 350 nautical miles. In the Philippines, NAMRIA is the only government organization with the competence to provide the baseline information from which maritime boundaries are delineated and measured to establish the sovereignty limits of the country. The official publication to contain such information is the nautical chart compiled and produced by CGSD.

*Portraying the Boundaries*

In previous years, the nautical chart has been regarded as just a plain and simple navigational tool and one of the items required by the International Maritime Organization (IMO) for every vessel to have aboardship. Nowadays, coastal states recognize the importance of nautical charts as an instrument in the delineation of their coastal boundaries. In Article 5 of the UNCLOS, it is very clear that the official publication that will contain the information about the coastal states' territorial sea is the nautical chart. Article 5 states: *Except where otherwise provided in this Convention, the normal baseline for measuring the breadth of the territorial sea is the low-water line along the coast as marked on* ***large-scale charts*** *officially recognized by the coastal State.* It is further expressed in Article 16, Section 1 and 2 which states: *The baselines for measuring the breadth of the territorial sea determined in accordance with articles 7, 9, and 10, or the limits derived therefrom, and the lines of delimitation drawn in accordance with articles 12 and 15 shall be shown on* ***charts*** *of a scale or scales adequate for ascertaining their position. Alternatively, a list of geographical coordinates of points, specifying the geodetic datum, may be substituted.* In Section 2, *The coastal State shall give due publicity to such* ***charts*** *or lists of geographical coordinates and shall deposit a copy of such* ***chart*** *or list with the Secretary General of the United Nations.*

CGSD is maintaining 178 nautical charts and about three-fourths of the total number have already been converted to digital form. The nautical charts produced and published by CGSD are divided into three groups. These are:

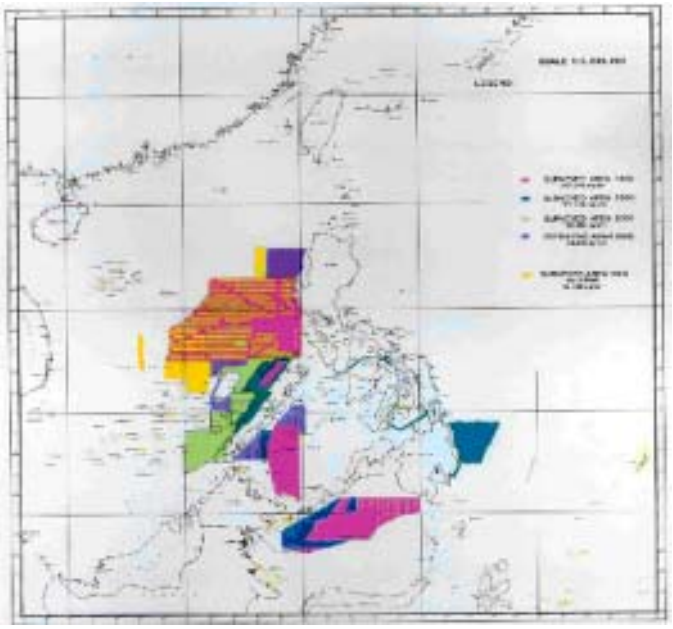
(a) **Large-Scale** charts intended for berthing, approaches to ports and other areas where navigation is constrained by traffic density and navigation hazards, and port planning;

(b) **Medium-Scale** charts intended for navigation along the coast, route planning, research and cable laying; and

(c) **Small-scale** charts intended for passage planning, research and navigation in the high seas.

The classification of these national chart series is dependent mostly on the area of coverage, the length of coastline and the extent and coverage of the country's EEZ. For navigation purposes it is ideal to link the national chart scheme to the international chart scheme in the region as expressed in certain provisions of the IHO. The purpose is to ensure that the needs of the international shipping community are met by way of coordination of the chart schemes of neighboring countries.

At present, all coastal states around the world rely on the paper chart not only for sea navigation but also to draw and delineate their boundaries, negotiate with neighboring countries, resolve maritime boundary disputes, strengthen the position to claim an extended continental shelf, explore and exploit the marine resources; not to mention other areas such as port construction and development, installation and construction of offshore structures, reclamation, fishing, research and



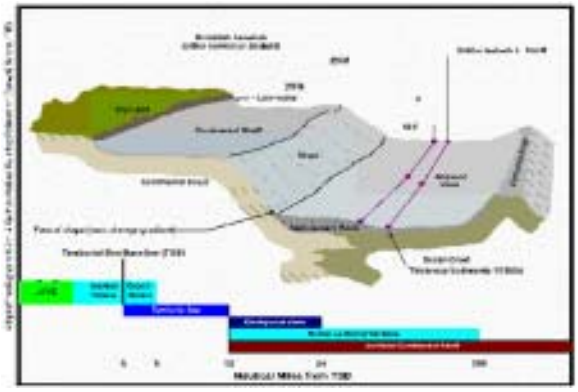
*This colored image shows the area surveyed using the multibeam echo sounder. BRP HYDROGRAPHER PRESBITERO and BRP HYDROGRAPHER VENTURA conducted the joint survey of these areas.*

development, management and preservation of coastal areas and fishery resources, among others. These marine-related activities cannot be undertaken without hydrography and the nautical chart. The Philippines being one of the coastal states in the region is also relying on the paper charts compiled and produced by CGSD. The importance of hydrography and nautical charting in national development cannot be quantified. Unfortunately, it is lacking in attention and importance in the highest level of government.

In the existing chart folio maintained by CGSD-NAMRIA, there are no boundaries plotted between our neighboring countries except the line dividing the southern portion of Mindanao and the State of Borneo which came about when a treaty was signed between the United States of America and the United Kingdom in 1930. And notably, the most familiar and widely "accepted" border enclosing the Philippine Archipelago, the Treaty of Paris limit with designation in the nautical chart (Chart 4200) as "International Treaty Limit." The Treaty of Paris was the agreement when the Kingdom of Spain ceded control of the Philippine islands to the Americans in 1898 in the amount of $20,000,000.00. The Philippines being a party to the UNCLOS convention should adhere to its provisions. A thorough review, however, of our existing laws (RAs, PDs, etc.) including treaties signed by countries which took control of the Philippines in the early part of the country's history would reveal that these laws have inconsistencies with the provisions of the UNCLOS.

*The Challenges Ahead of Us*

The Philippines is the eleventh nation to ratify the UNCLOS Convention on 08 May 1984. Prior to the ratification and entry into force of the UNCLOS provisions, many of its aspects have already been adopted by nations which saw the potential and resources of the sea around their EEZ. Many of these countries are now extracting and or looking for hydrocarbons, solid and liquid mineral deposits, developing their fishing industries, building offshore structures, laying underwater cables, and conducting research activities to tap the great potential of the vast oceans. Other countries are not satisfied with what they have in their own backyard. Some countries are using their influence to attract other nations to conduct research and inventory of resources, offering their services to extract the wealth, and in many instances leaving the less developed country behind with a small portion of the resources, as in the case of the Philippines.



*This figure shows the different maritime boundaries as expressed within UNCLOS.*

In the Philippines, there are issues both local and international that should be addressed at the earliest possible time. The most difficult to solve and the easiest to avoid concerns political, legal, and administrative issues. The country should also settle several boundary disputes with its neighbors (Malaysia, Japan, Taiwan, Indonesia, etc.) hopefully before the deadline for submitting a claim set by UNCLOS in May of year 2009. These problems are essential and must be resolved if the country is looking for progress. CGSD-NAMRIA is playing a very crucial role for the future generation of this country by providing valuable inputs and technical expertise in the preparation of the requirements for submission to the UN.

