Cagayan Riverine Zone
Development Framework Plan
2005–2030

Regional Development Council 02
Tuguegarao City

Message

The adoption of the Cagayan Riverine Zone Development Framework Plan (CRZDFP) 2005-2030, is a step closer to our desire to harmonize and sustainably maximize the multiple uses of the Cagayan River as identified in the Regional Physical Framework Plan (RPFP) 2005-2030. A greater challenge is the implementation of the document which requires a deeper commitment in the preservation of the integrity of our environment while allowing the development of the River and its environs.

The formulation of the document involved the wide participation of concerned agencies and with extensive consultation the local government units and the civil society, prior to its adoption and approval by the Regional Development Council. The inputs and proposals from the consultations have enriched this document as our convergence framework for the sustainable development of the Cagayan Riverine Zone.

The document will provide the policy framework to synchronize efforts in addressing issues and problems to accelerate the sustainable development in the Riverine Zone and realize its full development potential. The Plan should also provide the overall direction for programs and projects in the Development Plans of the Provinces, Cities and Municipalities in the region. Let us therefore, purposively use this Plan to guide the utilization and management of water and land resources along the Cagayan River.

I appreciate the importance of crafting a good plan and give higher degree of credence to ensuring its successful implementation. This is the greatest challenge for the Local Government Units and to other stakeholders of the Cagayan River's development. It is at the local level where we feel that the dedication and commitment of our Local Chief Executives and Sanggunians are most needed.

The individual agencies and instrumentalities of the public sector as well as the business and industrial sectors whose activities may affect the Riverine Zone are encouraged to take guidance from this Plan.

With enough determination and commitment, I believe and I am confident, that we can achieve our goal in uplifting the lives of the residents along the Cagayan Riverine Zone in particular and the people of Cagayan Valley in general.

Most Rev. RAMON B. VILLENA, DD
Bishop, Diocese of Bayombong, and
RDC 2 Chairman

Foreword

The Cagayan River, the longest river in the country and one of the biggest resource of the region is being threatened by urbanization and unsustainable economic activities. However, this resource has not been fully tapped, and the Plan looks into the development of the river's productive potentials. Thus, preparation of the Cagayan Riverine Development Framework Plan (2005-2030) underscores the need to protect and preserve what needs to be preserved for future generations.

This Plan is very useful for planners and policy makers in coming up with policies and strategies to address the problems and issues related to the quality, character and aesthetic value of the Riverine Zone. At the same time be efforts of program/project implementers will be synchronized and guided on how land and water management be sustainably carried out within the riverine zone. Major urgent projects are identified which will be implemented during the entire term of the Plan.

The preparation of this document is made possible through the dedicated commitment of the Technical Working Group of the Regional Land Use Committee. The planning process took the TWG two years to complete the document. Consultations were made in different levels where the first stage of consultation was with the provinces through the Provincial Land Use Committee (PLUC) of each province; the second level with the Sectoral Committees of the RDC; and the third level was done with the Regional Stakeholders composed of the Chairmen or presidents of the PAFCs and RAFC, Irrigators' Association, Tourist organizations, contractors, among others. The comments and recommendations generated significantly improved the Plan and led to the approval by the RDC in December 2006.

It is hoped that after so many years of complacency, everyone will now take active role in protecting, developing and preserving the biggest resource of the region.

MILAGROS A. RIMANDO
RLUC Chair and
NEDA Regional Director

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

LIST OF ACRONYMS

AFMA	- Agriculture and Fisheries Modernization Act
A&D	- Alienable and Disposable
BFAR	- Bureau of Fisheries and Aquatic Resources
BRS	- Bureau of Research and Standards
BSWM	- Bureau of Soils and Water Management
CITES	- Convention of International Trade in Endangered Species
CLUP	- Comprehensive Land Use Plan
C/MLUC	- City/Municipal Land Use Committee
COC	- Cut-Off-Channel
CRZDFP	- Cagayan Riverine Zone Development Framework Plan
DA	- Department of Agriculture
DLR	- Department of Land Reform
DENR	- Department of Environment and Natural Resources
EIA	- Environmental Impact Assessment
FARMCs	- Fisheries and Aquatic Resources Management Council
GIS	- Geographic Information System
IEC	- Information Education Campaign
IMR	- Infant Mortality Rate
IPM	- Integrated Pest Management
IUCN	- International Union for the Conservation of Nature
JICA	- Japan International Cooperation Agency
KBA	- Key Biodiversity Areas
LGC	- Local Government Code
LGU	- Local Government Unit
MCM	- Million Cubic Meters
MOA	- Memorandum of Agreement
MRF	- Materials Recovery Facilities
NGO	- Non-Government Organization
NIPAS	- National Integrated Protected Areas System
NPAAAD	- Network of Protected Areas for Agriculture and Agro-industrial Development
ODA	- Official Development Assistance
PLUC	- Provincial Land Use Committee
PO	- Peoples Organization
PPFP	- Provincial Physical Framework Plan
RDC	- Regional Development Council
RLAs	- Regional Line Agencies
RLUC	- Regional Land Use Committee
RPFP	- Regional Physical Framework Plan
SAFDZ	- Strategic Agriculture and Fisheries Development Zone
SFR	- Small Farm Reservoir
SUCs	- State Universities and Colleges
SWIP	- Small Water Impounding Project
TWG	- Technical Working Group

EXECUTIVE SUMMARY

CAGAYAN RIVERINE ZONE DEVELOPMENT FRAMEWORK PLAN (2005-2030)

Introduction

The Cagayan Valley Regional Physical Framework Plan (2005–2030) approved by the Regional Development Council in February 2005 identifies the Cagayan River and its tributaries as a Multi-Use Zone. This identification takes into account the many endowments of the riverine zone which can be tapped for many development activities.

While the riverine zone bears much potential as a production resource, there is the need for its protection in order to sustain and conserve the fishery and aquatic resources as well as the biodiversity in the area. Parallel to this is the need to protect the river in order to maximize its use for the present and future generations. This concept stands for a harmonized relationship between the region's desire to facilitate and attain agri-industrial development and the need to enhance the region's environmental integrity. Planning for this multiple land use therefore, would ensure the sustainable development of this resource.

Plan Objective

The overall objective of the Cagayan Riverine Zone development Plan is to guide the water and land management along the Cagayan Riverine Zone in order to harmonize its multiple uses. Towards this end, the Plan determines the policies and strategies to address the problems and issues related to the quality, character and aesthetic value of the Riverine Zone. The study area for the Plan covers the whole stretch of the Cagayan River which emanates from Quirino and Nueva Vizcaya and exits in Cagayan through Aparri. It includes major tributaries such as the Addalam River, Magat River, Ilagan River, Siffu-Mallig River, Dummun River, Pared River, Pinacanauan River and Chico River.

The document covers the assessment of the current utilization of the river, its potentials and problems and provides policy framework for the sustainable development of the riverine zone.

Current Uses of the Cagayan River

The water of the Cagayan River is used mainly for irrigation; however, the river is also used for other purposes such as fishery, transport, recreation and tourism. As of 2005, a total of 6,402 irrigation systems made use of the Cagayan River and its tributaries as their main source of water. Fourteen (14) of these systems are national with a service area of 126,585 hectares, while 6,388 are communal systems covering an area of 72,244 hectares. Another major use of the river and its bank is for sand and gravel extraction for concrete aggregates. All of the mainland provinces of the region depend on the Cagayan River and its tributaries for their supply of these materials.

Cagayan River is by itself, a tourist attraction and part of it at Nagtipunan town in Quirino province was adjudged "The Cleanest River in the Country" during the first Search for Cleanest Bodies of Water (River Category) of the Clean and Green Program. Recreational facilities like resorts, picnic sheds and the like have been put up by operators along the banks of the Cagayan River. With more tourism investments, the Cagayan River system has the potential of becoming a major tourist attraction in the future. Landing ports exist along strategic parts of the Cagayan River.

The Cagayan River is a major fishing ground for the region's farmers and fisherfolk. It plays a vital role as a fisheries and aquatic resource in the region. Given its wide area, it is one of the principal sources of freshwater fish such as the high-priced Ludong, *cestraeus plicatilis*, mollusks (unnok; *dalilea spp.*, balinggasa; *anodonta woodiana*, tulya; *corbicula manilensis*, and kabibe; *batissa violacea*, etc.) and crustacean (aramang; *palaemon and acetes spp.*, etc.).

The river's major tributary (Magat) is also tapped for hydro-electric power plant. In agriculture, the total cropland area for municipalities along Cagayan River is 519,525.93 hectares which is about 79 percent of the regional cropland of 654,560 hectares (Land Use and Vegetation Data, D.A R02). Of this area, 206,510.80 hectares or 40 percent is devoted to rice which indirectly or directly draw irrigation waters from the Cagayan River. It was estimated that 135,548.00 hectares are devoted to corn and are concentrated in plains as well as rolling areas suitable for corn in the provinces of Cagayan and Isabela .

Potentials, Problems and Issues

a) Potentials

The Riverine zone of the Region is endowed with various resources that can be tapped for various development activities. Its fertile lands can be developed for agriculture, its eco-tourism potentials, rich bio-diversity with increased fishing and aquaculture potential, water for irrigation development and the river provides opportunity for expansion of transport route for the region's products and travelers.

b) Problems and Issues

In spite of the potentials offered by the river, there are limited development activities occurring in the area due to the low level of advocacy and promotion causing minimum productivity of the zone in terms of economic activity. Specifically, there are four major factors that contributed to these problems to include the extensive and prolonged flooding, limited water supply during dry season, deteriorating water quality and low level of promotion on the potentials of the riverine zone.

The main factor to the problem on prolonged inundation and lack of water during summer are the insufficient structural facilities to regulate flood waters during rainy season and storage dams to collect and stock water reserves for use during dry season. Aggravating the situation are the deteriorating forest cover of watersheds, high rate of erosion, heavy siltation and the narrow portions causing bottlenecks in the downstream stretch of the river specifically in Tupang in Alcala, Nassiping, Gattaran and Magapit, Lallo all in the provinces of Cagayan.

It is also observed that the water quality of the river is deteriorating due to improper waste disposal, heavy use of chemicals in farming and unregulated disposal of mine tailings.

Goal, policies and strategies

Recognizing the significance of the river in the development of the region, the RDC2 now aims to accelerate the sustainable development in the riverine zone through proper management. In order to enhance the productivity and realize the full development potential of the area the following policies and strategies will be implemented:

a) Policies

1) Mitigation of the destructive effect of flooding and reduction of its extent in terms of area and time.
2) Availability of adequate water supply during dry season for domestic, industrial and agricultural uses.
3) Improvement of the deteriorating water quality in the Cagayan Riverine Zone.
4) Optimization of the development potentials of the Cagayan Riverine Zone.

b) Strategies

1) Construction of multi-purpose dams and water impounding facilities.
2) Construction of cut-off channels and riverbank protection facilities.
3) Maintain the favorable depth of the river by dredging along heavily silted portions of the river and removal of sediments allowing for faster flow of water especially during rainy season to further reduce the destructive effect of floods.
4) Strictly enforce environmental laws.
5) Improve the forest covers of watershed through the preparation and implementation of a watershed management plan.
6) Conduct research to determine the effects of diverting the waters of Cagayan River to the Casecnan.
7) Rationalize disposal of wastes through the conduct of massive IEC on Waste Management; construction of sanitary landfill, establishment of Barangay Material Recovery Facilities (MRF) and strict implementation of environmental and related laws.
8) Promote and encourage farmers to adopt sustainable farming practices and regulation of the use of farm chemicals.
9) Plan and control the use of the river for sand and gravel extraction.
10) Increase investments in the Cagayan Riverine Zone by promoting the development potentials of the zone in the tourism, irrigation and power generation, fisheries, river transport and mining and quarrying.

Implementing Mechanism

The implementation of the Cagayan Riverine Zone Development Framework Plan will be a concerted effort of the different RLAs, LGUs and other stakeholders. An Implementing Body or Structure is needed to oversee and orchestrate the overall implementation of the Cagayan Riverine Plan.

While awaiting the creation and operationalization of the permanent Implementing Body, a Memorandum of Agreement (MOA), will be forged between and among the RDC2 and the provinces of Cagayan, Isabela, Quirino and Nueva Vizcaya and the Cities of Santiago City, Cauayan City and Tuguegarao City. The MOA which shall provide an interim mechanism to synchronize the activities in the Riverine Plan shall specifically detail the roles of the RDC2, LGUs and other concerned entities.

The identified urgent projects and activities require an estimated cost of P114.21 billion where bulk (96.65%) of this is allotted for the construction of multi-purpose dams (Matuno, Tumanuini, Siffu, Mallig, Alimit and Kalipkip). Other immediate measures include the construction of urgent bank protection works, SWIPs and Small Farm Reservoirs (SFR), tourism and fishery development, solid waste management and dredging of critical portions of the Cagayan River.

The implementation of the Plan shall be closely monitored through the assistance of the Provincial/City/Municipal Land Use Committees (P/C/MLUCs) and this will be supported with advocacy, capability building and research.

Chapter 1

Introduction

I. Background and Rationale

The general policy of the country as enshrined in the Philippine Constitution, Section 16, mentions that *"the State shall protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature*". Various policy guidelines on land and water utilization, protection and management, are specifically crafted to create, develop, maintain and improve conditions under which man and nature can thrive harmoniously to fulfill the social, economic and other requirements of present and future generations and to ensure the attainment of an environmental quality that is conducive to a life of dignity and well-being.

The Regional Physical Framework Plan (2000- 2030) spells the policies and directions for the region's resources to be used and protected in the next thirty years. Urgent concerns that require immediate attention are to be addressed within the first phase of the plan or in the next ten years. One of the major concerns that require immediate attention is the Cagayan Riverive Zone.

The Cagayan Valley Regional Physical Framework Plan (2000 – 2030) approved by the Regional Development Council in February 2005 identifies the Cagayan River and its tributaries as a Multi-Use Zone. This identification takes into account the many endowments of the riverine zone which can be tapped for many development activities. Planning for this multiple land use therefore, would ensure the sustainable development of this resource. The concern about the Cagayan River is properly addressed in the "Parallel Growth Spatial Strategy" of the RPFP which is the overall framework for the utilization, allocation and development of the region's physical resources. This concept stands for a harmonized relationship between the region's desire to facilitate and attain agri-industrial development and the need to enhance the region's environmental integrity, hence, the ecological and socio-economic significance of the Cagayan River is emphasized in the said strategy. Figure 1 shows the major land use categories as specified in the RPFP.

While the riverine zone bears much potential as a production resource, there is the need for its protection in order to sustain and conserve the fishery and aquatic resources as well as the biodiversity in the area. Parallel to this is the need to protect the river in order to maximize its use for the present and future generations.

