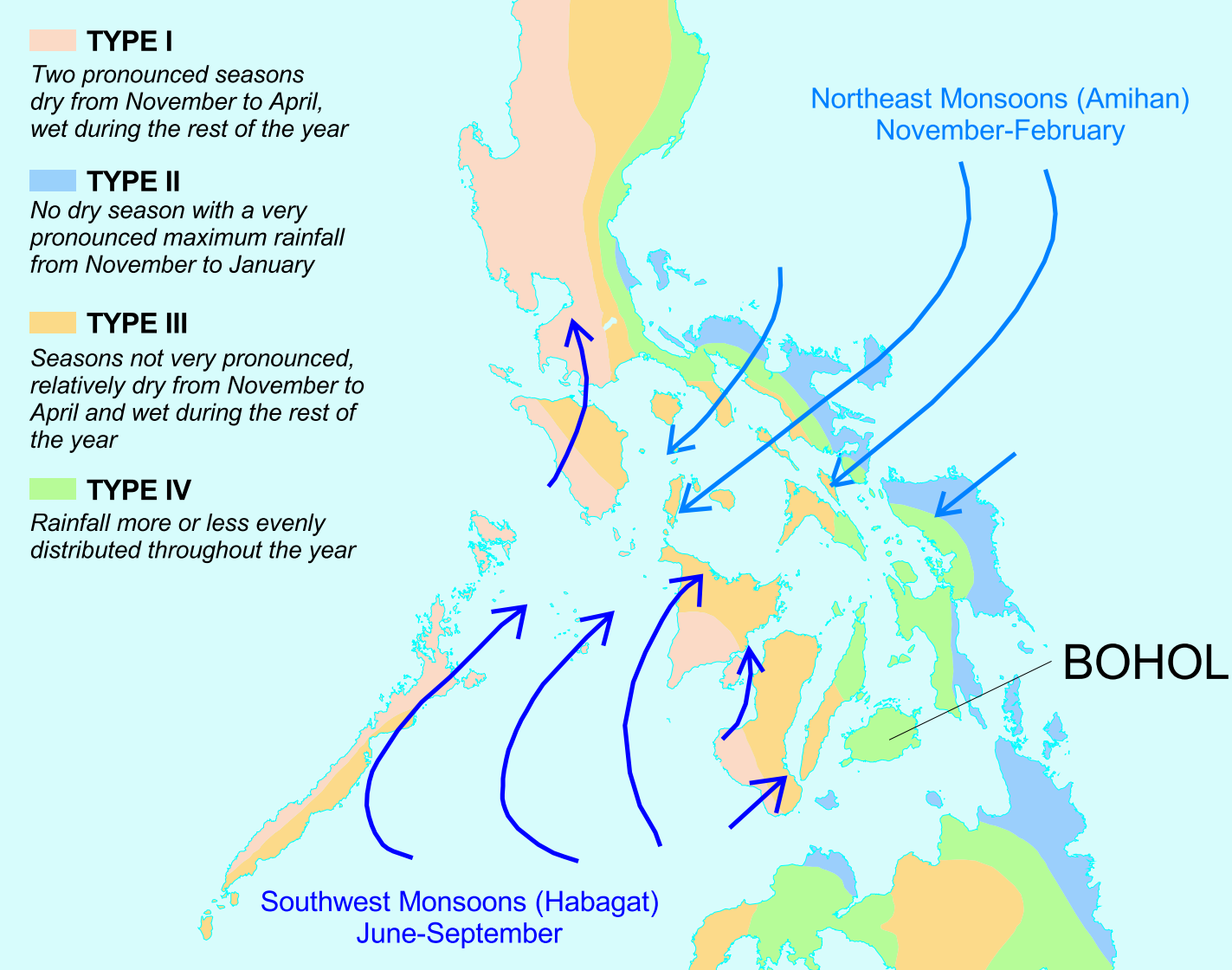


DATA DEVELOPMENT FOR WATERSHED COUNCILS

Carood Watershed, Bohol

PHILIPPINE CLIMATE



BOHOL

Watershed Councils

Watershed councils are developing in many parts of the Philippines today primarily because water is a resource that is under threat from over extraction, quality loss, and extreme fluctuations. Water resources increasingly need comprehensive management in order to sustain basic services, agriculture, and industry. The management of water resource cannot be done according to political boundaries as compared to water distribution. It needs to relate to the flow of the water within the catchment area or watershed. A watershed is seen as a coherent unit where all management activities must be coordinated not just in terms of water but land management. Municipalities sharing the same watershed are therefore realising that they must work together for the sustainability of resources, the accomplishment of the basic needs, and the reinforcement of protection of ecological services.