*Racing against Time*

The deadline set by UNCLOS for all coastal States to submit their claim to the UN is May 2009. Coastal states around the world are working round-the-clock to beat the deadline, even strengthening and expanding their hydrographic capabilities, acquiring sophisticated equipment, engaging the services of experts in various fields. Indonesia embarked on a very big project to last about ten years, focusing on their basepoints, baselines, hydrographic surveying, nautical charting among others and maybe in a few years' time will be ready to submit their claim to the UN. They are also eager to settle boundary disputes with their neighbors just to make sure that boundaries between adjacent states are properly delineated and reflected on their charts to strengthen their claim. Many countries around the world like Japan and Australia have created within their hydrographic organization a cohesive team whose function is dedicated to the UNCLOS.

Hydrography and nautical charting are among the major components in the UNCLOS. However, there are other important aspects included that should be undertaken by the Philippines, like the conduct of seismic, geophysical and geological studies, baselines and basepoints determination, among others. A well-coordinated effort is necessary to conduct the studies required and prepare all the documents. Other agencies of government are very much involved in this undertaking.

Strong support from the House of Representatives, the Senate, and the Office of the President is needed. Our own identity as a nation, our sovereignty, and the future of our generation is at stake here. The time is now to focus our attention on the ocean and the seas where a huge part of our wealth and resources are waiting to be explored and exploited.

The big question is, WHERE ARE WE NOW?·

# Scaling Heights, Breaking Barriers:

*A Day in the Life of NAMRIA IEC Teams for the Ancestral Domains Project*[1]

*by Xenia R. Andres*

*A waft of early December air greeted us as we began the uphill scale. Behind the lush mountains, the sun pressed its rays to splay over the golden terraces, deep gorges, rich valleys, and glistening rivers. As the powerful motor negotiated every sharp curve, we could not help but feel a sense of awe and timelessness.*

We were on our way to Hingyon in Ifugao to carry out a consultation meeting with officials and elders of the community. We were on Day 2 of the second leg of the information and education campaign (IEC) component of the collaborative project on the survey and mapping of ancestral domains. The IEC is one of the work scopes stipulated in Annex A of the memorandum of agreement inked by NAMRIA and the National Commission on Indigenous Peoples (NCIP). NAMRIA Administrator Diony A. Ventura and former NCIP Chairperson Attorney Evelyn S. Dunuan signed the addendum.

The IEC aims to create awareness of and support to both the project and the Indigenous Peoples' Rights Act (IPRA). The IEC efforts are specifically geared towards greater participation of indigenous cultural communities, officials and representatives of local government units, non-government organizations, and other stakeholders of the project. The IEC component has two prongs: information packaging and dissemination and the conduct of general/community consultation meetings. The first prong covers the preparation of IEC materials and the presentations on IPRA, zeroing in on the ancestral domain rights, and on the project itself. The consultation portion focuses on securing the consent and participation, through written agreements, of the communities concerned for the conduct of reconnaissance and perimeter surveys.

Upon reaching our destination, we were cheerfully greeted by the villagers and staff of the NCIP Provincial Office. They then ushered us to the municipal gym where the event was held. We set up our paraphernalia, did a little rearranging, and checked on the details for the day.

[1] *With inputs from Ms. Concepcion A. Bringas, head of the NAMRIA IEC component, and other team members: Renato E. Eguia, Joseph C. Estrella, Chester C. Nicolas, Benjamin T. de Leon, Rolando A. Mendoza, Floyd L. Lopez, Erlito P. Saberola, Arsenio B. Berriber, and Sheilah Mae G. Lopez.*

Pretty soon, the participants and concerned parties started to arrive and mill around the venue. Registration activities ensued while local music was played over the karaoke. After a while, the camera recorder began to roll and the still camera clicked away. The program was ready in 3…2…1.

The invocation and singing of the national anthem was followed with a welcome talk by the municipal vice mayor, Honorable Aquilino C. Namingit. Preceding the consultation and open forum were presentations on the IPRA and claims-conversion processes. NCIP Provincial Officer Fernando D. Bahatan Jr. served as the resource person. The project was well received by the community. They were very optimistic about it. As one IEC team member expressed, the project "was not only timely but necessary to put in order the controversies that have long been neglected in the dustbin of history. Such debates spawned animosities and conflicts regarding ancestral domain claims."

Prior to this activity, a larger IEC and consultation meeting regarding the survey and mapping of Kiangan Ancestral Domain or CADC 046 were conducted at the Lagawe Central School on 17-19 November 2002. The program structure was similar except for the consultation part wherein five clusters of municipalities adjoining Kiangan were formed. The groups included Lamut, Lagawe-Hingyon, Asipulo, Hungduan, and Tinoc. The clustering sought to: (1) obtain the consent of the concerned parties to allow the NAMRIA teams to conduct consultation, ground control, and perimeter surveys in their respective areas; (2) determine the proper authorities, i.e., local officials and representatives of the council of elders who shall agree on the boundaries; (3) set the schedule for the consultation and GPS surveys in the localities; and (4) discuss and resolve related issues. The technical staff of NAMRIA and NCIP served as group facilitators.

The project was in the same way embraced by the participants and stakeholders during the general IEC. They showed their keen interest by participating vibrantly during the discussions. As described by the head of the IEC component, the people "were authentic, accommodating, and open to possibilities, yet uncompromising of their ancestral land claims."

The success of the Lagawe event signaled the start of community consultations. That is why we set out at once on 03 December 2002. Our first stop was Lamut.

After the thorough community deliberations and with the necessary documents in place, we packed up our things, extended our sincere thanks, and sadly bid adieu. Soon we would be leaving for Manila. But our journey was not about to end. The third team was already upbeat on their IEC swing in Kiangan on 08 December 2002.

The IEC proved to be a daunting task, mainly in coordination. "It was challenging, especially since the people's socio-cultural values differ from ours. I had to constantly accustom myself with the place I was in and the people I was dealing with in order to achieve diplomacy and eventually pursue the goals of our undertaking," said our IEC head. "Overall, it was a learning experience for us." ·

# 2003 is International Year of Freshwater

*by Rijaldia N. Santos*[1]

The UN General Assembly proclaimed 2003 as the International Year of Freshwater (IYF). The proclamation seeks to increase awareness of the importance of freshwater, its sustainable use, management, and protection.

In the Philippines, IYF was launched last March 25 at the Ninoy Aquino Parks and Wildlife Nature Center in Quezon City. Environment Sec. Elisea G. Gozun led the celebration and stressed the need to protect our watershed areas, lakes, rivers, estuaries, wetlands, streams, underground aquifers, and groundwater. A memorandum of understanding was signed during the launching for the creation of a national technical working group on Philippine lakes.

The DENR and the Department of Agriculture (DA) embarked on a five-year program to preserve the country's critical watershed areas that support irrigation systems and are vital sources of freshwater as well.

The DENR-DA tandem has formulated a P2.85-billion Watershed Management Program, in coordination with the National Irrigation Administration (NIA), to address problems of degradation on watersheds, extend the useful life of NIA irrigation systems, and improve water yields. The program also incorporates livelihood opportunities for watershed residents.

NIA has identified some 136 watersheds in the Philippines as already in critical condition. This covers some 4.5 million hectares and is home to about 6.88 million Filipinos or 9 percent of the national population.

From March 24-27, the Philippines also hosted the second International Tropical Marine Ecosystems Management Symposium, bringing together government representatives, coastal managers, and decision makers from over 40 countries to discuss priority issues and gaps in coastal management.

Last April, Secretary Gozun led the Philippine delegation in Kyoto, Japan for a week-long Third World Water Forum. The World Water Council and the UN sponsored the forum. ·

[1]*Chief, Physiography and Aquatics Division, Remote Sensing and Resource Data Analysis Department (RSRDAD)*

# *Indigenous Peoples… Indigenous Filipinos!*

*by Maria Romina dR. Pe Benito*

There was the land to begin with and with the land were the people. Who were they? In our ancient times, the aborigines of our nation, the original settlers, peopled the archipelago. They make up our ancestors.