II. Plan Objective

The overall objective of the Cagayan Riverine Zone development Plan is to guide the water and land management along the Cagayan Riverine Zone in order to harmonize its multiple uses. Towards this end, the Plan determines the policies and strategies to address the problems and issues related to the quality, character and aesthetic value of the Riverine Zone.

III. The Cagayan Riverine Area Coverage

The study area for the Plan covers the whole stretch of the Cagayan River which emanates from Quirino and Nueva Vizcaya and exits in Cagayan through Aparri. It includes major tributaries such as the Addalam River, Magat River, Ilagan River, Siffu-Mallig River, Dummun River, Pared River, Pinacanauan River and Chico River (Figure 2). It does not include the northeast and northwest portions of Cagayan province whose watersheds do not drain through the Cagayan River. It does not include also the eastern part of Isabela along the eastern coast of the Sierra Madre Mountain because its watershed drains to the Pacific Ocean.

The Cagayan Riverine Zone includes the stream of water flowing in natural channels as well as the banks or easements bordering the said river. The water code sets the river easement as follows: three meters in urban areas, 20 meters in agricultural areas, and 40 meters in forest areas.

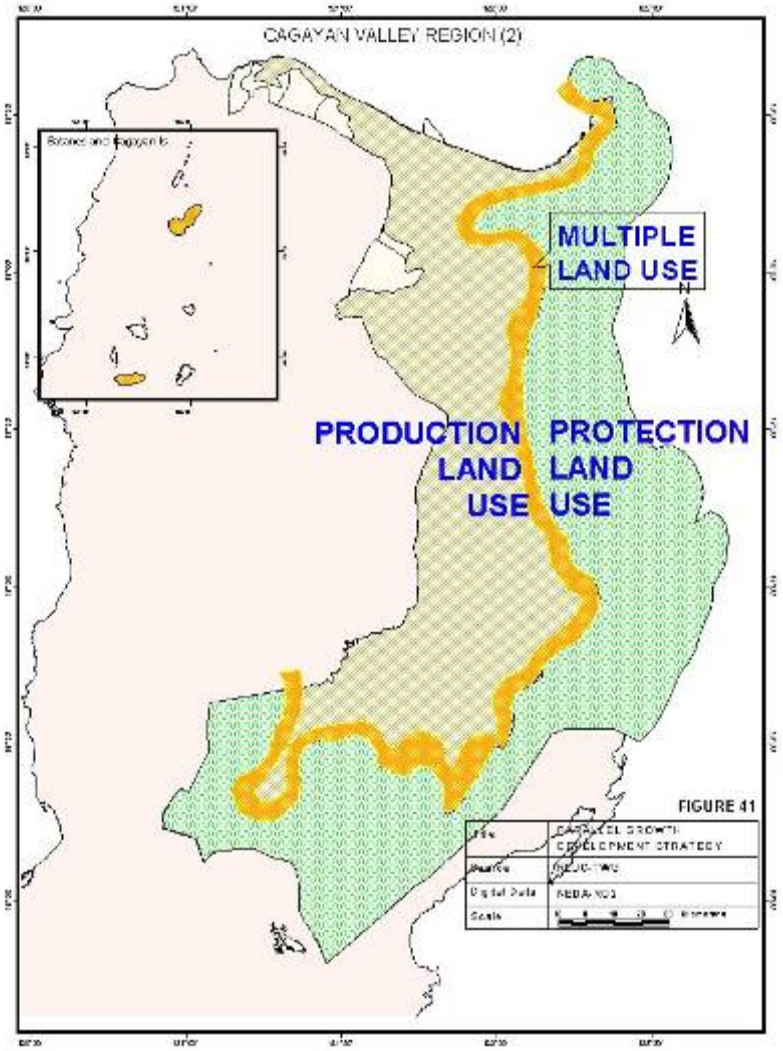
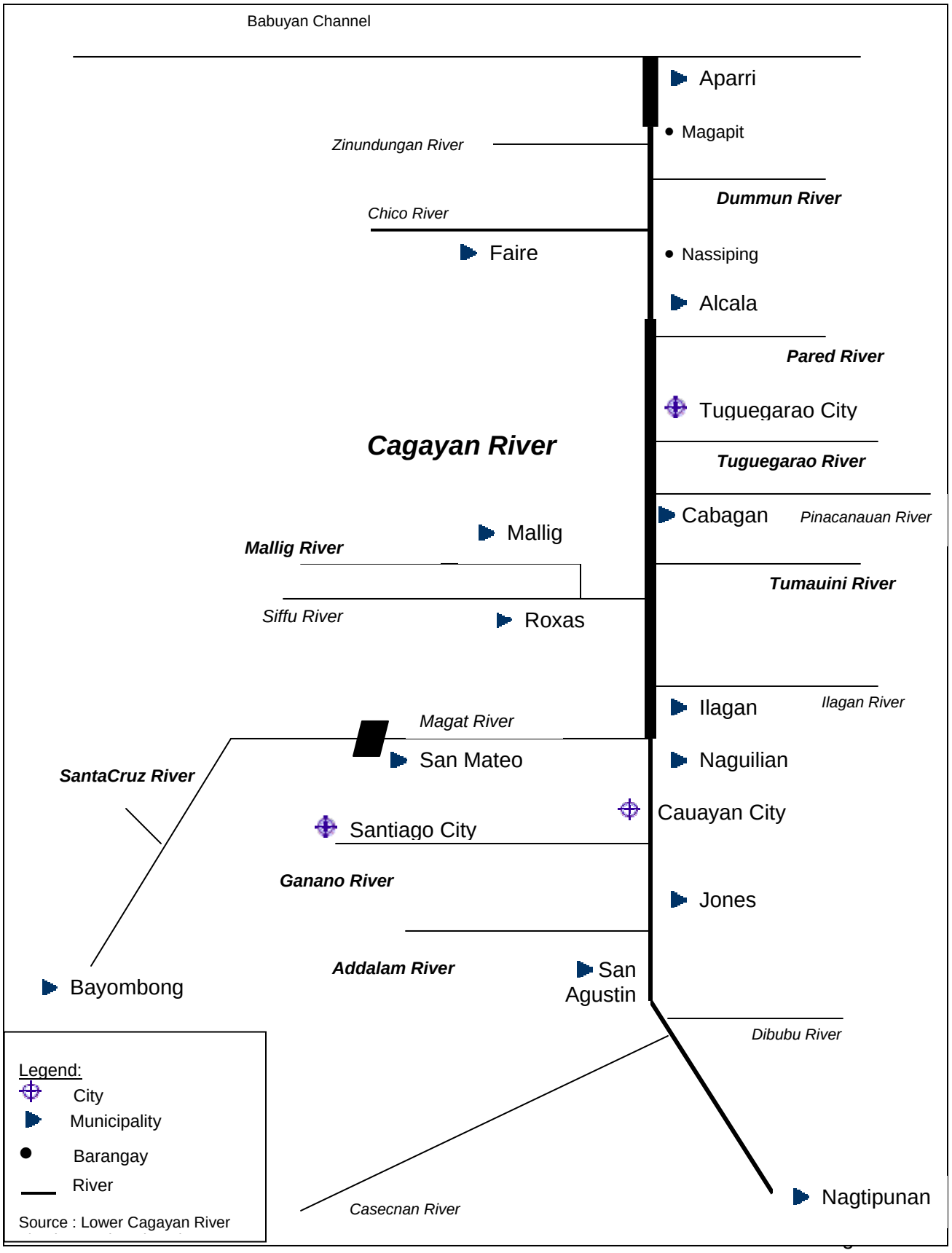


Figure 1. Major Land Use Categories

Figure 2. Schematic Diagram showing the Cagayan River and its major tributaries



Chapter 2

Profile of the Cagayan Valley

Location

Cagayan valley lies in the northeastern tip of the Philippines. It is bounded by three big mountain ranges namely, Cordillera on the west, Caraballo on the south and Siera Madre on the east. On the north is the Babuyan channel where the Cagayan River drains.

Political Subdivisions

The region has five provinces namely, Batanes, Cagayan, Isabela, Nueva Vizcaya and Quirino, covering a total of 10 congressional districts, 3 cities, 90 municipalities and 2,343 barangays. The Cagayan River flows through the mainland provinces (Fig. 3).

Land Area

The region's land area is the 4th largest region in the country. It has a total land area of about 2,683,758 hectares which is 9% of the total area of the Philippines. Out of these, 965,965 hectares are alienable and disposable (A & D) lands, and 1,717,793 hectares are forestlands. The forest land areas are further categorized into Production forest, with 929,630.802 hectares and Protection Forest, with 788,162

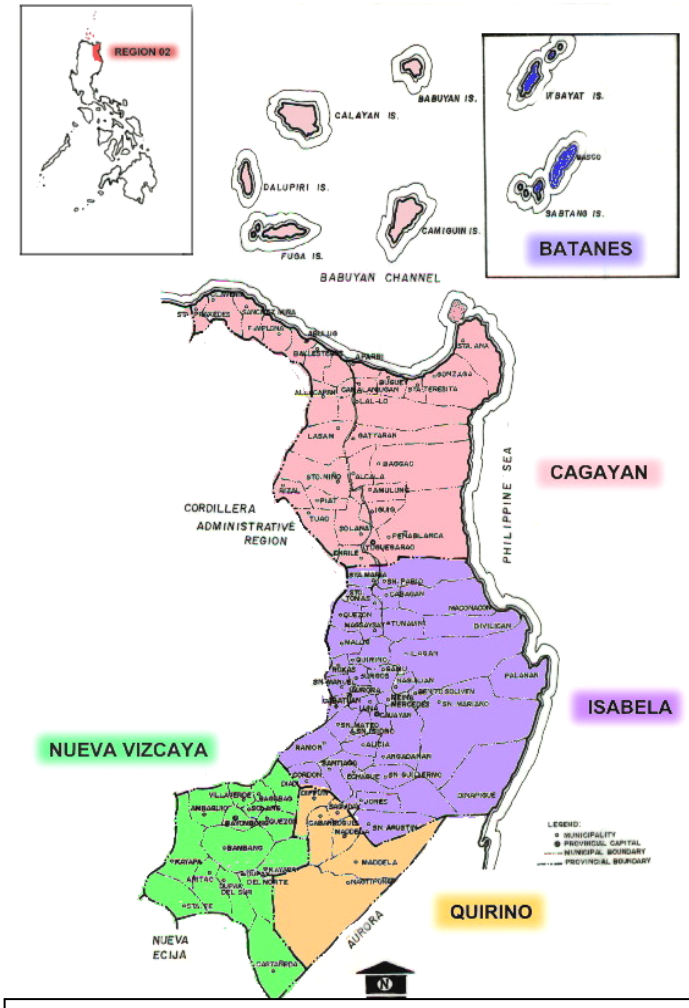


Figure 3. Location and Political Subdivision of Cagayan Valley Region

Table 1. Land Area and Classification of Region 02

Category	Area (has.)
1. Forest Area	1,717,793
1.1 Protection	788,162.198
1.2 Production	929,630.802
2. Alienable and Disposable (A and D)	965,965
Regional Land Area	2,683,758

Source: DENR Region 2 (2006)

Watershed Areas

Majority of the proclaimed Watershed Reserves are situated in the province of Nueva Vizcaya, A total of 515,520 hectares has been proclaimed in said Province. These are Casecnan River Watershed Reservation, Dupax Watershed Reservation and Magat River Forest Reserve, which has the largest area. There's only one watershed reserve in the Province of Isabela, the Tumauini Watershed Reservation covering 17,670 hectares. This area covers the municipalities of San Pablo, Cabagan, Tumauini, Maconacon and Divilacan. NIPAS areas include the idle and wilderness areas in Palanan with 50 kilometers radius covering Cagayan and Isabela.

In the Province of Cagayan , two (2) Watersheds have been proclaimed and these are located in the municipalities of Lallo and Gonzaga, having a total area of 15,987.0 hectares.

Agricultural Areas

In terms of agricultural resources, the region possesses the largest irrigable and irrigated land in the country at 472,640 hectares and is regarded as a major supplier of grains and legumes to the rest of the country.

The Cagayan River and its tributaries (Fig. 2) constitute the main source of irrigation waters for the different irrigation systems in the region. As of 2005, a total of 6,402 irrigation systems made use of the Cagayan River and its tributaries as their main source of water. Fourteen (14) of these systems are national with a service area of 126,585 hectares, while 6,388 are communal systems presently covering an area of 72,244 hectares.

Hydro-power

The region is also the location of Magat Dam, one of Asia's biggest. This is the source of the electric power of Magat Hydro-electric Plant, a 360 megawatt plant that contributes to the power needs of the Luzon Grid. The region has also various sites suitable for hydo- power aside from the Magat Dam which are not yet developed.

Mineral and other Resources

The region is rich in both metallic and non-metallic resources like gold, silver, copper, limestone and manganese. Furthermore, indigenous energy sources such as coal, natural gas, geothermal energy which remain still untapped are also abundant. Add to this is the vast forest land estimated at 1,717,793 hectares; the Cagayan River and its tributaries and 872 kilometers of coastline are rich sources of aquatic resources, both freshwater and marine products

Regional Population:

In 2005, the region's population reached 3.87 million, growing by an average of 2.25 percent from its 2000 level. Population density was computed at 104.82 persons per square kilometer land.

Health Status: Social indicators based on 2005 Millenium Development Goals (MDG) targets also reveal that the region's infant mortality rate (IMR) was 5.98 per 1,000 livebirths; maternal mortality rate (MMR) was 52 per 10,000 live births; fully immunized children was recorded at 83.00 percent and 79.61 percent of households had access to sanitary toilets.

Education Status: On the side of education (school year 2004- 2005), elementary education showed survival rate at 69.77 percent; participation arte at 79.62 percent; while drop-out rates was only 0.88 percent. On the other hand, secondary data shows the region's participation rate at 45.46 percent; survival rate at 60.29 percent and drop-out rate at 5.38 percent.

Regional Economy

Region 02 posted a high regional economic growth in 2004, with a 10.7 percent increase of its gross regional domestic product (GRDP), a remarkable improvement from its economic performance a year ago at 1.2 percent (Figure 3). This is recorded as the highest growth among the regions of the country. Correspondingly, the region showed the highest improvement in per capita GRDP with a growth of 8.9 percent from a 0.4 percent drop in 2004.