Their descendants are the native brothers and sisters whom we have come to know through generations and under various names. Presently they are known as *the indigenous peoples of the Philippines*, as recognized by the UN. We will attempt to make a profile of them here, using invaluable sources of knowledge about them, such as information materials from the NCIP.

*Roots Diversified*

According to the Filipino anthropologist, F. Landa Jocano,[1] our forebears were part of "a common population with the same base culture," to which belonged "the peoples of prehistoric Island Southeast Asia." Furthermore, variations to this core population came about through human evolution and movements.

In the case of the archipelago, there were the immigrants from neighboring countries of Asia such as China, Indonesia, and Malaysia. Other than those purposely seeking a new place of settlement, "immigrants" would also include those who came in as merchants, missionaries, teachers, or just plain adventurers and decided to remain.

Thus various groups of people were first encountered by the Spaniards, the acknowledged discoverer of the archipelago through Ferdinand Magellan. In the "History of the Filipino People" book of Teodoro A. Agoncillo, it is said that "on the eve of the coming of the Spaniards" there existed "multiple ethnolinguistic groups, mostly animistic, and in the south, Islamized." Historian William Henry Scott also has this account in an article:

*When the Spaniards arrived in the Philippines, they found the Filipino people divided . . . into a large number of groups, each speaking a different language. Their local customs varied from place to place, . . .*

The identity of pre-colonial Filipinos, as seen in their customs, modes of living, and traditions, was very much preserved. It certainly took a great deal of their tenacity to be able to resist subjugation and change especially with the presence of foreign conquerors who stayed for centuries.

*The Tribes*

There are a total of 110 indigenous ethnolinguistic groups in the Philippines. Several communities are classified into each of the following major tribal groups: the Negrito group, the Mangyans of Mindoro, and the Lumads of Mindanao. Other major groups are named after the places inhabited by the communities such as the peoples of Caraballo and Cordillera, mountain ranges respectively of Central and Northern Luzon; and the Palawan hilltribes. Then there is the Muslim group in Mindanao and Palawan where there are about 13 ethnolinguistic groups.

Most tribes practice self-governance and subsist on farming of rice and root crops, fishing, hunting wild game, and gathering of forest products. These are supplemented by livestock and poultry raising and doing menial work for landlords.

Distinct, homogenous groups have similarities in terms of arts, costumes, folklore, houses, languages, practices, rituals, and religious beliefs. This even if some may live far apart from one another. Subtle differences say in dialects and oral traditions account for the presence of subgroups for major groups.

The archipelago is made unique owing to the kaleidoscope of its various local cultures. Foreign tourists are especially appreciative of the indigenous peoples: their customs, lifestyle, and traditions; their artifacts, festive dances, musical instruments, and native costumes and industries. The archipelago is home to the world-famous, ingeniously made rice terraces in Banawe of the Ifugaos.

*Driven into the Hinterlands*

In ancient times, new visitors to the archipelago with the intention to stay settled down in whichever vacant part they wanted to make their home. If occupied, they did so in peaceful co-existence with the resident owners. It also happened that they themselves eased the old residents out as in the case of the Ati group of Panay Island who were convinced to sell their land to the newcomers, the Bornean *datus* led by their leader, *Datu* Puti.

The Wave Migration Theory, supposedly of and widely propagated by the American colonizers according to Scott, puts things quite severely. It is about the peopling of the Philippines "by a series of waves of migrants, each of which was superior to the ones that preceded it." The mindset brought about by this theory can help explain whatever existing prejudices, sentiments or acts of discrimination against indigenous peoples, which in turn lead to their oppression and exploitation.

The "driving off" aspect of the migration process is put this way in old basic Philippine history books such as that of Dr. Gregorio F. Zaide: "They [the Indonesians] drove the Pygmies into the mountains and occupied the lowlands." Then later, ". . . . they [the Malays] drove

[1]*As cited in Agoncillo, T. A., 1990. History of the Filipino People, GAROTECH Publishing, Quezon City, pp.21-22.*

the Indonesians into the forests and settled in the lowlands."

Indigenous peoples are generally known to live in the remote rural areas. Our ancestors did so not just because they were foremost lovers of nature. Their self-imposed living in isolation was also done to avoid the particularly strong transforming influences of certain alien cultures. Cases in point are the "Sword and the Cross" strategy (i.e., by force and conversion to Christianity) of the Spaniards and later the "Benevolent Assimilation" policy of the Americans which both failed to break the strong resistance of most indigenous peoples to change.

To live in the hinterlands would mean to be isolated from or deprived of the foremost benefit of modern civilization which is socio-economic development. Indigenous peoples generally managed to survive in the past despite whatever were the limitations. Nevertheless, through the years there were families who migrated to other places for better economic opportunities. In joining the mainstream, so to speak, such as living and working in the lowland areas for their keep, some allowed themselves to be assimilated into the new culture.

Being simple people with basic needs, many indigenous peoples would generally have managed to thrive independently in places where they could do so, freely. Grave conditions and events of modern times, however, eventually caught up with them. It was and continuous to be proven that the resulting displacement or forced evacuation leads to poverty and marginalization, especially if left unchecked.

A case in point is the prolonged armed conflict in Mindanao, more recent episodes of which have displaced hundreds of families from their homes. Those already traumatized by war still have to deal with the deprived conditions in evacuation centers: hunger, discomfort, despair, the possibility of disease or even of death.

Indigenous peoples who suffered dislocation so many times in their history are the Negritos. From mostly living in the plains/lowlands to withdrawing to the mountains or wherever in the interior areas they could settle, many became nomads with the intrusion of the likes of logging concessionaires, miners, and even of other displaced groups. This is also because of the construction of government infrastructure projects in their areas, and of military operations out to flush out insurgents. Later descendants have had to deal with further incidences of eviction or of fruitless legal battles to deal with claimants. The 1991 volcanic eruptions of Mt. Pinatubo caused the displacement of hundreds of families who lived in its vicinity.

*Outcasts in Their Own Territory*

Valued greatly was the land which was tilled for food and where stood the shelter of the first family that lived there, the earliest members of the tribal race. There familial bonds took root and were nourished with the love, concern, and respect members had for one another. The land was the common property of all the members. The cycle would forever repeat itself for all generations to come. The head of the family decreed it to be so. With the coming of other residents and the setting up of a community or tribe headed by the chieftains there were then communally-defined territorial limits for the living spaces of respective families.

The tribe had their rights over their communal land which they vowed to uphold no matter what. The "no matter what" were the efforts of those out to evict them for reasons of progress or simply of greed, with weak or no recognition of whatever their rights or claims.

Much as the tribes would want to function independently, they would still be subject to the laws of the ruling, non-indigenous majority. The focus of government on indigenous peoples shifted through the years. This, from the objective of seeking their integration into the mainstream population, as was the function of the American regime's Bureau of Non-Christian Tribes, to that of protecting and promoting "the interest and well-being of the indigenous peoples with due regard to their beliefs, customs, traditions and institutions," the mandate of the NCIP.

In recent years, the government through the Department of Environment and Natural Resources (DENR), was able to ease somewhat the long struggle of the indigenous peoples to keep or recover their birthright to their ancestral domain through the issuance of the Certificate of Ancestral Domain Claim (CADC) to empower holders "to manage and exploit the resources found within their domains in accordance with existing laws, to plan their own future and to gain access to adequate basic services. The CADC was a provisional measure prior to the passage of the Indigenous Peoples Rights Act of 1997 or Republic Act number 8371. The law which created the NCIP is for the recognition, promotion, and protection of, among others, the right of the indigenous peoples to ancestral domains.

Among the tasks of the NCIP at present is the issuance and conversion from the CADC of the Certificate of Ancestral Domain Title (CADT). The CADT signifies ownership by the tribe of its ancestral domain. With NAMRIA, the NCIP is undertaking the survey and mapping of ancestral domains for sustainable land use and management.

*The Filipino Defined*

The scattered islands of the archipelago was named after a foreign ruler and became the country known as the *Philippines*, and its people with many diverse cultures carried the name *Filipinos*.

The Filipino is a mixture of races. Perhaps in being less conscious of distinctions, there can be a totality of parts and in the psyche can be extinguished long-existing conditions or connotations associated with certain labels: Christian, Western, superior— on one hand; *indio*, non-Christian, pygmy, infidel, pagan, savage, non-superior— on the other. Indigenous and non-indigenous peoples live on the same archipelago, the same country and both deserve respect and recognition. Indigenous peoples *are* Filipinos. Someday perhaps the struggle for most of them will cease. ·

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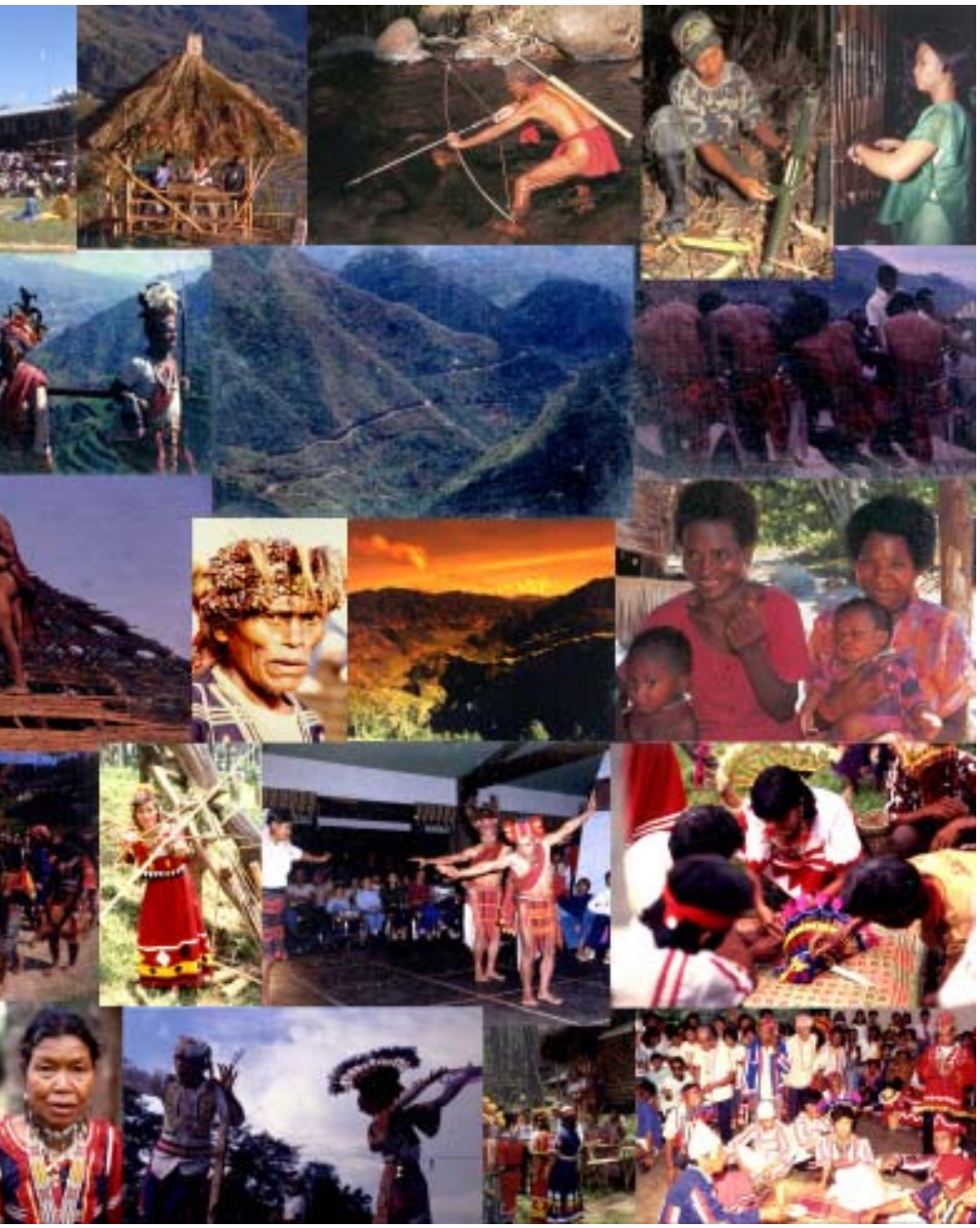

*Photos by Department of Tourism & NDJ*

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# NAMRIA, FMB in FSIS project (phase 1)

*by George T. Corpuz*

For a more effective management of our country's forests, NAMRIA Administrator Diony A. Ventura and Forest Management Bureau (FMB) Director Romeo T. Acosta, early this year entered into a memorandum of agreement to jointly undertake the development and implementation of the Forestry Statistics Information System (FSIS) project. The project is intended to create an information system that will facilitate the management and generation of forestry-related statistical and geographic information/data. The scope of work for the development of the system includes: the analyzing of process/work flow; designing the attribute and spatial databases, and user interface; computer programming; training of users; systems maintenance activities; and integration/ population of datasets into the forestry statistics database.

The pilot areas for the phase one (1) project are Regions II and III which shall cover the following applications: Forestry Land Use Planning, Industrial Forest Management, Community-based Forest Management, Forest Land Grazing Management, Forest Stock Monitoring, and Timber Licensing Agreement Monitoring, Special Land Use, Private Land Forest Management, and Management of Protected Area. Revised Price Monitoring System and Statistical Reporting System will also be enhanced. The systems review of the FMB Central Office has been conducted while those in the FMB Field Offices is scheduled in July 2003.

To date, accomplishments include data sets gathered from relevant offices as required for system design and testing purposes. Sample data sets such as maps, images, and statistics were gathered from the FMB Central Office. These sets will be converted into their appropriate digital format and structure. Also, 25 technical personnel from Forest Management Service (FMS) Regions II and III undertook Basic GIS Training Course at the NAMRIA Geomatics Training Center (GTC) on 16-20 June 2003.

Per work plan, detailed systems design will start in July 2003. These includes: (1) data maintenance and integration, (2) query and report generation, (3) data housekeeping and utilities, and (4) system security and authentication. An on-the-job training for the build up of spatial data will follow in Regions II and III. The rest of the activities include: design implementation and prototype testing; training of end-users and system

*...continued on page 14*

*NAMRIA Administrator, Usec. Diony A. Ventura hands over the outputs of the agency's land use mapping project with the Clark Development Corporation (CDC), to Dr. Emmanuel Y. Angeles, CDC President and Chief Executive Officer. The turnover ceremony was held in March 2003 in Clark Air Base, Angeles City , Pampanga.*