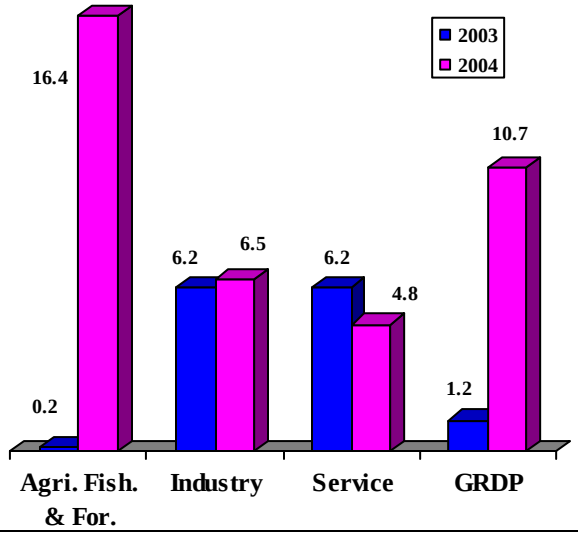


Fig. 4. GRDP Performance in Region 2, 2003-2004

The region's robust performance was buoyed up by the hefty 16.4 percent expansion of agriculture, fishery and forestry, which accounted for around half of the region's economy. The Industry sector also contributed to the good regional performance as it grew by 6.5 percent, which was propelled by construction, and mining and quarrying activities. The Services sector, which accounted for 33.9 percent of the regional economy, went down to 4.8 percent in 2004 from 6.2 percent in 2003 due mainly to the effect of the rising cost of fuel in the transportation, communication, trade, and government services.

There has been no significant change in the region's economic structure. Agriculture remains the major contributor to GRDP and its proportion to the GRDP increased to 51 percent in 2004 from 49 percent in 2003. The Services sector also slightly increased its proportion reaching 36 percent from 35 percent in 2003.

Employment:

Based on the Labor Force and Employment Survey (October, 2004) of the National Statistics Office, the region has 1.429 million employed persons. Being endowed with vast agricultural resources, the region's employment is basically agriculture with 63.05 percent of the workforce employed in Agriculture, fishery and forestry; 30.79 percent in services and 6.16 percent in industry sector. Employment by major occupation also shows that 636,000 (44.58 percent) are employed as laborers and skilled workers; 358,000 (25.05 percent) workers are employed either as farmers, fishermen or forestry workers, 341,000 (23.86 percent) in various occupational groups such as in sales, trades, professionals etc. and 93,000 (6.51 percent) work in the government.

Poverty Threshold and Incidence

The region's per capita poverty threshold was computed at P11, 409 in 2003. This amount reflects the minimum yearly per capita income required to meet the minimum basic food and non-food requirements for the year. Notwithstanding the increase in the annual per capita poverty threshold from P11, 129 in 2000 to P11, 409 in 2003, the incidence of poor families in the region declined to a low of 19.3 percent from 25.2 percent in 2000. Subsequently, the incidence of poor population also fell from 30.4 percent to 24.5 percent in 2003. This incidence refers to the number of families or population whose per capita income falls below the poverty threshold.

.

Chapter 3

The Characteristics and Condition of the Cagayan Riverine Zone

I. Physical Characteristics of the Cagayan Riverine Zone

1. General Characteristics

The Cagayan Riverine zone is located in the northeastern portion of Northern Luzon and covers four out of the five provinces of the Cagayan Valley region. It slices the region into two big parts with the Sierra Madre on one side and the production valley area on the other. It is bounded by the Sierra Madre mountain range on the east, the Caraballo –Mamparang mountain ranges on the south and the Cordillera Mountains on the west. It exits in the north to the Babuyan Channel through the municipality of Aparri.

The riverine zone is a part of the large Cagayan River Basin area as shown in figure 5. The river basin is estimated at 27,281 square kilometers. This area covers the 4 provinces of Region 2 and the provinces of Apayao, Ifugao, Kalinga and Mt. Province in the Cordillera Administrative Region (CAR) and the province of Aurora in Region 3.

2. Topography and Geology

The river originates from the Caraballo Mountains in the south and exits in the north into the Babuyan Channel in Aparri. It travels a distance of about 520 km. along the Cagayan Valley region. The river flows through a flat alluvial plains between the slopes of the Cagayan Valley. Tributaries also flow from these slopes and drain in the Cagayan River. As the river nears its mouth, it constricts somewhere in the Magapit area, which is about 30 kilometers away from Aparri.

The topography of the area ranges from hilly to mountainous. As far as the river zone is concerned, the lands with a slope of less than 8% on both sides of the river are areas developed for agricultural purposes. Hilly lands are left as grasslands.

Data from the JICA Feasibility Study show that rocks of the River are represented by a thick sequence of pre-Tertiary metamorphic and plutonic rocks. An Oligocene to Pliocene Marine section with up to 9,000 meters thick along the flanks but maximizes to 12,000 meters at the center occupies the main area. The Oligocene section is composed of lava flows, metamorphosed conglomerate, tuff breccia and sandstone and siltstone. Late Pleistocene to recent sands, silts, gravels and pyroclastics are found generally in the center.

Fig. 5. The Cagayan River Basin

3. Meteorology

The climate in the Cagayan River zone falls under Type III. This is characterized by not very pronounced seasons with relatively dry weather condition from November to April while the rest of the months from May to October are noted as wet weather.

Climate variability in the region also ascribed to the El Nino phenomenon. Records show that El Nino occurs almost every three years. On the other hand, typhoons also normally strike during the months of July to December, with an average of 8 typhoons every year.

4. Hydrology

Hydrology of the Cagayan River Basin reflects an average annual rainfall of 2,600 mm which varies from less than 2,000 mm in the lowland to more than 4,000 mm in the mountainous area. Average monthly temperature ranges from 23.1 degrees Celsius in January to 29.0 degrees Celsius in May. Annual average is computed at 26.4 degrees Celsius at Tuguegarao City. High humidity between 70% and 90% is observed within the area while daily evaporation is 4 mm to 5mm. The maximum is recorded in April and the minimum in December. During the rainy and typhoon months, floods usually occur which bring about abundant rainfall to the river basin.

The major tributaries of the Cagayan River are the Magat River, Ilagan River, Siffu-Mallig River and Chico River. The average runoff of the river and its tributaries are shown below:

Table 2. Estimated runoff of the River Basin and its Tributaties

Tributary	Catchment (sq. km)	Annual Average Runoff (cu. m/s)
Upper Cagayan River	6,633	289.3
Magat River	5,113	269.8
Ilagan River	3,132	147.1
Siffu-Mallig River	2,015	88.2
Chico River	4,551	256.1
Whole Basin	27,281	1,371.6

Source: JICA FS of Flood Control Project for the Lower Cagayan River

5. Inundation

Based on the RPFP, the inundation area of the Cagayan River and its tributaries is estimated at 186,000 hectares covering 52 municipalities of the region. Specifically, these municipalities are mostly located in the provinces of Cagayan, Isabela and Nueva Vizcaya as shown in Figure 6. Theses areas are within the 650,243 hectares presently used for agricultural production. Settlements near the Cagayan River and its tributaries are also subjected to flood occurrence, and most of these are found in the urban areas of the region where public river easements are disregarded.

6. Flora and Fauna

The Cagayan Valley region is endowed with rich biodiversity. In the recent Philippine Biodiversity Conservation Priority Setting, the region has been identified as one of the priority conservation

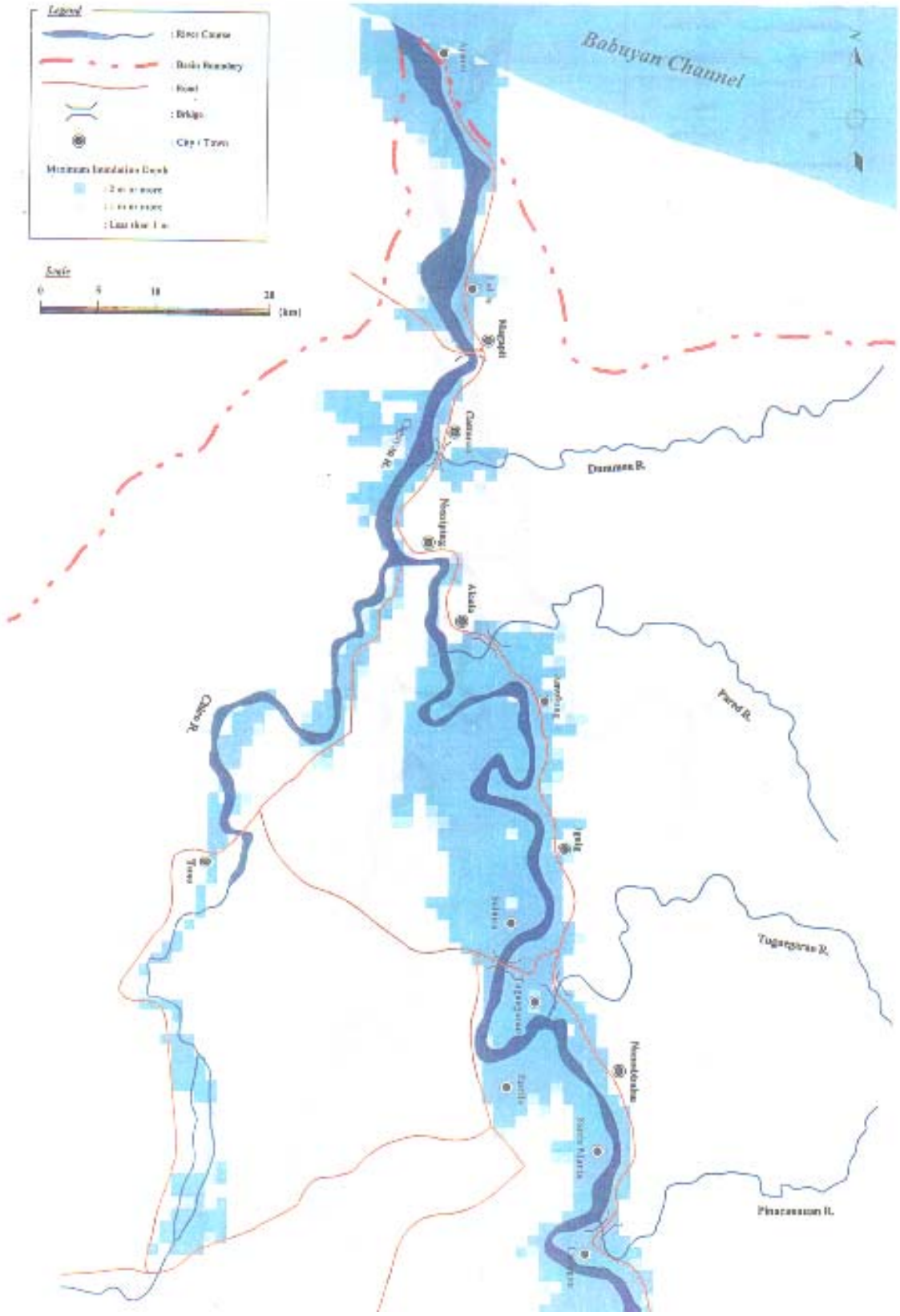


Fig. 6 Inundation Area of the Cagayan River

sites within the country and its vast forest that function as watershed for the Cagayan River is identified as Key Biodiversity Areas (KBA). This means that these areas are home to several threatened species that are found nowhere else in the world. Part of the process is also identifying candidate KBA, of which Cagayan River is among the areas identified. These areas are potential biodiversity rich areas but do not have enough information available to merit a Key Biodiversity Area status. They are also priority area for research.

To date, there are 75 species of plants and animals recorded in the Cagayan Valley Region that are threatened and categorized as Critically Endangered, Endangered and Vulnerable by the International Union for the Conservation of Nature (IUCN) 2006 Red List (Table 3). Among the threatened species 75% are found only in the Philippines. This makes the region a globally important conservation site. Appendix 1 shows the list of threatened species in Region 02.

Table 3. Number of Threatened Species Recorded Within the Cagayan Valley Region

IUCN Criteria	Fauna	Flora	Total
Critically Endangered	3	18	21
Endangered	8	5	13
Vulnerable	28	13	41
	39	36	75

Source: Conservation International Philippines, DENR-PAWB and Haribon Foundation. 2006. Priority Sites for Conservation in the Philippines: KBAs. Quezon City, Philippines, 24 pp.

Few studies have been done on the biodiversity of Cagayan River. Most of the information available is anecdotal and historical accounts from early naturalist and explorers such as the presence of freshwater crocodiles in the river. The only recent study conducted on flora and fauna of Cagayan river was done by JICA in 2001 as part of the feasibility study of flood control in the lower Cagayan River. The study documented a total of 79 families with 298 species of which 37 are endemic and 7 are considered endangered as they are affected by human activities and/or due to habitat loss (Table 4).

Table 4. Number of Terrestial Flora Identified in Cagayan Valley

Item	Number Recorded	Remarks
Family	79	
Species	298	
Endemics	37	Defined as those found only in the Philippines
Indigenous Species	80	Defined as those that can be found in the Philippines and elsewhere in Southeast Asia but not necessarily exotic in the whole region.
Endangered Species	7	
Rare Species	10	
Indeterminate Species	23	Defined as those that are considered ecologically endangered but there not enough data to support such status.

Source: JICA FS of Flood Control project in the Lower Cagayan River, CY 2001

The tree species still dominate the lower Cagayan River area with 88 species, followed by shrubs with 24 and grass with 10 species (Table 5). This kind of distribution reflects two types of ecosystems that dominate the area: the forest ecosystem and the lowland ecosystem that

consists of small trees, shrubs and grasses. Significant numbers of species are indigenous in the area (Table 6) and there are those that are identified as endangered such as; Dungon, Tindalo and Kalantas while rare species are the Bamban and the Bayok.

Table 5. Plant Forms and Number of Species in the Cagayan Valley Area

Plant Form	Number of Species
Tree	88
Shrub	24
Grass	10
Herb	8
Bamboo	7
Vine	5
Fern	2
Palm	5
Total	**149**

Source: JICA FS of Flood Control Project in the Lower Cagayan River, CY 2001 and DENR Region 2, 2006

Table 6. Conservation Status of Flora Species in Cagayan Valley

Conservation Status	Number of Species
Endemic	15
Indigenous	110
Endangered	3
Indeterminate	6
Rare	2
Exotic	14
Common	68
Threatened	1
Uncommon	19
Depleted	40
TOTAL	**278**
Endemicity	*10.79%*

Source: JICA FS of Flood Control Project in the Lower Cagayan River, CY 2001

In terms of terrestrial fauna recorded in Cagayan Valley, there are a total of 75 families and 182 species found in Cagayan Valley (Table 7). Among these recorded, 19 are listed in the International Union for Conservation of Nature and Natural Resources (IUCN) while 29 are recorded in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). This numbers indicate that the whole of Cagayan Valley can still be considered as treasure of wildlife and should be recognized by not only ecologists but also by public officials.

The DENR in Region 2 lists a total of 54 fauna species found in Region 2 which are rare threatened and endangered (Table 8). More recently, a study was conducted by Weerd and Ploeg in 2004 on the waterbirds of Cagayan Valley. They recorded a total of 53 species of birds (Appendix III). This includes 2 threatened species, the Chinese Egret and the Philippine Duck. More importantly 37% of the species recorded are migratory birds and number by the thousands. This exhibits the importance of Cagayan River as a globally important conservation site.