## 110 Ethnolinguistic Groups[1]

| *Indigenous Tribe* | *Indigenous Tribe* | *Indigenous Tribe* | *Indigenous Tribe* | *Indigenous Tribe* |
|---|---|---|---|---|
| 1. Abelling/Aborlin | 23. Banwaon | 45. Hanunuo | 67. Kalinga | 89. Sama/Kalibugan |
| 2. Adasen | 24. Barlig | 46. Higaonon | 68. Kankanaey | 90. Sama/Samal |
| 3. Aeta | 25. Batak | 47. Ibaloi | 69. Kirintenken | 91. Sangil |
| 4. Aeta/Abiyan | 26. Batangan/Tao Buid | 48. Ibanag | 70. Langilad/Talaingod | 92. Subanen |
| 5. Agta | 27. Binongan | 49. Ifugao | 71. Mabaca | 93. Sulod |
| 6, Agutaynon | 28. Bontok | 50. Igorot | 72. Maeng | 94.T'boli |
| 7, Alangan | 29. Buhid | 51. Ikalahan/Kalanguya | 73. Magahat/Corolanos | 95. Tadyawan |
| 8. Applai | 30. Bugkalot | 52. Ilianen | 74. Malaueg | 96. Tagabawa |
| 9. Arumanen | 31. Bukidnon | 53.Ilongot/Bugkalot | 75. Mamanua | 97. Tagakaolo |
| 10. Ata-Matigsalog | 32. Camiguin | 54. Inlaud | 76. Mandaya | 98. Talaandig |
| 11. Ati | 33. Cimaron | 55. Iraya | 77. Mangguangan | 99. Talaingod |
| 12. B'laan | 34. Coyonon | 56. Isinai | 78. Manobo | 100. Tao't Bato |
| 13. Badjao | 35. Danao | 57. Isneg/Apayao | 79. Manobo Blit | 101. Tasaday |
| 14. Bago | 36. Dibabawon | 58. Itneg | 80. Mansaka | 102. Tigwayanon |
| 15. Bagobo | 37. Dumagat | 59. Itawes | 81. Masadiit | 103. Tingguian |
| 16. Balangao | 38. Eskaya | 60. Itom | 82. Matigsalog | 104.Tiruray/Teduray |
| 17. Balatoc | 39. Gaddang | 61. Ivatan | 83. Palaranum | 105. Tuwali |
| 18. Baliwen | 40.Giangan | 62. Iwak | 84. Palawanon | 106. Ubo |
| 19. Baluga | 41. Gubang | 63. Kabihug | 85. Pullon | 107. Umayamnon |
| 20. Banac | 42. Gubatnon | 64. Kalagan | 86. Ratagnon | 108. Yakan |
| 21. Bangon | 43. Guiangan/Clata | 65. Kalanguya | 87. Remontado | 109.Yogad |
| 22. Bantoanon | 44. Hanglulo | 66. Kalibugan | 88. Sama | 110. Zambal |

News

# NAMRIA develops GIS-based climate information system for PAGASA

*by Benjamin P. Balais*[1]

NAMRIA and the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) are undertaking a project on the development of a GIS-based Climate Information System focusing on rainfall analysis to meet the weather information needs of the farmers and the agricultural sector.

The project is envisioned to provide timely and reliable forecasts and advisories on extreme weather and climate conditions, a critical function of PAGASA. The project started in July 2002 and is expected to be completed in June 2003.

The strategic objectives of the project are as follows: (1) the establishment of the GIS-facilities that will manage the developed system; (2) the development of the required database to develop the envisioned GIS-based system; and (3) the provision of training covering both formal (lectures/hands-on) and non-formal (on-the-job) training courses on GIS. The acquisition and installation of the basic hardware and software were completed within the first three months of the project implementation. Development of the databank is going on full swing with the completion of the 1:250,000 map-sheet-based 100 meter-contour interval expected in June. Training courses have been scheduled judiciously to coincide with the different project development phases.

The training component includes not just the GIS technology but also covers affiliated technologies which will make the agency competent in managing and maintaining the GIS-based Climate Information System. Training courses covering the GIS concepts, usage, and other components were held from September to November 2002; while courses on the use of MS Access and SQL were held in April and May 2003.

The formal training course is designed to equip participants with the concepts and basics that will strengthen the foundation for a better understanding of the GIS technology. The on-the-job training provides a walk-through on the use of the software, touching on the problems that were encountered by NAMRIA staff in its use and the solutions applied. Actual data are used in the training and form part of the database build-up.

A customized system which is scheduled to be finished in June 2003 shall be installed at the Climate Information, Monitoring and Prediction Services (CLIMPS), a highly technical unit of PAGASA tasked to provide the agriculture sector with climate information, forecasts, and advisories on extreme weather and climate conditions. ArcViewâ serves as the environment in which the system is being developed and envisioned to run. The final system involves the conversion of analog climatological data from weather stations all over the country into a digital form. These data will be processed to generate the daily, seasonal, and annual weather and climate statistics. The statistics include averages, standard deviations, percentile ranks, weather extreme index to indicate potential drought/flood, departure from normal, standardized anomaly, moisture stability index, etc.

These information will serve as inputs to the development of models covering the Identification of Drought-Prone Areas; Updating of Climate Types; Formulation of Crop-Weather Calendars; and Prediction of Onset of Rainy Season. These modules are integral components of the system and are scheduled for development in the anticipated project extension. The use of GIS technology would facilitate the analysis and generation of spatial and map-based outputs not erstwhile available for previous systems that have been developed.

In addition to the digitization of a 100 meter-contour interval based on 1:250,000-scale topographic maps, the digitization of the river network is another major activity in the database buildup. These features are important factors in understanding the weather and atmospheric systems. The datasets play a significant role in the development of climate models. ·

*Database Management Division (DMD) Chief, Bobby A. Crisostomo, looking over the work of PAGASA personnel undergoing the training course on basics of GIS and ArcView and their applications to climatology*

[1]*Information Technology Officer II, DMD, Information Management Department (IMD)*

# Most Outstanding GEP President Award for NAMRIA employee

*by Elinor C. delos Reyes*

Engr. Randolf S. Vicente, chief of the NAMRIA Plans and Operations Division, was awarded as the Most Outstanding Geodetic Engineers of the Philippines (GEP) Regional President for year 2003 in the recently concluded GEP, Inc. 29th Annual National Directorate Meeting and Convention. The national convention was held at the Barcelo-Sarabia Manor Hotel and Convention Center in Iloilo City last 12-14 June.

Engineer Vicente was elected president of the GEP-National Capital Region (NCR) in May 2002 and was re-elected this year. Being the organization's president until year 2004, he is leading the 11-member Board of Directors and about 600 members of the association. During his term, the GEP-NCR was also awarded the Most Outstanding GEP Regional Division during the convention. This is the second time for the GEP-NCR to be given such an award, the first being in 1994.

Among the organization's projects/activities were those in support of the priority programs of the GEP Board of Governors, and pioneering initiatives such as: the creation and accreditation of the Resource and Learning Center of the GEP-NCR, an attached center to the GEP Academy; development of GEP-NCR website; ecological conservation and development, social outreach programs; conduct of policy fora and publication of a policy handbook; conduct of *Lakbay-Aral* 2003-*cum*-symposium for geodetic engineering students; technology transfer, training programs, and exposition; formulation of sensible policies and recommendations; establishment of an information base and knowledge hub; strengthening of partnership with the local and international counterparts; and reinforcement of a system of professionalism among the officers, members, and secretariat of the division.

Currently, Engineer Vicente is the assistant officer-in-charge of the newly created Development Studies and Standards Office under the NAMRIA Administrator's office.

Engr. Epifanio D. Lopez, a member of the GEP-NCR division, was also a Most Outstanding GEP awardee for year 2003. Engineer Lopez is the director of the Training Center for Applied Geodesy and Photogrammetry, and concurrent chair of the Department of Geodetic Engineering, College of Engineering of the University of the Philippines in Diliman.

NAMRIA under Administrator, Usec. Diony A. Ventura fully supports its competent employees in their esteemed membership in various professional organizations such as the GEPI. This year's GEPI national convention which had for its theme, *"Onward GEP for National Development,"* was participated in by GEPI members from Aparri to Jolo.·

***NAMRIA, FMB in FSIS...***

*from page 12*

operations personnel; systems installation; and turn-over of systems documents and source program.

Forestry statistics is a very important tool to support policy recommendations, decision making and operations management. And FMB recognizes NAMRIA's expertise in the development of information systems using GIS and web technology. These modern technologies are vital to meet the increasing demands for forestry statistics and information services. The IMD-NAMRIA is the implementing unit of the project and it is expected to be completed in March 2004. ·

***Editorial...***

*from page 2*

Cognizant of aforementioned rights, NAMRIA and NCIP embarked on a project to survey and map these domains for sustainable land use and management. This project is a step forward to improve the plight of indigenous peoples. The ensuing benefits of the undertaking are, among others: (a) ecological protection of native lands, (b) sustainable land management and use, (c) strengthened policies on protecting and empowering indigenous cultural communities/indigenous peoples, (d) preservation of indigenous heritage and cultural rights, (e) stronger cooperation at all levels to address indigenous issues in such areas as environment and ancestral domains, and (f) human resource development and technology transfer.

An author once said that since the colonial period, the indigenous peoples' response to their disenfranchisement could be categorized into three: armed resistance, flight into the interior or pragmatic acceptance of the powers-that-be. With the initiative to survey and map the ancestral domains, they no longer have to resort to these choices. This project is a progress made toward changing their options, a contribution to their long-awaited realization of social justice, equity, and genuine development. At long last, they will find indisputable refuge in their ancestral domains. ·

Technical Paper

# Integrated Techniques for Base Map Updating

*by Nicandro P. Parayno*[1]

## I. Introduction

The primary base maps for the Philippines produced by NAMRIA are at scales 1:50,000 and 1:250,000. The latter smaller-scale maps are derived from the larger-scale series. At present, these conventional topographic base maps are outdated but users have to contend with available existing maps. Urban centers that are potentials of growth and economic expansion are covered with base maps that have not been updated.

During the past decade, development activities on areas specifically along coastal regions have rapidly increased. Prime agricultural lands are being converted to industrial and residential use. Heavy influx of population and rapid urban growth is also threatening its resources. With these dilemmas, there is an urgent need to update the maps covering this region considering the changes that have occurred on the land features. It is a worrying trend when base maps are not updated since it implies that the mapping activities fundamental to a country's development may not be taking place (Davis and Fairbairn, 1998). Frequent updating should help lessen the more difficult and costly process that may accumulate in the long run. Local government authorities, planners and decision-makers will benefit from the new land cover information in the revised maps.

A developing country like the Philippines experiences a situation where it has to be up-to-date with new technologies and developments to solve present problems. This is evident in the field of map production. New concepts, ideas, procedures and technologies help mapping agencies like NAMRIA to satisfy the ever growing demands for up-to-date maps and the changing requirements of geo-information users. A proper integration and adaptation of new technologies into the digital environment has to be undertaken to overcome problems of efficiency and effectiveness (i.e., maximizing the use of geographic data, equipment, and personnel).

## II. The Study Area

Progress is fast following a heated pace in the province of Laguna. Municipalities juxtaposed on the western lakeshore have been identified by the government as primary growth areas with development programs for modern housing complexes, residential estates, and various industries of the commercial and business sectors.

Due to the heavy influx of population and rapid urban growth, land cover and land use of the area have tremendously changed giving a lot of difficulties to planners and decision-makers. It thus brings political and environmental issues that require immediate action by higher authorities. Therefore, an urgent need for an indispensable tool should be provided

*Location Maps of the Study Area*

[1]*The original paper is the thesis of the author submitted in April of this year to the Department of Geodetic Engineering, College of Engineering of the University of the Philippines in Diliman, in partial fulfillment of the course requirements for the degree of Master of Science in Remote Sensing.*

to the authorities concerned and update the latest land information by carefully planning the economic indicators such as road network, infrastructure, and other planning parameters.

The current technology used for base map updating is time-consuming, costly, and labor-intensive. This consists of aerial photography, establishment of photo control points by ground surveys, stereo-compilation, field verification, and cartographic enhancement. Hence, only a small percentage of the 642 sheets of 1:50,000 base maps have been completely or partially revised.

Aerial photography is necessarily undertaken to have a data source for the area to be mapped. Photo-control survey for establishing position of points using the global positioning system is an activity being undertaken by CGSD-NAMRIA. Stereo compilation or data capturing of line features from aerial photographs is a photogrammetric activity that usually comprises the major portion of the map production and revision process. In order to produce a single medium-scale base map at scale 1:50,000; 25 map sheets at scale 1:10,000 with a geographic format of 3' x 3' will be needed. Utilizing the present hardware and software installed and the production capability of the NAMRIA Mapping Department, about 55 topographic base maps at scale 1:10,000 can be produced in one year. This, however, does not include field verification and cartographic enhancement activities. With this conventional technology, only two (2) sheets for 1:50,000 map series can be produced or completely revised in one year.

## III. General Objective

After more than twelve years since the creation of NAMRIA, only about 30% of the entire land area of the country has updated 1:50,000-scale maps. Some of these maps were revised through foreign-assisted projects.

The study aims to integrate satellite remote sensing and digital photogrammetric techniques in updating large and medium-scale base maps particularly the planimetric information in areas that have strong potentials for urban growth. The new base map of the study area will be stored in a digital format and will serve as a cartographic model for frequent revision processes.

## IV. Methodology

The study developed a map-revision model integrating remotely-sensed data, high-resolution photogrammetric data, and existing graphical database. (See figure)

## V. Detailed Methodology

Remote Sensing Image Processing

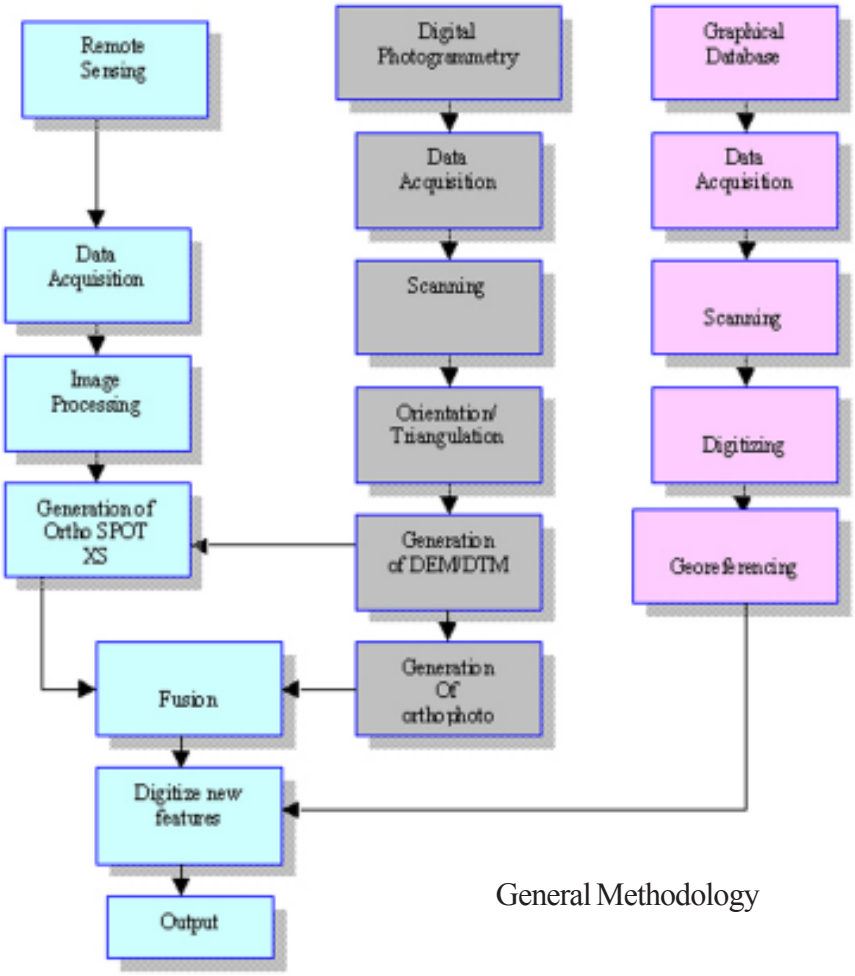
SPOT optical imagery was selected for this study because of its successful use in mapping at medium scales and particularly for map updating.

Digital image processing will involve image enhancement using the linear stretch method, registration, and ortho-rectification. These operations are necessary to correct distorted or degraded digital image data and create a more truthful representation of the original scene. The image is registered and ortho-rectified to remove scale variation. Thus, the image will then have approximately the same geometry as the map to be updated.