According to the Bureau of Fisheries and Aquatic Resources (BFAR), there are about 25 popular freshwater fish and 3 bivalves' species found in the Cagayan River. Of the freshwater fish five of which are endemic, seven are introduced and 13 are native species (Table 9).

Table 7. Terrestial Fauna Recorded in Cagayan Valley

Class	Family	Species	Conservation Category	
			IUCN	CITES
Mammals	10	20	2	4
Birds	49	119	13	19
Reptiles	13	32	3	6
Amphibians	3	11	1	0
TOTAL	75	182	19	29

Source: JICA FS of Flood Control Project in the Lower Cagayan River, CY 2001

Table 8. Rare, Threatened and Endangered Fauna Species Region 2, as of 2006

Species	Number of species	Status
Philippine eagle	1	Critically endangered
Owl, dove, kingfisher,sea eagle, warbler, pitta, thrush, fruit bat	10	Vulnerable
Pigeon, hornbill, babbler, flycatcher, tailorbird, flying fox, deer,	29	Near Threatened
Forest bat, frog, lizard, skink	14	Range restricted

Source: DENR Region 2

Note: See Appendix II for the scientific name, English name and status of species for the flora and fauna of Cagayan Valley based on IUCN 2006.

Table 9. Initial List of Freshwater Fish Species along the Cagayan River as of 2006

Family	Scientific Name	English Name	Local Name
Anabantidae	*Anabas testudineus*	climbing perch	martiniko
Anguillidae	*Anguilla spp.*	eel	igat
Ariidae	*Arius spp.*	spotted catfish	kanduli
Chanidae	*Channa striata*	mudfish	dalag
Cichlidae	*Oreochromis spp.*	tilapia	tilapia
Clariidae	*Clarias batrachus*	walking catfish	hito
Clariidae	*Clarias macrocephalus*	catfish	hito
Cyprinidae	*Aristhictys nobilis*	bighead carp	karpa
Cyprinidae	*Cyprinus carpio*	carp	karpa
Cyprinidae	*Hypophthalmichthys molitrix*	silver carp	karpa
Cyprinidae	*Labeo rohita*	rohu	karpa
Gobiidae	*Glossogobius celebius*	celebes goby	biya
Gobiidae	*Stenogobius opthalmoporus*		biya
Gobiidae	*Gobiopterus lacustris*	lacustrine goby	dulong, ipon
Megalopidae	*Megalops cyprinoides*	Indo-Pacific tarpon	buan-buan
Mugilidae	*Liza macrolepis*	mullet	banak
Mugilidae	*Cestraeus plicatilis*	freshwater mullet	ludong
Osphronemidae	*Trichogaster pectoralis*	gouramy	gurami
Pristigasteridae	*Ilisha megaloptera*	bigeye ilisha	kapak
Terapontidae	*Leiopotherapon plumbues*		ayungin
Sergestidae	*Acetes spp.; Nematopalaemon spp.*	bubok shrimp	aramang
Corbiculidae	*Batissa violaceae*	freshwater clam	kabibe
Corbiculidae	*Corbicula manilensis*	freshwater clam	tulya/bennek
? Unionidae	*Dalilea spp.* *Anodonta woodiana*	freshwater clam freshwater mussel	unnuk balinggasa
Ampullariidae	*Pomocea canaliculata*	apple snail	bisukol
Viviparidae	*Angulyagra oxytropis*		leddeg
Thiaridae	*Melanoides (Stenomelania) torulosa*	trumpet snail	sosu
Planorbidae	*Indoplanorbis exustus*	snail	kusikus
Lymnaeidae	*Lymnaea (Radix) auricularia*	pond snail	duriken
Thiaridae	*Thiara (Thiara) rudis*	snail	agurong
Thiaridae	*Brotia (Antimelania) costula*	snail	agurong
Thiaridae	*Thiara cancellata*	snail	agurong
Thiaridae	*Thiara (Melanoides) tuberculata*	snail	agurong
Thiaridae	*Melanoides maculata*	snail	agurong

BFAR RO2 Profile 2006

7. Water Quality

A survey by the DENR on most of the sections of the Cagayan River System showed that most are categorized as Not Polluted while two sections were categorized as Slightly Polluted. This indicates that the Cagayan River has no major source of water pollution. On the other hand, measurement results obtained by the Bureau of Research Standards (BRS) reveal that generally, the river water is within allowable limits of water criteria for Class A (Public Water Supply II).

Per DAO 34 of the DENR, rivers are classified from A to D. These classifications depend on the quality of the water as well as its beneficial use. As far as the Cagayan River is concerned, the upper part is classified as A, meaning it can be used for Public Water Supply II. The lower part is classified as C, which is useful for Recreational Water II, for Fishery Water and Industrial Water Supply.

Water quality tests were undertaken by the JICA team early in 2000 in order to assess the quality of both the surface water and the ground water. These tests were conducted in Cagayan River, Chico River, Pinacanauan River in Tuguegarao, Ilagan River and Magat River, as well as in the waters of Aparri, Alcala, Tuguegarao, Cabagan and Ilagan. Results of these analyses reveal that the Cagayan River and its tributaries are of good water quality. However, microbial quality as coliform bacteria were found to exceed standards in the surface waters of the Pinacanauan River in Tuguegarao and the portion of the river along Santiago City where sewage from residences and buildings including domestic waste are flowing into the Cagayan River System.

II. Current Uses of the Cagayan River

1. Irrigation

The water of the Cagayan River is used mainly for irrigation; however, the river is also used for other purposes such as transport, recreation and tourism. The Cagayan River and its tributaries provide the irrigation waters for the different irrigation systems in the region. As of 2005, a total of 6,402 irrigation systems made use of the Cagayan River and its tributaries as their main source of water. Fourteen (14) of these systems are national with a service area of 126,585 hectares, while 6,388 are communal systems covering an area of 72,244 hectares.

Of the 126,585 hectares service area targeted by national irrigation systems, only about 104,098 hectares (82.24percent) are actually irrigated during the dry months of the year. As for communal irrigation systems, only about 49,425 hectares (68.41 percent) are irrigated during the wet season from out of the 72,244 hectares target service area covered. This scenario implies that much is still to be done in terms of developing and irrigating the vast irrigable lands of the basin.

2. Quarrying and Gold Panning

Another major use of the river and its bank is for sand and gravel extraction for concrete aggregates. All of the mainland provinces of the region depend on the Cagayan River and its tributaries for their supply of these materials.

The Cagayan riverine zone production areas and the annual production rate per province as of year 2005 are summarized as follows:

- Cagayan – has a production area of 107 hectares at an annual extraction rate of 986,067 cubic meters of sand and gravel. On metallic minerals, there are 20 hectares production areas with production rate of 420 metric tons.

- Isabela – has a production area of 108 hectares with extraction rate of 1,035,692 cubic meters of sand and gravel. For metallic minerals, there are 20 hectares with a production rate of 2,000 metric tons of minerals,

- Nueva Vizcaya – has a production area of 35 hectares with extraction rate of 280,060 cubic meters of sand and gravel. For metallic minerals, there are 410 hectares with 49,000 metric tons of minerals extracted. A projected 2,000,000 metric tons of minerals containing gold and copper is also available in the province.

- Quirino – has 5 hectares production area with an extraction rate of 21,748 cubic meters of sand and gravel.

Aside form the abovementioned production of sand and gravel, small-scale mining (gold panning) activities are also undertaken in the tributaries of the river in Quirino and Nueva Vizcaya. On the other hand, manganese and chromite permits are released in the provinces of Cagayan and Isabela.

As of August 2006, there are pending applications for industrial sand and gravel extraction with a total land coverage area of 167 hectares located in the provinces of Cagayan and Isabela.

3. Tourism and Culture

Cagayan River is the longest river system in the country, and by itself, a tourist attraction. Part of it at Nagtipunan town in Quirino province was adjudged “The Cleanest River in the Country” during the first Search for Cleanest Bodies of Water (River Category) of the Clean and Green Program.

Many of its tributaries and even the river itself are presently being used for tourism purposes by special interest groups. Kayaking, river rafting/white water rafting, river trailing and swimming are favorite activities of tourists and excursionists in the river. Bancarera or banca race is another activity with mass appeal being undertaken in selected portions of the river. Recreational facilities like resorts, picnic sheds and the like have been put up by operators along the banks of the Cagayan River. With more tourism investments, the

Cagayan River system has the potential of becoming a major tourist attraction in the future.

Presently, the river is being used by some municipalities and provinces of the region for cultural celebrations during fiestas such as the fluvial parade of Our Lady of Piat, in Cagayan which is celebrated every first week of July.

4. Transportation

Landing ports exist along strategic parts of the Cagayan River. These include the following ports in the municipality of Aparri Cagayan ; Furugganan Landing at Centro 15, Toran Landing at Toran, and Macanaya Landing at Macanaya. All of these ports are cargo and passenger fish port that link the western portion of the municipality of Aparri to Fuga Island and Camiguin Island of Calayan, Cagayan.
There are also sub-ports in the municipalities of Allacapan and Camalaniugan, Cagayan which are only operational during rainy season.

A public passenger port is also located at Callao Norte, Lasam, Cagayan linking Lasam to Gattaran, Alcala and other nearby municipalities of Cagayan. In other areas, there are actually no landing and infrastructure facilities; however bancas transporting passengers to nearby municipalities along the river use makeshift ports.

Another public port is found at Centro Norte, Gattaran, Cagayan that serves as an embankment and dis-embankment point. It covers the municipalities of Gattaran and Lasam. Aside from this, there exist private ports at barangays Nassisping, Guising, Lapogan and Centro Sur which occasionally function as both fish port and cargo/passenger port.

There is also a public port found in barangays Dungao and Abariongan Ruar, Sto. Niño, Cagayan that is due for upgrading and expansion. It is characterized by a very steep slope and becomes muddy during rainy season. Public bancas are operational for passengers; however, they are already dilapidated making them dangerous for continuous operations. This port serves as a link of Santo Nino to Gattaran, Cagayan.

In the Province of Isabela, public ports (passenger and fishing) are located at barangays Yeban Sur, Maluno Sur and Maluno Norte all in the municipality of Benito Soliven,. The ports are usually underwater during rainy season and are due for rehabilitation. The public vessels are utilized both for cargo and passengers but are not operational when the river is inundated while private vessels are for fishing and passenger only since the facilities have limited loading capacity.

The province of Quirino has its locally operated mini port in Nagtipunan which is used for fish landing and transport. Ferry boats are used because the bridge is not operational.

5. Fishing and Aquaculture

The Cagayan River is a major fishing ground for the region's farmers and fisherfolk. It plays a vital role as a fisheries and aquatic resource in the region. Given its wide area, it is one of the principal sources of freshwater fish such as the high-priced Ludong, *cestraeus plicatilis*, mollusks (unnok; *dalilea spp.*, balinggasa; *anodonta woodiana*, tulya; *corbicula manilensis*, and kabibe; *batissa violacea*, etc.) and crustacean (aramang; *palaemon and acetes spp.*, etc.).

The river also provides water for the aquaculture ventures of residents in municipalities that are near the river.

6. Hydro-power generation

The region has one operating hydro-electric power plant, the Magat Hydroelectric Power Plant in Isabela which has an installed capacity of 360 megawatts. However, said power plant is not operating at its full capacity due to forest denudation and siltation of the upper area of the Magat River.

7. Agriculture

The total cropland area for municipalities along Cagayan River is 519,525.93 hectares which is about 79 percent of the regional cropland of 654,560 hectares (Land Use and Vegetation Data, D.A R02). Of this area, 206,510.80 hectares or 40 percent is devoted to rice which indirectly or directly draw irrigation waters from the Cagayan River. It was estimated that 135,548.00 hectares are devoted to corn and are concentrated in plains as well as rolling areas suitable for corn in the provinces of Cagayan and Isabela .

The DA Region2 reports that, the river passes through a total of 598,314.03 hectares of land from the 68 municipalities/cities. Of the 598,314.03 total land area devoted to crop production, 315,313.75 hectares or 52.70 percent is devoted for palay production, 185,902.31 hectares or 31 percent is devoted to corn production and 97,897.92 hectares or 16.23 percent is devoted to the plantation of either temporary or permanent crops

Chapter 4

Development Potentials and Problems of the Cagayan Riverine Zone

Potentials of the Riverine Zone

The Riverine zone of the Region is endowed with various resources that can be tapped for various development activities. These resources can be utilized for the following development opportunities:

Fertile Lands for Agricultural Development

The farmlands near the river that are annually subjected to flood occurrences possess very fertile lands which are suitable for farming.

The flood plains along the Cagayan River are rich agricultural areas presently devoted to cash crop production such as rice, corn, legumes and vegetables. These areas, if properly managed can be a major crop production area of the region.

Major agricultural production areas of the region are shown in Figure 7. The areas along the Riverine Zone are found in the following municipalities:

- Cagayan Lowland municipalities of Alcala, Amulung, Iguig, Lallo, Solana, Enrile, and Tuguegarao.
- Isabela lowland municipalities in the Mallig Region, San Pablo, Cabagan, Ilagan, Tumauini
- Municipalities of Bambang, Solano, Villaverde of N.Vizcaya and Municipalities of Diffun, Maddela and Cabarroguis in Quirino

Growth of Adventure Tourism and Eco-cultural Tourism

The Cagayan River system has also the potential for eco-tourism. The Upper Cagayan River (Nagtipunan) was adjudged as the “cleanest river in the country” during the 1st search for cleanest bodies of water (River Category) of the clean and green program.

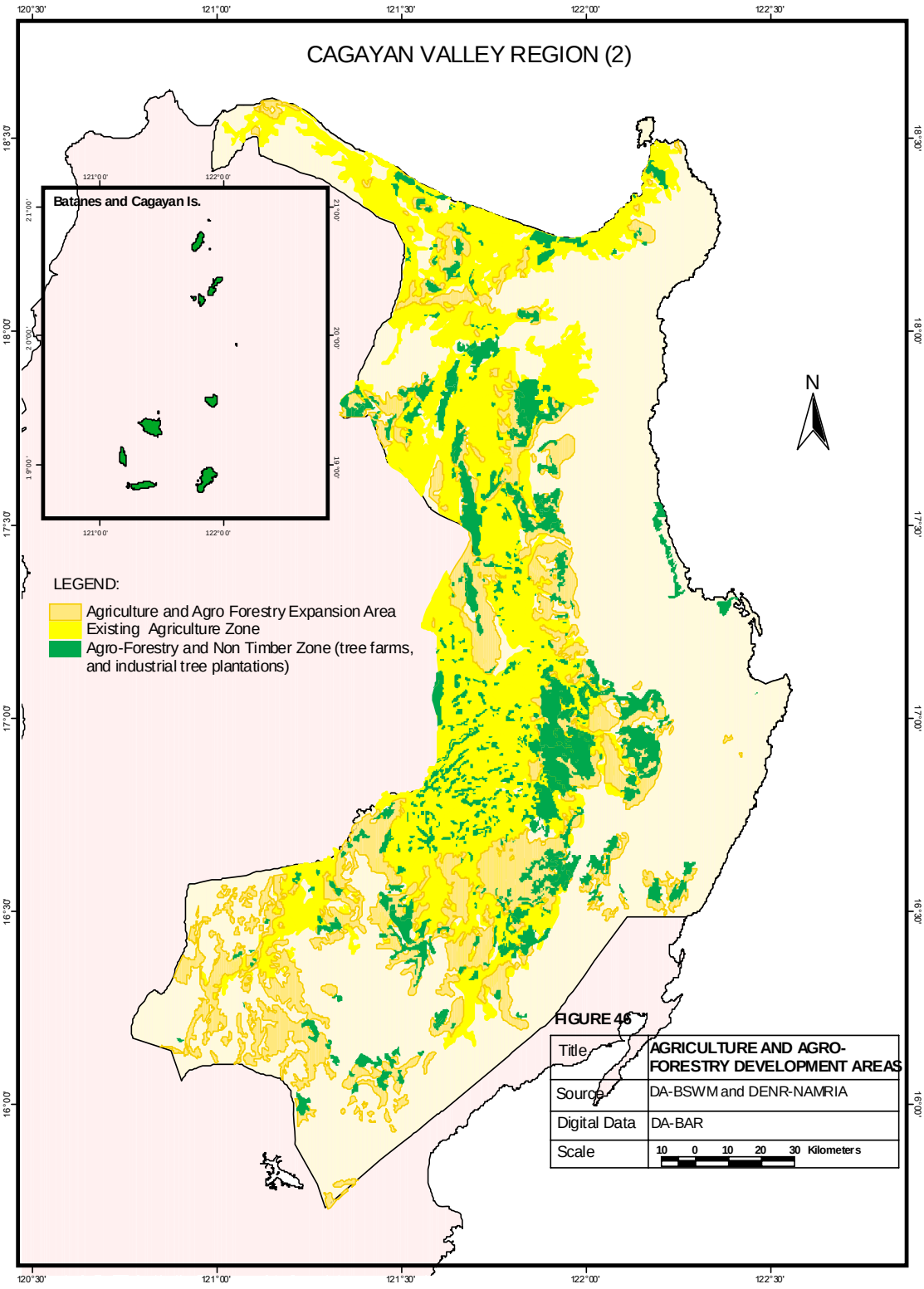


Fig. 7. Major Agricultural Areas

Presently, it is being used by some municipalities and provinces of the region for cultural celebrations during fiestas such as fluvial parades and the "bancarera". Special interest groups also attract visitors by promoting the river and its tributaries for kayaking, river rafting, white water rafting and river trailing. Excursionists also use the river as picnic and swimming area, encouraging some businessmen to establish resorts along the riverbanks. Promoting the river for eco-tourism and providing facilities will attract more tourists and investors in the area.

Rich Biodiversity Potential

The riverine zone is home or habitat of endemic species such as ludong, and indigenous species of shellfish and fish, trees and other plants. So far not much is known about the biodiversity of flora and fauna of Cagayan River. Most of the information available is anecdotal and historical accounts from early naturalist and explorers such as the presence of freshwater crocodiles in the river. Aside from the records of migratory and water birds of Cagayan (Weerd and Ploeg 2004)., Boxed turtles (*Coura spp*) which is under CITES Appendix II were the only species of reptile recorded and the only known endangered species documented that thrive in the river is the Cantor's Giant Soft Shelled Turtle (*Pelochelys cantorii*) which is found in the upper cagayan river and the area along San Pablo and Cabagan Municipality. Despite several reports by the local community along the river on the presence of gobies, ludong, cat fish, carps, and other freshwater fishes, no study has ever been conducted to systematically document the diversity of freshwater species in the Cagayan River. A study on the freshwater resources of the river and its embankments is a high priority.

Increased Fishing and Aquaculture Potential

The Cagayan River has also big potential for the development of the fisheries industry, both for capture and aquaculture activities. At present, it is a major inland fishing ground for the part-time and full-time fisherfolk residing near its tributaries. It is the migratory path and natural habitat of the catadromous endemic species of mullet locally known as *Ludong*. The Magat area has the most number of contiguous fish cages within the region, producing at least five (5) metric tons of tilapia daily. The aquaculture park proposed to be established in the Magat reservoir and the mushrooming fishponds near the riverbank of major tributaries present good prospects for the aquaculture industry.

Water for Irrigation Expansion

The potential of the Cagayan River for irrigation purposes is still not optimized. Only about 104,098 hectares (82.00**%**) of the 126,585 hectares target irrigable area of the National Irrigation System are actually irrigated and only 49,425 hectares (68.00%) of the 72,244 hectares target service area of the communal irrigation are presently being served.

More Transport Routes

The Cagayan River provides opportunity for expansion of transport route for the region's products and travelers. The river serves the transportation needs of the municipalities of Aparri, Alcala, Enrile and Sto. Nino, Camalanuigan, Allacapan, Lasam, Gattaran in Cagayan; the municipalities of Benito Soliven, Tumanuini, Delfin Albano, Cabagan and San Pablo in the province of Isabela, and the municipality of Nagtipunan in Quirino. These can be further extended to the other municipalities of the region that are along the river by constructing ports and making the river navigable by dredging shallow portions.

II. Problems and Issues in the Riverine Zone

The core problem faced within the riverine zone is its slow pace of development. In spite of the potentials for intersectoral development offered by the river, there are limited development activities occurring in the area.

The slow pace of development in the Cagayan Riverine zone is due to the low level of productivity of the zone in terms of economic activity. Its attractiveness in fishing for instance has declined because of meager catch and the growth of land transportation had relegated the use of the river as major transportation route in the sideline. The low level of productivity is also brought about by the yearly occurrences of flood resulting to the loss of life properties and the occurrences of water borne diseases thus, discouraging investors to invest in the riverine zone. Use of illegal fishing gears, electro-fishing and other illegal fishing activities and other activities detrimental to the riverine's environment have resulted to the decline in the population of the flora and fauna in the riverine area which threatened the biodiversity of the Cagayan Riverine zone.

Specifically, there are four major factors that contributed to the above mentioned problems. These are extensive and prolonged flooding, limited water supply during dry season, deteriorating water quality and low level of promotion on the potential of the riverine zone.

1. Extensive and Prolonged Flooding

Flood-prone areas are those which are within the inundation coverage of the Cagayan River and its tributaries. This covers a total area of 1.86 million hectares and affects 52 municipalities in the provinces of Cagayan, Isabela and Nueva Vizcaya. Of this, 1.86 million hectares, about 650,243 hectares or 40 percent are alluvial plains which are presently used for agricultural purposes. The period of flooding last for a number of days while the inundated areas expands every time floods occur.

Among the contributory factors to the inundation problem are:

1.1 Insufficient structural facilities (water collecting and regulating facilities).

Structural facilities are major components of flood control. The entire riverine zone is in need of structural facilities as a measure to check flooding and inundation. However, national and local governments lack the necessary financial capability to undertake or implement structural projects within their area of jurisdiction.

Typical flood control facilities existing along the Cagayan River are bank protection works which consist of gabion, concrete revetments, dry and wet masonry and spur dikes. The Cagayan Riverine zone needs more multi-purpose dams, diking systems, and bank protection projects. These projects have been relegated to lower priority because of other infrastructure projects such as roads, bridges, school buildings, etc.

1.2 Insufficient non-structural flood control systems

Non-structural measures needed in the riverine area include watershed protection and rehabilitation, establishment and maintenance of tree zones and dredging of the portions of the river that have heavy sedimentation. These are presently lacking or inadequate to significantly contribute in mitigating the occurrences of flood in the riverine area.

Other non-structural flood control systems that are wanting are the institutionalization of disaster management measures such as; a) flood forecasting and warning systems, b) evacuation systems/centers and c) resettlement development system or plan. This also includes enhancing the capability of disaster coordinating councils to manage disasters caused by floods.

1.3 Constricted Flow of Water

The constricted flow of the Cagayan River System is caused by the presence of bottleneck in a section of the river called the Magapit Narrows. Within this section are found three specific bottlenecks namely: a) Tupang in Alcala, b) Nassiping in Gattaran and c) Magapit in Lallo. All together, this whole stretch measures about 30 kilometers. These bottlenecks also aggravate the prime factor of river meandering where there is an imbalance between the strong flow of water from the mountain slopes surrounding the river and the capacity of the river to contain the flow of water.

1.4 Heavy siltation/sedimentation

Landslides have become rampant after the July 1990 earthquake. These are mostly observed in the Magat Area in Nueva Vizcaya where rehabilitation activities were concentrated in the past 10 years. The effects of this devastation are heavy especially in

the Upper Cagayan River or along the Magat Dam Reservoir where sediment discharges in the watersheds have increased.

The Dam has a basin area of 4,140 sq. kms. When this was completed less than 25 years ago, the reservoir had a live storage capacity of 1.2 billion cu.m and a dead storage capacity of 300 million cu. m. However, due to continuous increase in sedimentation from the upper basin, the dead storage capacity has been reduced to 112 million cu.m during the past years. The annual sedimentation rate was recorded at 10.4 million cu.m , which is twice the projected rate of 5.5 cu.m. This is also occurring in the Cagayan River and its tributaries.

Heavy sedimentation in the middle and lower portions of the Cagayan River are observed especially in the following sections; Amulung, Lallo, Camalaniugan and at the rivermouth in Aparri.

2. Limited Water Supply During Dry Season

The region experiences abundant supply of water from the Cagayan River during the rainy months. With much water, more lands are irrigated, and water for industrial and for household use is always available. However, during the dry months of the year, the river almost gets dry and water for irrigation and other purposes is scarce. Area of Irrigated lands decrease due to the lack of water. This condition even gets worst during the occurrences of the El Niño. During these dry months people and farmers resort to over extraction of water from the rivers, over extraction of other surface water sources and sub-surface sources. Intensive usage of tube wells has led to abstraction of water in excess of natural recharge by rainfall and river seepage, and a progressive lowering of the water table."

Among the reasons for this limited water supplies are:

2.1 Insufficient structural facilities for water collection

There are many areas in the Cagayan Riverine zone that are suitable for multi-purpose dams, small water impounding project (SWIP) and small farm reservoir (SRF). However, these areas are not presently tapped for such porposes. Developing these areas for collecting water during the rainy season can significantly alleviate the problem of limited water supply during the dry season for irrigation and other purposes. The riverine zone has five potential sections for multi-purpose dam development. This includes Matuno, Tumauini, Siffu, Alimit, Mallig, and Kalipkip rivers. The combined potential water storage capacity of these dams is about 950 MCM. The riverine area has also 27 potential areas for SWIP, and 920 SRF that can also be developed to collect more water during the rainy season.

2.2 Deteriorating forest cover of the watersheds

Forest cover of the watersheds of the Cagayan River has been declining. This resulted to increased surface runoff during rainy season because of the thinning of vegetation that deters the flow of water. Vegetation slows down the flow of water thereby increasing water infiltration and the storage of water in the upland. This will give rise to the continuous flow of water in streams even during dry season. The deteriorating vegetation of the watersheds therefore is one of the causes of the drying up of streams limiting water supply during dry season.

The declining forest cover is due to the increasing exploitation of the region's watersheds (human intrusion, slash and burn farming practices and illegal logging activities).
Other indirect causes are population growth in the upland due to migration from the lowlands; inappropriate conservation measures; absence of mechanisms to facilitate and coordinate the mandates of various agencies; inadequate land use and management plans; absence of institutional mechanism to encourage active, collective and sustainable participation of stakeholdersr. Likewise, there is a very poor watershed management due to the absence of watershed management plan.

2.3 Diversion of the waters from Casecnan to the Pantabangan Reservoir

One of the possible factors affecting the volume of water of the Cagayan River especially during the dry season is the diversion of the waters of the Cagayan River to the Casecnan reservoir. This can affect the availability of the waters required by the region for irrigation and other purposes especially during dry season.

3. Deteriorating water quality

Water quality is a vital factor in attracting investors to the river. Good water quality attracts investors and tourists to the river. While the upper portion of the river (Quirino area) is still clean and potable, the lower end of the river particularly in the areas of Isabela and Cagayan is getting more turbid every year. The slow deterioration in the quality of the water of the river is caused by the following:

3.1 Improper waste disposal

As a whole, the water quality of the Cagayan River is not yet contaminated as declared by the DENR. In most cases, the quality of the river water is within the allowable limits of fresh water criteria set by the DENR. However, as the surface water that flow into the river is getting contaminated the water quality of the river slowly deteriorates. As early as 2000, the JICA study on the river revealed that microbial quality of coliform bacteria was high in some sections of the river. This is caused by sewage from residential and industrial buildings whose waste flow to the Cagayan River system. Solid wastes, petroleum and residual products of petroleum also find their way to the river especially in the urban areas. This contributes further to the declining quality of the water of the river.

3.2 Heavy use of Chemicals in farming

About 80 percent of the croplands of the region lie on both sides of the riverine zone. For most farmers, two croppings per year are being practiced as a result of the presence of irrigation waters from the river. However, the present farming practices which are extensively practiced in the region are dependent on inorganic inputs such as fertilizers, insecticides, pesticides and herbicides . These inputs not only reduce the quality of soil but are also washed to the rivers during rains and floods which contribute further in the deterioration of the water quality of the river.

3.3 Water quality issues in the fisheries subsector

Currently, there are no capture nor aquaculture practices that contributes environmental hazards on a wide scale to the Cagayan River System. As reported, the water quality is still favorable for the growth of aquatic plants and animals. However, safeguard mechanisms to prevent water pollution and destruction of habitats should remain a priority concern. Issues on blast and electro fishing remain a problem that needs to be addressed by competent authorities. Overfeeding of cultured fish species that contribute to the deterioration of water quality in the immediate environment still needs to be resolved through the introduction of ecologically-sound aquaculture practices as mandated by the Code of Conduct for Responsible Aquaculture and intensive information and education campaign. Dumping of waste on riverbanks and the river system itself is affecting the biodiversity of sessile organisms like the “unnok” and other bivalves. The problem on the improper waste disposal that resulted to the “Unnok Scare”, wherein the endemic bivalve in Lallo, Cagayan became unsafe for human consumption due to ingestion of “unnok” of harmful plankton brought about by the increased organic matter content of water, needs to be tackled by the LGUs to prevent the recurrence.