Image Classification

The classification system to be used in this study will recognize only the land cover classes that are required in a 1:50,000-scale base map. The spectral patterns of the image data will be used mainly for classifying each pixel in the image into land cover classes.

In this study, one of the objectives of the classification process is the delineation of new major land cover




General Methodology

categories that will serve as inputs to update land cover information of the base map being revised. The resulting land cover classes to be derived from the SPOT multispectral (XS) image will be vectorized and used as polygon boundaries in the data integration to produce the revised digital base map.

### Change Detection

The change detection technique will provide information about seasonal or other changes in the land cover. The method aims to detect new major information particularly planimetric details.

The information is extracted by comparing and merging two or more images of the study area that were acquired at different times. The digital numbers (DN) of one image are subtracted from those of an image acquired earlier or later (1982 scanned image for this study). The resulting values for each pixel will be positive, negative, or zero; the latter indicates no change. The next step is to plot these values as an image in which a neutral gray tone represents zero. Black and white tones represent the maximum negative and positive differences respectively. Contrast stretching is employed to emphasize the differences (Sabins, 1986).

### Digital Photogrammetry

The digital photogrammetric phase will begin with image scanning, to convert the photographic images of the study area into a digital image file. Stereo models or pairs of aerial photographs are digitally scanned using a high resolution image scanner which is precisely guided by a CCD-camera (a camera with a Charge-Coupled Device installed in the film or image plane) which traverses over the entire 23 cm x 23 cm image format.

The selection of an appropriate sampling interval is important in this part of the research since the corresponding pixel size will have great influence on the quality of the digital orthophoto that will be merged with the SPOT image. Normally, the smaller the pixel size, the better the quality of the orthophoto, but noise increases with very small pixels. Any errors introduced at the scanning stage will remain throughout the digital photogrammetric process. It is therefore, essential that the scanner exhibit the highest possible geometric and radiometric accuracy.

### Orientation of the Digital Images

The photogrammetric point measurements determine the positions of point objects in three-dimensional space from digital images of aerial photographs. Three-dimensional coordinates will define these positions. Digital photogrammetric point measurement should yield accurate results provided certain limiting conditions are observed and can compete favorably with other survey measurement techniques. Furthermore, there are some measurement tasks which can only be performed by photogrammetry.

The orientation of the images will include measurement of fiducial marks of the scanned photographic image based on the calibration report of the particular camera used during photography and points (tie points) that are common to each stereo pair of photographs of the study area.

### Aerial Triangulation Measurement and Adjustment

In digital aero-triangulation, the technique is to automatically measure the digital images. The software will automatically determine the x- and y-photo coordinates of points using the image grey values. Using more complicated algorithm based on the geometry of the scanned photographs, the gray values of these photo coordinates are related to the ground positions of points. The recreation of the stereo model and their connections are done digitally.

Model block preparation is done in a form different than that used in conventional aero-triangulation. Of particular interest in this research, are the generation of the topology in higher pyramid levels and measurement in the original images. These two components replace the measurement phase in conventional aero-triangulation. The computation of the bundle block adjustment, the quality control and the presentation of results are the next and final steps in Automated Aero-Triangulation.

### DTM/ DEM Generation

The first step of digital terrain model (DTM) generation will be the matching of homologous interest points out of the feature pyramid which means the determination of an extremely high amount of irregularly distributed mass points in the image of the study area. Then the grid points of the DTM (which can reach up to several ten thousands of points per stereo model) are derived from these mass points. Because of the high redundancy of the process, it is possible to achieve a high DTM accuracy and to recognize outliers on the surface (single houses and trees) which will be eliminated. During the whole process statistical parameters are stored for a subsequent quality analysis. The final output will be a grid-DTM of high resolution where the pre-defined exclusion areas and the borderlines are integrated three-dimensionally.

After the DTM generation, a quality check will be performed. The checking is based on the analysis of the statistical parameters and registers possible weak areas. A more detailed DTM check will be possible by comparison of digital orthophotos of the two images.

### Orthophoto Production and Mosaicking

One of the essential features in this research will be the production of digital orthophotos from the 1982 aerial photography of the study area. The result will be merged with the multispectral

mode of SPOT in 1997 using image fusion techniques and analyzed using change detection techniques.

The production of the digital orthophoto begins with the definition of the required image matrix in the XY-plane of the ground coordinate system, followed by the transformation of the centers of these elements into the camera coordinate system. For this transformation, the Z-coordinates of the points in the XY-grid are also required. These will result from a very close mesh of grid points measured from the digital terrain models using an analytical stereo-plotter to provide the Z-coordinates of a close mesh of XY-points.

When all of the digital orthophotos comprising the study area have been produced, individual overlapping pairs will be combined and enhancements of contrast and brightness will be introduced to form the mosaic.

Digital Graphics Databasing

In order to facilitate access during updating, a digital graphics database of the targeted base map is required.

A 1990 topographic base map at scale of 1:50,000 of the study area will be scanned at a resolution where the finest detail particularly planimetric information can be easily identified during on-screen digitizing procedure. The digitized planimetric details will have an assigned layer and each layer or coverage will be geo-referenced at a map projection common with that of the optical image and digital orthophoto.

The editing of all the digitized vector data will also be undertaken to maintain the accuracy and integrity of the digital data in accordance with standards and specifications for a 1:50,000 scale base map.

Data Integration and Updating

The new and old information that are detected and extracted from the first interrelated phases of this study can be integrated to have a model of the study area and serve as a prototype for map revision processes. All image data can be used as a backdrop to come up with a new image map. Policies and new systems for revision can be formulated based on this model.

## VI. Results

Remote Sensing Phase

*Image Acquisition*

The subset image of the SPOT XS data has 1,000 numbers of samples and 822 numbers of lines with path number 304 and row number 321 respectively. The scene was acquired in May 2, 1997.

*Raster-to-Vector Conversion*

One land cover class was vectorized from the final classified image. In addition, vectorized cropland was subject to final editing in the data integration and updating phase of this study. The other land cover classes/categories were not vectorized since the expected output for updating was an image map which already depicts planimetric features, e.g., built-up areas including buildings and residential structures that were detected in the image fusion task.

*Image Fusion and Change Detection*

The image fusion process merged the 1997 ortho-rectified SPOT XS color image with a grayscale 1982 orthophoto mosaic. The fusion process included an RGB-to-IHS transform which replaced the lightness band with the input high-resolution orthophoto and automatically resampled the hue and saturation bands to the high- resolution pixel size using cubic convolution. The composite RGB image generated the 5-meter pixel size of the input 1982 digital orthophoto mosaic.

The first image fusion improved the spatial resolution of the multispectral SPOT image and enhanced planimetric features for map updating within the test area.

A second fusion mathematically combined the 5-meter composite image generated from the initial fusion with the 4-meter 1997 orthophoto mosaic resulting in a more sharpened image. Each band of the composite image was multiplied by a ratio of the orthophoto mosaic data divided by the sum of the color bands. As with the initial image fusion technique, the composite RGB image generated from the second integration was automatically resampled to a pixel size of 4 meters using cubic convolution.

The second image fusion did not only improve the spatial resolution of the composite RGB image but also gave adequate change detection results. Man-made changes such as new buildings and residential structures appeared significantly brighter than the corresponding features in the original images of 1982 and 1997.