3.4 Weak implementation of policies resulting to uncontrolled use of the river areas and banks for sand and gravel extraction

Suspended solids are retained in the river areas and banks of the Cagayan River due to extraction of sand and gravel for concrete aggregates. These solids make the water turbid. On the other hand, the lack of policy on sand and gravel extraction result to abuse by extractors wherein they extract without due consideration of the processes and environment of the river. Such practices will not only make the water turbid but also hampers the free flow of water thereby contributing to prolonged flooding.

3.5 Improper disposal of mine tailings

Mining and mineral extraction is a transitory land use that takes many forms (e.g., dredging, placer, area mountain-top removal, and contour operations). It includes exploration, site preparation, mining, milling, waste management, decommissioning or reclamation, and even mine abandonment. Mining, if not properly managed impacts on fish and aquatic resources through erosion and sedimentation, dewatering of wetlands, diverting and channelizing of streams, and contaminating surface water and aquifers with toxic chemicals. These impacts result in loss of sensitive species, biodiversity, and ecosystem integrity. Chemical pollution can result in complete and "permanent" losses extending far downstream. Accumulation of contaminants in fish may render them unsuitable for human consumption. This is the situation in some mining areas in the provinces of Nueva Vizcaya and Quirno where small-scale miners practice open pit mining without due consideration on the use of sustainable mining practices.

3.6 High Rate of Erosion

Erosion is a major problem observed in the Cagayan River that is affecting the water quality of the river. The riverbanks especially of the Isabela and Cagayan portions of the river are continuously suffering from sever erosions; this causes turbidity affecting the quality of the water. The JICA study came up with about 73 sites along the Cagayan River which are exposed to destructive damage. These are found in the following areas:

a) In Cagayan – sites in the municipalities of Aparri, Lallo, Gattaran, Alcala, Amulung Iguig, Tuguegarao, Solana, Enrile, Tuao

b) In Isabela – sites in the municipalities of Cabagan, Tumauini, Mallig, Ilagan, Cauayan, Echague, Santiago and Jones

c) The whole province of Nueva Vizacaya where the Magat river runs.

The average annual bank erosion rate reaches 10 meters in the downstream of Magapit Narrows, while the erosion along the municipality of Alcala in Cagayan reaches 24 meters per year.

The high rate of erosion is caused surface runoff, the physical characteristic and composition of the rock in the river as well as the high rate of denudation.

4. Low level of promotion on the potential of the riverine zone

The multiple uses of the river has not been adequately explored and developed. To date, it is used as fishing area, limited transport route and source of irrigation waters. Among the reasons for the lack of attention on the river may be the absence of an authority or an organization that will oversee the promotion of the river, harmonize and orchestrate activities, similar to the organizations that developed other rivers such as Palawan River, Bohol River, Marikina and Pasig Rivers, among others.

Chapter 5

Goal, Objectives, Policies and Strategies

The Cagayan River System which traverses four provinces of region 2 is considered to be a major resource of the region. The key role of this resource in the overall development of the region is recognized in the Regional Physical Framework Plan by delineating the riverine zone as multiple land use zone. Presently, the riverine zone's contribution to the development of the region is not yet optimized because the use of the resource is still limited to the traditional use as fishing ground, irrigation, and agriculture, venue for cultural celebrations, recreational and to a limited extent for transport.

Goal:

To accelerate the sustainable development in the riverine zone through proper management, in order to realize the full development potential of the area.

Objectives:

The goal can be realized through the attainment of the following objectives:

1. To enhance the productivity and safety of the Cagayan Riverine Zone. At the end of the Plan period, it is targeted that investments in terms of agriculture, fishery, tourism, transportation, power and irrigation shall have increased within the Riverine Zone.

2. To improve the level of population of the aquatic resources in the Cagayan Riverine Zone such that by year 2010, this will have increased by 15% compared to its 2000 level and reach 100% by year 2030.

Policies:

The attainment of the objectives hinges on the following policies;

1) Mitigation of the destructive effect of flooding and reduction of its extent in terms of area and time.
2) Availability of adequate water supply during dry season for domestic, industrial and agricultural uses.
3) Improvement of the deteriorating water quality in the Cagayan Riverine Zone.
4) Optimization of the development potentials of the Cagayan Riverine Zone.

Strategies:

The following strategies will be adopted to operationalize the policies of the plan.

1. Strategies for the mitigation of the destructive effect of flooding and reduction of its extent in terms of area and time.

1.1. Reduce extent of flooding in terms of area and time through the construction of multi-purpose dams and water impounding facilities.

Construction of structural flood control facilities such as dams, small water impounding projects and small farm reservoir can substantially reduce the occurrence of flood in the riverine area. The volume of water that flows into the river can be reduced by storing the rain water in these structures and can be released and used for irrigation and other purposes during dry season.

Construction of small water impounding facilities and multi-purpose dams shall be provided in the strategic sites in the Cagayan River and its tributaries to regulate flood waters. Multi-purpose dams shall be constructed in the upstream of the river preferably on major tributaries that contribute substantial discharge during rainy season or during flood occurrence. Priority shall be given to these structures in order to regulate and reduce flood discharge over the low-lying downstream flood prone areas. The construction of dams will ensure and significantly reduce the area affected by flooding in the lower reaches of the river. Agricultural damages are expected to be reduced to the minimum due to a much lesser flooded area and flooding time.

1.2. Construct cut-off channels.

Channel normalization in the Magapit narrows which serves as the bottleneck and the primary cause of inundation in the lower sections of the Cagayan River is suggested to be undertaken. Cut-off-channel will be constructed in three (3) sections to ensure a smooth and accelerated drainage of flood water in the lower sections of the river. However, a study is suggested to be done before its implementation to ensure that the benefits out weight any cost due to its implementation.

1.3. Construct riverbank protection facilities.

Another strategy to control and delay the sudden discharge of flood water from the upstream is the conservation of the retardation capabilities of the banks of the river channel in the upper reaches of the Cagayan River and its tributaries. Efforts will be focused on bank protection on these sections to ensure stable and erosion-free embankment. Bank protection and dike structures shall also be constructed to protect low-lying areas within its lower reaches.

1.4. Maintain the favorable depth of the river by dredging along heavily silted portions of the river and removal of sediments allowing for faster flow of water especially during rainy season to further reduce the destructive effect of floods.

Areas that have heavy sedimentation such as the Amulung and Aparri portions of the river retard the flow of flood waters. Towards this end, studies should be conducted to determine if dredging is possible as well as to determine if there are negative effects of such activity. Following this, cost estimates of dredging activities should be made and financing assistance be sought at the national and international sources.

1.5. Improve and institutionalize flood control and mitigating systems

Flood control and mitigating systems that are wanting are the institutionalization of disaster management measures such as; a) flood forecasting and warning systems, b) evacuation systems/centers and c) resettlement development system or plan. This also includes enhancing the capability of disaster coordinating councils to manage disasters caused by floods.

The upgrading and operationalization of flood warning system is also needed to further reduce the destructions brought about by flooding. Along with the upgraded flood warning system shall be the capability building of Regional and Local Disaster Coordinating Councils.

1.6. Strictly enforce the easement required by the Water Code of the Philippines.

The local government units are enjoined to strictly enforce the easement required in the Water Code of the Philippines. The water code sets the river easement as follows: three meters in urban areas, 20 meters in agricultural areas, and 40 meters in forest areas. Provision of the easement area would help render an un-obstructed flow of water especially during the occurrences of flood. This will also stabilize and protect the river banks from erosion.

1.7. Ensure that in-stream projects (Dams, bridges, SWIPs) within the riverine zone do not interfere with natural stream processes.

SEC. 56 of the Philippine Water Code prohibits any constructions which obstruct any defined migration path of migratory fish species such as river mouths and estuaries. Structure should be designed improve the passage of fish particularly during spawning seasons in the Cagayan River and its tributaries. **FAO 109** also prohibits the construction or establishment of fishpond or fish enclosures in inland waters without permit. Observance and strict enforcement of this provision of the water code will contribute to the reduction of the damages caused by flood for it will allow free flow of stream water thereby reducing the time of inundation. This will also help in improving the declining population of aquatic flora and fauna by providing favorable environment for their natural growth.

2. Strategies for ensuring the availability of adequate water supply during dry season for domestic, industrial and agricultural uses.

2.1. Construct structural facilities for water collection

This strategy is in conjunction with the strategy on the construction of dams and water impounding facilities to control flood which was earlier mentioned. Control of flood using such structures would also result to the storage of rain water which can be released during the dry months. Hence, implementing the strategy to control flood through the construction of multi-purpose dams and small water impounding projects would also ensure the availability of adequate water supply during dry season for irrigation and other purposes.

There are many areas in the Cagayan Riverine zone that are suitable for multi-purpose dams, Small Water Impounding Project (SWIP) and Small Farm Reservoir (SRF). However, these areas are not presently tapped for such purposes. Developing these areas for collecting water during the rainy season can significantly alleviate the problem of limited water supply during the dry season for irrigation and other purposes. The riverine zone has five potential sections for multi-purpose dam development. This includes Matuno, Tumauini, Siffu, Alimit, Mallig, and Kalipkip rivers. The combined potential water storage capacity of these dams is about 950 MCM. The riverine area has also 27 potential areas for SWIP, and 920 SRF that can also be developed to collect more water during the rainy season.

2.2. Improve the forest covers of watershed through the preparation and implementation of a watershed management plan.

Forest cover of the watersheds of the Cagayan River has been declining. This resulted to increased surface runoff during rainy season because of the thinning of vegetation that deters the flow of water. Vegetation slows down the flow of water thereby increasing water infiltration and the storage of water in the upland. This will give rise to the continuous flow of water in streams even during dry season. The deteriorating vegetation of the watersheds therefore is one of the causes of the drying up of streams limiting water supply during dry season. It also results to increase in the rate of erosion. High rate of erosion causes siltation and sedimentation of waterways thereby contributing to the destructive effect of flooding by prolonging the time and extending the area affected. Erosion also contributes to the decline of the water quality of the Cagayan Riverine because it makes the water turbid which is one of the major parameters for favorable growth of aquatic life. Preparation and implementation of a watershed management plan would therefore address many problems. The problem on forest cover which will be adequately taken cared of by such plan and its implementation is paramount in the development of the Cagayan Riverine.

2.3. Identify and delineate impact reforestation areas within protection forest.

Protection forests, especially those that are untenured shall be the subject of closer protection and management. As such, exploitation of whatever nature is not allowed. Henceforth, all areas falling under this type shall be improved to enhance its biological features.

Presently, Region 02 excluding Batanes has 774, 666.198 hectares of protection forest with 308, 995.849 hectares of untenured portion. The impact areas within the untenured portion are identified and delineated on the ground. These areas are situated in the 20 municipalities of the region having an estimated area of 63,593 hectares.

2.4. Conduct research to determine the effects of diverting the waters of Cagayan River to the Casecnan.

There is the need to conduct research to determine the effects of diverting the waters of Cagayan River to the Casecnan and institute mitigating measures to avert any negative effects brought about by such water diversion.

3. Strategies for improving the water quality in the Riverine Zone.

3.1. Rationalize disposal of wastes through the conduct of massive IEC on Waste Management; construction of sanitary landfill, establishment of Barangay Material Recovery Facilities (MRF) and strict implementation of environmental and related laws.

All sorts of wastes generated by the households, commercial, service and industrial establishments find their ways into the Cagayan River contributing to the declining quality of the water especially in urban areas. Awareness campaign on the negative effect of such to the population is needed aside from the provision of waste disposal facilities and systems such as landfill.

There should be strict implementation of the RA 9003 (Solid Waste Management Act) and RA on Clean Air Act and Water Act and other related laws such as P.D. 1152, P.D.1067, P.D. 1586, and P.D. 7586. Strict observance and enforcement of these laws will not only help in maintaining good water quality of the river but will also help in improving the declining population of the aquatic flora and fauna in the riverine area. Clean water will provide favorable environment for their growth and reproduction.

3.2. Promote and encourage farmers to adopt sustainable farming practices and regulation of the use of farm chemicals.

The following should be undertaken in support of the strategy;

- Wide adoption of organic farming system thru the conduct of Integrated Pest Management (IPM) Trainings;

- Packaging and adoption of Sustainable farming practices. Local ordinances should be enacted such that these packaged farming practices will be the one adopted and implemented by farmers;

- Pushing for a law requiring agriculturist to prescribe pesticides and other farm inputs as prerequisite by farmers to purchase such farm inputs. The justification here lies in the fact that agriculturists are now required to pass the board examination before they could be recognized and one form of recognition of their expertise is for them to prescribe proper farm inputs. There is also the need to strictly implement R.A. 8436 and DAO 38.

3.3. Promote environment-friendly fishing practices and improve aquaculture productivity within ecological limits

Some incidence of blast fishing, electro fishing and establishment of illegal stationary fishing gears are still observed in some parts of the Cagayan Riverine area. These fishing practices do not only put into peril the future population of aquatic resources but also contribute somehow to the deteriorating quality of the river. Blast fishing is particularly destructive because of the direct effect on fish and invertebrates within the blast zone. Not only are the preferred species and sizes killed but the blast also kills all the fish in that area (http://www.tracc.00server.com/Fisheries/blast_fishing). This may lead to changes in fish populations that could further result in the changes in ecological niches or directly reduce the biodiversity within a particular area. Continuous improper implementations of package of technology in aquaculture contribute further to the deterioration of water quality. Hence, the need to strictly implement monitoring, control and surveillance measures provided under the Philippine Fisheries Code of 1998 (RA 8550).

3.4. Plan and control the use of the river for sand and gravel extraction

The present practice of indiscriminately extracting sand and gravel in the Cagayan River and its tributaries obstruct the free flow of water contributing to prolonged flooding and also contributes to the turbidity of the water affecting the water quality. The oil discharges of the heavy equipments that go into the river during operation further contribute to the poor quality of the water. There should be proper planning and controlled extraction of sand and gravel to arrest the further deterioration of the quality of the water of the river.

4. **Strategies for optimizing of the development potentials of the Cagayan Riverine Zone.**

Increase investments in the Cagayan Riverine Zone by promoting the development potentials of the zone in the following areas:

4.1. Tourism
- Conduct of cultural activities and celebrations;
- Promotion of fresh water sports and freshwater sports fishing;
- Construction of recreational facilities.

4.2**.** Irrigation and power generation
- Identification and Investigation of possible Small Scale Irrigation Project and Multi-Purpose Dam Project from existing maps by the concerned agency for technical and economic feasibility, social acceptability, funding and implementation;

- Encouraging LGU's, existing irrigators association and farmer groups to report potential irrigable area with dependable water source for irrigation development;

- Encouraging LGU's through resolution/ordinances to set aside portion of their development fund for the repair and rehabilitation of existing small scale Irrigation system as well as construction of new irrigation project;

- IEC to Irrigator's Associations on the efficient utilization and management of irrigation water.

4.3. Fisheries

a. Aquaculture
- Adopt proper water usage and effluent management;
- Apply the recommended practices on Fisheries Administrative Order No. 214 on feed, feed use and management;
- Continuous water quality monitoring and issuance of water quality bulletin and advisory to guide fish producers;
- Culture of aquatic species with high local demand;
- Demonstrate and pilot mature aquaculture technologies for future commercialization;
- Develop culture techniques for endemic species such as "Ludong", *cestraeus plicatilis*;
- Empower fisher folk through capability-building and technology trainings;
- Establish aquaculture parks;
- Establish more hatcheries to support the input requirement of farm operators;
- Formulate incentives to encourage compliance with the environmental standards and promotion of sustainable management practices on aquaculture;
- Improve aquaculture data management;
- Improve farm design and construction;
- Promote fish health management practices;
- Provide post harvest facilities in major aquaculture areas like the Magat reservoir;
- Recommend policies to govern the introduction of exotic species and genetically modified organisms;
- Register all aquaculture farms as mandated by law for regulatory purposes;

- Regulate the use of drugs, chemicals, potentially toxic pesticides and fertilizers so as not to endanger food safety or threaten the environment;
- Research and development of ecologically-sound aquaculture technologies;
- Support the policy on the insurance of aquaculture crops/stocks (FAO 215);
- Venture into the production of high value fishery commodities.

b. Capture fisheries
- Conduct capabiity-building and values-orientation seminars to eliminate illegal fishing activities;
- Conduct technology demonstration and training on the design, construction and use of environment-friendly fishing gears;
- Improve capture fishing technology;
- Provide alternative livelihood to marginal fisherfolk;
- Sustain the fingerling dispersal program;

c. Maintenance of the diversity and abundance of aquatic communities
- Conduct intensive IEC on riverside residents and farmers on the ill-effects of dumping of wastes and discharge of water from croplands containing fertilizers and pesticides to the riverine ecosystem;
- Conduct studies relative to the recommendation to CITES based on the current state of fish and aquatic resources within the riverine zone;
- Establish fish sanctuaries and fishery reserves along the riverine zone for special or limited use, including but not limited to educational, research, and or special management purposes;
- Mandatory construction of fish ladders in all dams and other major water control structures;
- No foreign finfish, mollusk, crustaceans or aquatic plants shall be introduced without a sound ecological, biological and environmental justification based on scientific studies subject to biosafety standards as provided for by existing laws: provided, however, that the government may approved the introduction of foreign aquatic species for scientific research purposes;
- Organize fisherfolk organizations that shall become government partners in the protection and conservation of the lacustrine resources;
- Research and development on the biology of aquatic fauna and flora found in the riverine zone;
- Stock assessment of macro fauna and flora in the riverine zone;
- Studies on hydrology, bathymetry and other lacustrine acoustics necessary for the conservation of critical breeding, feeding and growing habitats of endemic fishery species;
- Zonation plan that will define the boundaries of specific areas for fishery utilization and development purposes, such as for aquaculture and other uses;
- Protection and improvement the status of endemic, threatened and endangered species, and formulate and implement (threatened species) recovery plans. Establish cost sharing mechanism with various stakeholders (e.g. LGUs, private sectors, fisherfolks) highlighting priorities areas in the riverine zone area;
- Utilization of the EIA System, review and regulate all gravel and sand excavation, bridge construction and other development projects that may

impact on the river and recommend appropriate action to maintain, improve or protect aquatic habitats;
- Adoption of a standardized monitoring plan for Cagayan River and its various tributaries on its endemicity and maintain a region wide database linked to the regional geographic information system database for planning.

d. Enforcement of fishery laws and related laws

- Formulation of Municipal Fisheries Ordinance mandating, among others, the protection and conservation measures of the riverine fishery resources;
- Mandatory and urgent creation of Fisheries and Aquatic Resources Management Councils (FARMCs) in municipalities and barangays abutting the Cagayan River System with existing fisherfolk organizations;
- Strict implementation of the provisions under the Philippine Fisheries Code of 1998 (RA 8550) and its Implementing Rules and Regulations, including the approved Fisheries Administrative Orders;
- Effect the convergence of LGUs and existing institutions toward inter-provincial or interregional cooperation for the protection, maintenance, enforcement of laws and sustainable utilization of the Cagayan river
- Cooperation of LGUs with DENR in the preparation of Cagayan Valley RiverWater Policy which restricts/regulate the use of water;
- Conduct of training and deputization of fishery wardens;
- Conduct market denial activity in local markets within the Cagayan Riverine Zone;
- Encourage LGU legislative bodies to ensure the protection and sustainable use of rivers in their respective areas through localization and mainstreaming of existing legislations on river waters;
- Strict implementation of the provisions of the Fisheries Code.

4.4**.** River transportation

- Port improvement /rehabilitation and construction;
- Dredging of silted portions of the river making it ideal for navigation;
- Making the river a major transport route (from upper to lower Cagayan River).

4.5. Mining and quarrying

- Encouraging local government units to enact ordinances similar to what is being done in the province of Cagayan where operators are not allowed to leave behind, piles of gravel in the are where they operate. This will ensure that the area is free of encumbrances such that the river will maintain its smooth flow;
- Deputizing mining warden.

Chapter 6

INSTITUTIONAL AND OPERATIONAL MECHANISM

The implementation of the Cagayan Riverine Zone Development Framework Plan will be a concerted effort of the different RLAs, LGUs and other stakeholders. An Implementing Body or Structure is needed to oversee and orchestrate the overall implementation of the Cagayan Riverine Plan.

The Regional Land Use Committee (RLUC) shall conceptualize and develop long-term implementing mechanism and structure to coordinate the programs and projects in the Cagayan Riverine Plan. Considering the critical role of the Provinces, Cities, RLAs and NGOs in the use and development of the river, the stakeholders shall be properly consulted in the conceptualization and development of this implementing mechanism. This is to have a wider participation and also ensure full support and commitment of Local Chief Executives and other stakeholders in the region to the Cagyan Riverine Program.

The Committee (RLUC) shall explore options of creating the Body and ascertain the feasibility of its establishment and operation. The Body may be created through legislation or by an Executive Order or even Joint Executive/Legislative Order among concerned LGUs to include the provinces of Cagayan, Isabela, Quirino and Nueva Vizcaya and the City Governments of Santiago City, Cauayan City and Tuguegarao City.

The Cagayan Riverine Plan subsumes projects that are urgent and require immediate implementation and therefore, an interim implementing mechanism will be adopted to guide the different stakeholders. While awaiting the creation and operationalization of the permanent Implementing Body, a Memorandum of Agreement (MOA), will be forged between and among the RDC2 and the provinces of Cagayan, Isabela, Quirino and Nueva Vizcaya and the Cities of Santiago City, Cauayan City and Tuguegarao City. The MOA which shall provide an interim mechanism to synchronize the activities in the Riverine Plan shall specifically detail the roles of the RDC2, LGUs and other concerned entities. The Regional Development Council 02 (RDC2) shall facilitate the development of the MOA for the implementation of the Cagayan Riverine Zone Development Framework Plan.

Financing the plan

The plan commands a considerable amount of financial support to realize the programs and projects in the Cagayan Riverine Zone Development Framework Plan. The initial cost in the implementation of the plan which primarily involves the implementation of urgent projects in the riverine area is estimated at P114.210 B. Given this huge required amount, funding of these projects can be sourced from the Official Development Assistance (ODA) with corresponding national and local government share.

The national government shall provide the necessary counterpart for projects needing ODA funds and shall allocate funding support to small and medium projects with region wide implementation. The local government units will finance projects that are local in nature and are encouraged to provide counterpart for other projects needing such. The breakdown and details of the urgent projects are shown in the Table 10.

Table 10. Urgent Projects for Implementation in Cagayan Riverine Zone

PROJECT/ACTIVITIES	FUNDING REQUIREMENT
I. Flood Mitigating Projects -	113,993.38M
A. Structural Projects -	112,726.96M
1. Conduct of Feasibility Studies for priority dams, dikes, bank protection and cut-off channels.	390.8 M
i. Matuno River Multi Purpose Project (Bambang, Nueva Vizcaya)	
ii. Tumauini River Multi Purpose Project (Tumauini, Isabela)	
iii. Siffu Dam Project (Roxas, Isabela)	
iv. Alimit Dam Project (Lamujt, Ifugao)	
v. Mallig Dam Project (Mallig, Isabela)	
vi. Kalipkip Irrigation Project (Cabagan, Isabela)	
vii. Sabo Dams (N. Vizcaya and Ifugao)	
viii. Dredging of the Cagayan River (Aparri to Lallo (Magapit) in Cagayan)	
ix. Cut-off-Channels within the lower Cagayan River (Lallo, Gattaran in Cagayan)	
2. Bank Protection Projects along the following critical areas (includes resettlement of affected families/houses)	P 1,678.76 M
a. Cagayan River (Tuguegarao City, Iguig, Amulung, Camalaniugan, Lallo, Alcala, Enrile, Gattaran and Solana in Cagayan Ilagagn, Angadanan, Cauayan, Cabagan, San Pablo, Echague, Jones and Sta. Maria in Isabela)	
b. Siffu River (Roxas, Isabela)	
c. Ilagan River (Ilagan, Isabela)	
d. Magat River (Solano, N. Vizcaya)	
e. Sta. Fe River (Sta Fe and Bambang, N. Vizcaya)	
f. Sta. Cruz River (Kayapa, N. Vizcaya)	
g. Apatan River (Dupax Del Norte, Nueva Vizcaya)	
h. Benay River (Dupax Del Sur, N. Vizcaya)	
3. Construction of Dams (Matuno, Tumanuini, Siffu, Mallig, Alimit and Kalipkip)	P 110,390 M

PROJECT/ACTIVITIES	FUNDING REQUIREMENT
4. Construction of SWIPs (Regionwide (27 Units)	P 241.9 M
5. Construction of Small farm Reservoirs (Regionwide 1,020 Units)	P 25.5 M
B. Non-Structural projects - - - - - - - - - - - - - - - - - -	P1,266.42 M
- Watershed Rehabilitation, Protection and Management	
a) Improvement of Flood Warning and Forecasting System (Regionwide)	P 267.0 M
b) Watershed protection and rehabilitation in Upper Magat and major tributaries (Regionwide)	P96.72 M
c) Desilting of waterways within the irrigation system service areas (Regionwide)	P 200.0 M
d) Sierra Madre Corridor Biodiversity Conservation and Water Resource Management Dev't. Project (Regionwide)	P 250.0 M
e) Progressive People's Forest Project - CEZA (Sta. Ana, Cagayan)	P 330.0 M
f) Soil Conservation, Reforestation and Development of Community Watershed (Regionwide)	P 122.7 M
II Other Sectoral Projects -	P216.78 M
1. Tourism Development - Development of Ecotourism Sites including Magat Tourism Dev't.	P 61.06 M
2. Fishery Development	P 147.7 M
3. Solid Waste Management	Cost will be determined by each LGU
4. Dredging of critical portions of the Cagayan River (Feasibility Study)	P 8.02 M
Total Funding Requirement of Urgent Projects - - - - - - - - - - - - - - - -	**P 114,210.16 M**

Monitoring and Evaluation

The implementation of the Plan shall be closely monitored through the assistance of the Provincial/City/Municipal Land Use Committees (P/C/MLUCs). Part of the implementing mechanism shall be a monitoring system that shall be established involving major/critical agencies such as the DENR, DA, BFAR, DPWH, DOTC and DTI. The Results Monitoring Evaluation (RME) System will be employed as much as possible in the monitoring process. Close coordination between RLUC, PLUCs and C/MCLUCs in the monitoring of the Plan implementation shall be established.

Plan Implementation Support

1. Plan Advocacy

The support of the local government units is crucial in the implementation of the Plan. Hence, involvement of the LGUs, from planning to implementation and monitoring and evaluation is mandatory. As a policy framework document, mainstreaming of the Riverine Plan in the different LGUs shall be a challenge in the implementation of the document.

Part of the commitment and support of the provinces, cities and concerned municipalities shall be the preparation of their respective Riverine Plan counterpart. Concerned LGUs shall formulate their respective riverine plans.

The conduct of provincial, city and municipal consultation shall be complemented by IEC activities. Printed materials (popularize the plan) will be distributed which will be augmented with radio and cable TV presentations in conjunction with the programs of the DILG.

2. Capability Building

The Regional Development Council (RDC2) and its member agencies and LGUs shall be technically capable in the different facets of riverine development. Ideally, the implementing structure shall be a well rounded and technically equipped body. Its members shall undergo series of capacity-building activities to have adequate exposure in riverine policy making and management.

Equally important shall be the conduct of field visits and exposure trips to existing or similar institutions for the sharing of experiences and practices.

3. Research and Technical Assistance

Regional Line Agencies (RLAs), State Universities and Colleges (SUCs) and other bodies will be regularly tapped to provide technical assistance in the conduct of researches and preparation of proposals in order to assure better projects and development activities in the Zone.

APPENDICES

Appendix I

Specific Policies on land and water utilization, protection and management:

- **P.D.1586: ESTABLISHING AN ENVIRONMENTAL IMPACT STATEMENT SYSTEM, INCLUDING OTHER ENVIRONMENTAL MANAGEMENT RELATED MEASURES AND FOR OTHER PURPOSES.**

  Environmental Impact Statements provides the establishment and institutionalization of a system whereby the exigencies of socio-economic undertakings can be reconciled with the requirements of environmental quality. It also caused for the declaration of certain projects, undertakings or areas in the country as environmentally critical. For this purpose, the proper land and water use pattern for the areas of said critical projects shall be prepared**.** The decree also declared the policy of the State to attain and maintain a rational and orderly balance between socio-economic growth and environmental protection. Specifically, to ensure the protection of river systems, aquifers and mangrove vegetations from pollution and environmental degradation:

- **R.A.No.7586: AN ACT PROVIDING FOR THE ESTABLISHMENT AND MANAGEMENT OF NATIONAL INTEGRATED PROTECTED AREAS SYSTEM, DEFINING ITS SCOPE AND COVERAGE, AND FOR OTHER PURPOSES**

  National Integrated Protected Areas System Act of 1992 recognizes the critical importance of protecting and maintaining the natural biological and physical diversities of the environment notably on areas with biologically unique features to sustain human life and development, as well as plant and animal life. In this regard, the State adopts the policy to establish a comprehensive system of integrated protected areas within the classification of national park as provided for by the Constitution for the purpose of securing perpetual existence of all native plants and animals for the present and future generations.

- **Department of Agriculture, Administrative Order No. 38 Series of 1999**

  Adoption of strategic Agriculture and Fishery Development Zones (SAFDZ) and the Network of Protected Areas for Agriculture and Agro-industrial Development (NPAAD) as the prime natural and economic resource endowments for the modernization of agriculture and fishery sectors in the Philippines and providing institutional mechanisms for their sustainable utilization, management and protection

- **P.D.1067: The Water Code of the Philippines**

  The 1976 Water Code of the Philippines adopts a basic law governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources and rights to land thereto. It provides that any watershed or any area of land adjacent to any surface water or overlaying any ground water may be declared as protected area. Rules and regulations may be promulgated to prohibit or control such activities by the owners or occupants thereof within the protected area which may damage or cause the deterioration of the surface water or groundwater or interfere with the investigation, use, control, protection, management or administrative of such waters.