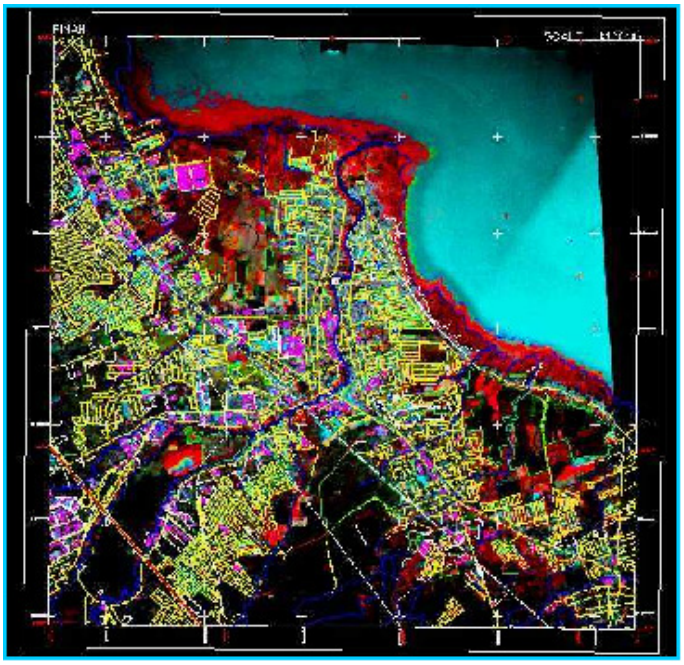
Since the immediate interest of this study is to extract planimetric features such as new roads and building structures based on the fused images, feature discrimination was used as an evaluation criterion for updating.

Data Integration and Updating

*Composite image mapping*

The composite image map generated was a compilation of data from two different sensors acquired in different seasons in 1982 and 1997 with an overlay of updated vector linear information. The composite imagery consists of the ortho-corrected multi-spectral SPOT data and two sets of orthophoto mosaics with 5 and 4 meter ground resolutions respectively. The ortho-rectified multispectral SPOT data provides the color information, the 1982 orthophoto mosaic enhanced the planimetric details, and the 1997 orthophoto mosaic contributed new infrastructure enhancement for the final image map.

The updated planimetric information can be easily differentiated since these have different attribute properties, e.g., color and line style, different from the existing features in the geo-referenced digital graphics database. The updating employed on-screen digitizing techniques



*Composite image map of the study area consisting of ortho-corrected SPOT XS, 1982 and 1997 orthophoto mosaics and updated vector information*

of the enhanced and new planimetric features of the composite image. The figure shows the composite image map of the study area with an overlay of updated vector information.

*Final Editing and Output Generation*

The updated information was edited to minimize errors including undershoots, overshoots and sliver polygons.

The final image generated has a file size of 28.5 Mbytes and was stored in compressed JPEG and standard TIFF formats. The storage media used was a CD-ROM while a hard copy print-out was produced for submission to authorities concerned for their appropriate comments.

## VII. Conclusions and Recommendations

This study shows that a new method of digital map revision or updating using data sources from multispectral, space-borne, multi-temporal airborne imageries and vector graphics data is an efficient and accurate process. SPOT XS data as with any other multi-spectral imagery, once ortho-corrected, provides color information which serves as the basis for updating vegetation cover for a medium-scale map. To enhance the geometric resolution of the SPOT data, a 1982 orthophoto mosaic with scale of 1:32,000 and re-sampled at 5 meter ground pixel size was merged to produce an output having a resolution equivalent to that of the orthophoto. Furthermore, to detect changes and subsequently enhance planimetric features such as roads and infrastructure, a 1997 orthophoto mosaic with scale of 1:25,000 and re-sampled to 4 meter ground resolution was later digitally merged to the initial fusion.

The final composite image re-sampled at 5 meter ground resolution serves as backdrop for the vector graphics information during updating. By integrating all the data using image processing and softcopy photogrammetry, a model for base-map updating has been introduced and its application in the pilot area has proved to be effective in highly-urbanized areas where land-cover changes rapidly.

The map revision procedure established in this study can serve as a cartographic model for future map revision programs of NAMRIA and can also be extended and modified to meet new base-map product requirements.

The integration of satellite imagery with aerial photographs and vector graphics database offers new avenues of approach for medium-scale map revision in the digital domain.

The following are the recommendations:

Aerial photographs that are used as basic source of information in base mapping should be scanned at a resolution sufficient for their application. Image correlation is highly dependent on the quality of the scanned aerial photographs and the scanner to be used for this purpose should exhibit the highest possible geometric and radiometric accuracy;

Areas covered with large varying terrain displacement should be corrected using Digital Elevation Models, which can be generated automatically or manually with digitized break-lines and cut-out areas;

To improve and enhance the spatial resolution of satellite imagery, a high resolution airborne data from aerial photography should be merged using IHS transformation. This function replaces the lightness band with the high-resolution image, automatically re-samples the hue and saturation bands to the high-resolution pixel size using a cubic convolution technique;

The updating should be undertaken by on-screen digitizing of new features, assigning specific attribute property so they can be easily differentiated and used as evaluation criterion by specific users;

The updated vector information with the composite image as backdrop should be used as a model for future map revision activities of the Mapping Department of NAMRIA.

Urban centers usually located on coastal regions within the archipelago are potentials of growth and economic expansion. Conventional medium-scale base maps covering these areas should be prioritized for updating; and

The integrated methodology of base-map updating in the digital domain developed in this study is recommended to be adopted and to serve as a model for map revision activities which are primarily being spearheaded by NAMRIA. •

# Survey and mapping of ancestral domains

*by Olivia R. Molina*[1]

NAMRIA and NCIP embarked on a joint project, entitled "Survey and Mapping of the Ancestral Domain of the Indigenous Cultural Communities (ICCs)/ IPs," through a memorandum of agreement which was signed on 15 February 2002. This project aims to survey and delineate seven priority Certificate of Ancestral Domain Claim (CADC) areas covering CADC 046 (Kiangan, Ifugao) as the pilot area, CADC 021 (Kasibu, Nueva Vizcaya), CADC 055 (Iriga, Camarines Sur), CADC 166 (Dumarao, Capiz), CADC 172 (Manbajao, Camiguin), CADC 012 (Arakan, Cotabato), and CADC 176 (La Paz, Agusan del Sur). The *ancestral domain*, which is covered by a CADC, refers to all areas generally belonging to ICCs or IPs. This comprises lands, inland waters, coastal areas, and natural resources therein, which are held under claim of ownership, occupied or possessed by ICCs/IPs, by themselves or through their ancestors since time immemorial.

The scope of work for the project includes IEC through the conduct of consultation meetings of the seven target priority CADC areas. On 18 November 2002, a general consultation meeting was held at Lagawe, Ifugao which was attended by 120 tribal leaders, local government officials of six adjoining municipalities of Kiangan, NCIP personnel, and NAMRIA officials. Clustering of the different municipalities was done to facilitate easier and faster consultation considering that the municipalities are apart and virtually inaccessible from each other. Community level consultation meetings were also conducted on the adjoining municipalities of Kiangan, namely: Lamut, Lagawe, Hingyon, Asipulo, Hungduan, and Tinoc. Similar activities are being prepared for the Provinces of Nueva Vizcaya, Camarines Sur, Capiz, Camiguin, Cotabato, and Agusan del Sur.

While public awareness campaign is necessary, it is also equally important to develop the knowledge and skills of the technical personnel and staff in charge of the project implementation. For this purpose, the NAMRIA GTC was tasked to conduct training on perimeter survey for the survey teams of NAMRIA and NCIP. The GTC is also in charge of the conduct of various training needs of the project personnel. These include, among others: basic mapping, introduction to GIS, basic ArcView, and GIS prototypes user's training.

Further, 40 LANDSAT scenes covering the entire country and mapping supplies were procured for use in the project. Computer software and hardware, surveying equipment and mapping facilities earmarked for the project had also been upgraded. In addition, 12 personnel specialists were hired to digitize and encode data from the field.

To date, a total of 46 CADCs have been gathered of the necessary data. These are located in Pangasinan (2), Nueva Vizcaya (3), Quirino (4), Camarines Sur (8), Ifugao (2), Kalinga (2), Misamis Oriental (2), Camiguin (1), Cotabato (1), South Cotabato (4), Agusan del Sur (8), Capiz (2), Abra (5), and Ilocos Sur (2). ·

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