- **PD 1152- Philippine Environmental Code**

  The Code prescribed the management guidelines aimed to protect and improve the quality of Philippine water resources through a) classification of Philippine Waters according to best usage, b) establish of water quality standards, c) protection and improvement of the quality and d) responsibilities for surveillance and mitigation of pollution incidents.

- **RA 6657 : Agrarian Reform Law**

  The law provides that no conversion of public agricultural lands into other uses except when the land will have greater economic value for residential, commercial and industrial purposes as determined by the local government units and concurred by concerned agencies that the Department of Agrarian Reform may authorized the reclassification or conversion and deposition of the land.

- **RA 8550: Fisheries Code**

  Provides for the conservation, protection and sustained management of the country's fishery and aquatic resources, the improvement of productivity of aquaculture within ecological limits

  Instructs the BFAR to coordinate with LGUs, FARMCs,a nd other government agencies in the development, conservation, protection, utilization and management of fisheries and aquatic resources.

  Mandates the LGUs to prohibit or limit fishery whenever it is determined by the LGU and the DA that a municipal water is overfished based on available data or information or in danger of being overfished, and that there is a need to regenerate the fishery resources in that water, the LGU shall prohibit or limit fishery activity in the said waters.

  Stipulates that not over ten percent (10%) of the suitable water surface; area of all lakes and rivers shall be allotted for aquaculture purposes like fish pens, fish cages and fish traps; and the stocking density and feeding requirement which shall he controlled and determined by its carrying capacity:

- **REPUBLIC ACT NO. 8435: AGRICULTURE AND FISHERIES MODERNIZATION ACT OF 1997**

  States that development should be compatible with the preservation of the ecosystem in areas where agriculture and fisheries activities are carried out. The State should exert care and judicious use of the country's natural resources in order to attain long-term sustainability

- **RA 7160: Local Government Code 1991**

  Local Government Code of 1991 states that a city or municipality may classify agricultural lands provided that there exists an approved zoning ordinance implementing its comprehensive land use plan and provided that it is within the limits prescribed thereof. It is further stated that agricultural lands maybe classified if it cease to be economically feasible and sound agricultural purposes or when the land shall have substantially greater economic values for residential, commercial and industrial purposes. Agricultural lands may be reclassified in excess of the limits for food production, human settlements, ecological

considerations, and other relevant factors in the city or municipality. Cities and municipalities are also mandated to prepare and update their respective comprehensive land use plans enacted through zoning ordinances which shall be the basis for use of their resources and reclassification of agricultural lands.

- **Republic Act No. 8041: Water Crisis Act of 1995**

  Declared the policy of the State to adopt urgent and effective measures to address the nationwide water crisis which adversely allocate the health and well-being of the population, food production and industrialization process and that issues relevant to the water crisis including, but not limited to, supply , distribution , finance , privatization of state-run water facilities, the protection and conservation of watersheds and the waste and pilferage of water, should be addressed

- **R.A. NO. 9003: An Act Providing for an ecological Solid Waste Management Program, Creating the Necessary Institutional Mechanisms and Incentives, Declaring Certain acts Prohibited and Providing Penalties, Appropriating Funds Thereof, and for Other Purpose.**

  This is an act enforcing local government units to properly manage their solid waste disposal. A system of segregation and collection of solid waste shall be established by the LGU from the barangay level. Proper disposal of disposable waste should also be done by establishing sanitary landfills.

Appendix II.

List of threatened species recorded in region 02. (Source: Conservation International Philippines, DENR-PAWB and Haribon Foundation. 2006. Priority Sites for Conservation in the Philippines: KBAs. Quezon City, Philippines, 24 pp). Threat status and endemicity is based on IUCN 2006 Red List of Threatened Species.

Scientific Name	Common Name	IUCN	Endemicity
Crocodylus mindorensis	Philippine Crocodile	CR	E
Crunomys fallax	Northern Luzon Shrew Mouse	CR	E
Pithecophaga jefferyi	Philippine Eagle	CR	E
Acerodon jubatus	Golden-crowned Fruit-Bat	EN	E
Ciconia boyciana	Oriental Stork	EN	
Oriolus isabellae	Isabela Oriole	EN	E
Pelochelys cantorii	Cantor's Soft-shelled Turtle	EN	
Platymantis cagayanensis	Cagayan Forest Frog	EN	E
Platymantis pollilensis	Polillo Forest Frog	EN	E
Platymantis taylori	Taylor's Forest Frog	EN	E
Pteropus leucopterus	Mottle-winged Flying Fox	EN	E
Anas luzonica	Philippine Duck	VU	E
Bubo philippensis	Philippine Eagle-owl	VU	E
Ceyx melanurus	Philippine Dwarf Kingfisher	VU	E
Chrotomys whiteheadi	Luzon Striped Shrew Rat	VU	E
Crocidura grayi	Fawn-colored roundleaf bat	VU	E
Ducula carola	Spotted Imperial-pigeon	VU	
Erythrura viridifacies	Green-faced Parrotfinch	VU	E
Haplonycteris fischeri	Philippine Pygmy Fruit Bat	VU	E
Harpyionycteris whiteheadi	Harpy Fruit Bat	VU	
Hypothymis coelestis	Celestial Blue Monarch	VU	E
Kaloula kalingensis	Kalinga Narrow-mouthed Toad	VU	E
Kaloula rigida	Luzon Narrow-mouthed Toad	VU	E
Muscicapa randi	Ashy-breasted Flycatcher	VU	
Otopteropus cartilagonodus	Luzon Pygmy Fruit Bat	VU	E
Pitta kochi	Whiskered Pitta	VU	E
Platymantis pygmaeus	Pygmy Forest Frog	VU	E
Platymantis sierramadrensis	Sierra Madre Forest Frog	VU	E
Prioniturus luconensis	Green Racquet-tail	VU	E
Ptilinopus marchei	Flame-breasted Fruit-dove	VU	E
Rana tipanan	Brown and Alcala's Sierra Madre Frog	VU	E
Rhacophorus bimaculatus		VU	
Rhinolophus subrufus	Small Rufous Horseshoe Bat	VU	E

Continuation of Appendix II.

Scientific Name	Common Name	IUCN	Endemicity
Rhinomyias insignis	White-browed Jungle-flycatcher	VU	E
Rhyacornis bicolor	Luzon Water-redstart	VU	E
Spizaetus philippensis	Philippine Hawk-eagle	VU	E
Sus philippensis	Philippine Warty Pig	VU	E
Varanus olivaceus	Monitor Lizard	VU	E
Zoothera cinerea	Ashy Ground Thrush	VU	E
Flora			
Scientific Name	Common Name	IUCN	
Dipterocarpus gracilis	Panau	CR	NE
Dipterocarpus grandiflorus	Apitong	CR	NE
Dipterocarpus hasselti		CR	?
Dipterocarpus kerrii	Malapanau	CR	NE
Dipterocarpus kunstleri		CR	NE
Dipterocarpus validus	Hagakhak	CR	NE
Hopea acuminata	Manggchapui/Dalingdingan	CR	E
Hopea cagayanensis		CR	E
Hopea malibato	Broad-winged Apitong	CR	E
Hopea plagata	Saplungan	CR	NE
Parashorea malaanonan		CR	
Shorea contorta	White Lauan	CR	E
Shorea guiso	Guijo	CR	
Shorea malibato		CR	E
Shorea negrosensis	Red Lauan	CR	E
Shorea palosapis	Mayapis	CR	E
Shorea polysperma	Tanguile	CR	E
Vatica pachyphylla		CR	E
Gloeocarpus patentivalvis	Tamaho	EN	E
Guioa discolor		EN	E
Guioa myriadenia		EN	E
Mangifera monandra	_	EN	E
Vatica mangachapoi	Narig	EN	NE
Agathis philippensis	Almaciga	VU	?
Aglaia aherniana	Alamag	VU	E
Aglaia pyriformis	Panining-peneras	VU	E
Alangium longiflorum		VU	NE
Dillenia philippinensis	Katmon	VU	E
Dillenia reifferscheidtia (D. reifferscheidia [?])	Katmon Kalabau	VU	E
Diospyros blancoi		VU	E
Diplodiscus paniculatus	Balobo	VU	E
Ficus ulmifolia	Is-is	VU	E
Guioa bicolor	Kaninging	VU	E
Lithocarpus ovalis		VU	E
Macaranga caudatifolia		VU	E
Mangifera altissima	Pahutan	VU	NE

Appendix III. Checklist of water birds recorded along Cagayan River. This is adopted from Weerd and Ploeg 2004.

Species	Status[1]	Cagayan river delta		Malasi lakes		Lake Magat		Buguey wetlands	Linao swamp	Total	
		Nov 2001	Jan 2002	Nov 2001	Jan 2002	Nov 2001	Jan 2002	Jan 2002	Jan 2002	Nov 2001	Jan 2002
LITTLE GREBE *Tachybaptus ruficollis*	R			25	42					25	42
GREY HERON *Ardea cinerea*	M	2	6	1	2	1			16	4	24
PURPLE HERON *Ardea purpurea*	R	1	2	1	1	5		2	7	7	12
GREAT EGRET *Casmerodius albus*	M	7	6	7	3	220	208	11	52	234	280
PACIFIC REEF EGRET *Egretta sacra*	R	1								1	0
INTERMEDIATE EGRET *Mesophoyx intermedia*	M	9	2	11		2		1	49	22	52
CHINESE EGRET *Egretta eulophotes*	VU, M	1								1	0
LITTLE EGRET *Egretta garzetta*	M	15	2	1		102	71	3	17	118	93
LITTLE HERON *Butorides striatus*	R					1		2		1	1
CATTLE EGRET *Bubulcus ibis*	R	14	1	20					51	34	52
CINNAMON BITTERN *Ixobrychus cinnamomeus*	R					5			1	5	1
YELLOW BITTERN *Ixobrychus sinensis*	R	1				9			4	10	4
BLACK BITTERN *Dupetor flavicollis*	R	1								1	0
WANDERING WHISTLING-DUCK *Dendrocygna arcuata*	R			1,228	3,050					1,228	3,050
RUDDY SHELDUCK *Tadorna ferruginea*	M					1				1	0
NORTHERN PINTAIL *Anas acuta*	M			30	21	1	1		500	31	522
PHILIPPINE DUCK *Anas luzonica*	VU, R		16	1,200	1,320	2,000	610		34	3,200	1,980
EURASIAN WIGEON *Anas penelope*	M			2	46					2	46
GARGANEY *Anas querquedula*	M			260	100	30	243			290	343
NORTHERN SHOVELER *Anas clypeata*	M	4		1,320	1,920	10	278		1	1,334	2,199

Continuation of Appendix III

Species	Status[1]	Cagayan river delta		Malasi lakes		Lake Magat		Buguey wetlands	Linao swamp	Total	
		Nov 2001	Jan 2002	Nov 2001	Jan 2002	Nov 2001	Jan 2002	Jan 2002	Jan 2002	Nov 2001	Jan 2002
TUFTED DUCK *Aythya fuligula*	M	20	80	71	32	1			4	92	116
UNIDENTIFIED DUCKS									10,000	0	10,000
OSPREY *Pandion haliaetus*	M	1		1		2	1			4	1
WHITE-BELLIED SEA EAGLE *Haliaeetus leucogaster*	R		2							0	2
EURASIAN MARSH HARRIER *Circus aeruginosus*	M			1	2					1	2
PIED HARRIER *Circus melanoleucos*	R		1	2						2	1
SLATY-BREASTED RAIL *Gallirallus striatus*	R					1				1	0
BARRED RAIL *Gallirallus torquatus*	R					1				1	0
WHITE-BREASTED WATERHEN *Amaurornis phoenicurus*	R					2				2	0
COMMON MOORHEN *Gallinula chloropus*	R		1	2	41					2	42
COMMON COOT *Fulica atra*	M				15					0	15
GREY PLOVER *Pluvialis squatarola*	M	1						17		1	17
PACIFIC GOLDEN PLOVER *Pluvialis fulva*	M								192	0	192
LITTLE RINGED PLOVER *Charadrius dubius*	R			5						5	0
KENTISH PLOVER *Charadrius alexandrinus*	M	254	341					360		254	701
MALAYSIAN PLOVER *Charadrius peronii*	NT, R	1								1	0
LESSER SAND PLOVER *Charadrius mongolus*	M	251						1		251	1
GREATER SAND PLOVER *Charadrius leschenaultii*	M	3						17		3	17
EURASIAN CURLEW *Numenius arquata*	M	9						3		9	3
WHIMBREL *Numenius phaeopus*	M							1		0	1
COMMON GREENSHANK *Tringa nebularia*	M	22	73	2				3		24	76
COMMON SANDPIPER *Actitis hypoleucos*	M	3	1	4						7	1
WOOD SANDPIPER *Tringa glareola*	M			1					6	1	6
MARSH SANDPIPER *Tringa stagnatilis*	M	4							70	4	70
RUDDY TURNSTONE *Arenaria interpres*	M							90		0	90

Continuation of Appendix II

Species	Status[1]	Cagayan river delta		Malasi lakes		Lake Magat		Buguey wetlands	Linao swamp	Total	
		Nov 2001	Jan 2002	Nov 2001	Jan 2002	Nov 2001	Jan 2002	Jan 2002	Jan 2002	Nov 2001	Jan 2002
UNIDENTIFIED SNIPE *Gallinago* sp.	M	8							4	8	4
RED-NECKED STINT *Calidris ruficollis*	M	3								3	0
CURLEW SANDPIPER *Calidris ferruginea*	M	6								6	0
DUNLIN *Calidris alpina*	M	17	2							17	2
UNIDENTIFIED WADERS			125							0	125
BLACK-HEADED GULL *Larus ridibundus*	M		8			3		20		3	28
COMMON KINGFISHER *Alcedo atthis*	M	2	1			4		1	2	6	4
WHITE-THROATED KINGFISHER *Halcyon smyrnensis*	R					2				2	0
COLLARED KINGFISHER *Todiramphus chloris*	R	2						4		2	4
ORIENTAL REED WARBLER *Acrocephalus orientalis*	M	21								21	0
Total no. individuals		684	670	4,195	6,595	2,403	1,412	535	11,010	7,282	20,222
Total no. species	53	29	18	22	14	21	7	16	18	48	40

[1]NT = Near Threatened, VU = Vulnerable (BirdLife International 2001); M = Migrant, R = Resident (Kennedy *et al.* 2000)