Carood Watershed is comprised of six municipalities that have their own resource management plans though within the same watershed management unit.

Information is being gathered from different government sources and integrated to give an initial water budget for the area. Local government is drawing on this knowledge of the local environment to engage more effectively in the long-term management of the resources in addressing social and environmental concerns.

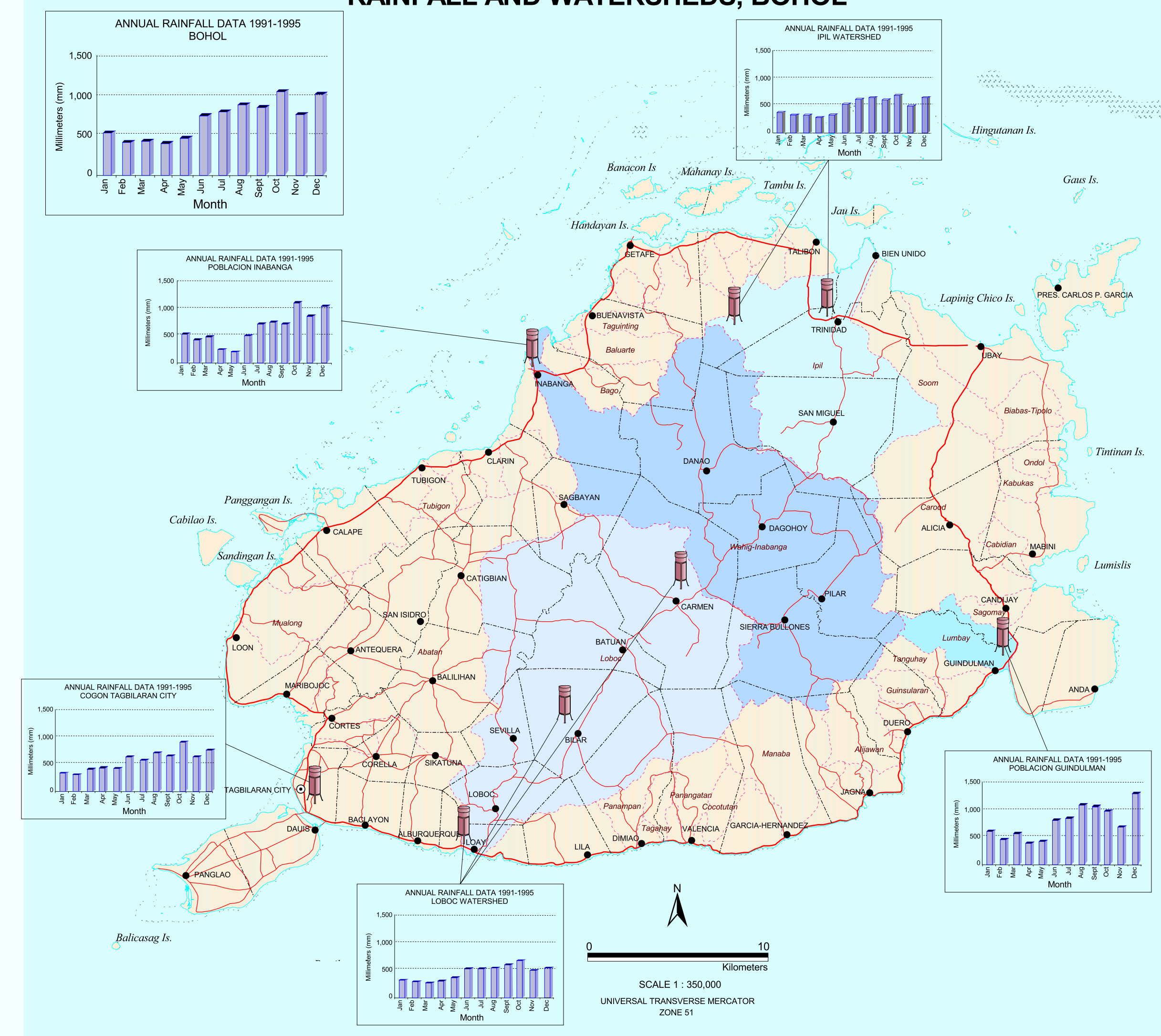
Data Development

The basic high-school knowledge of Philippine Climate gives the context for understanding the more detailed rainfall data gathered in Bohol over the years by different institutions. This data is in turn related to the different watersheds. What affects

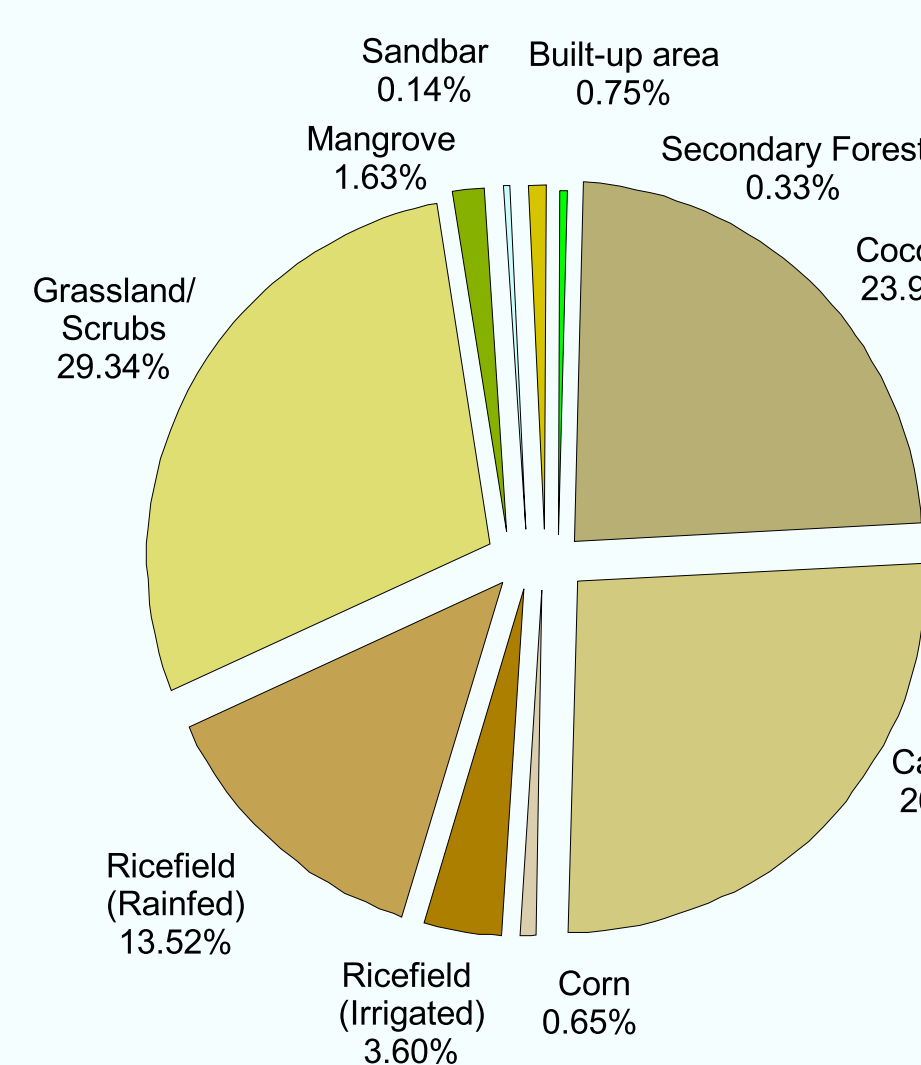
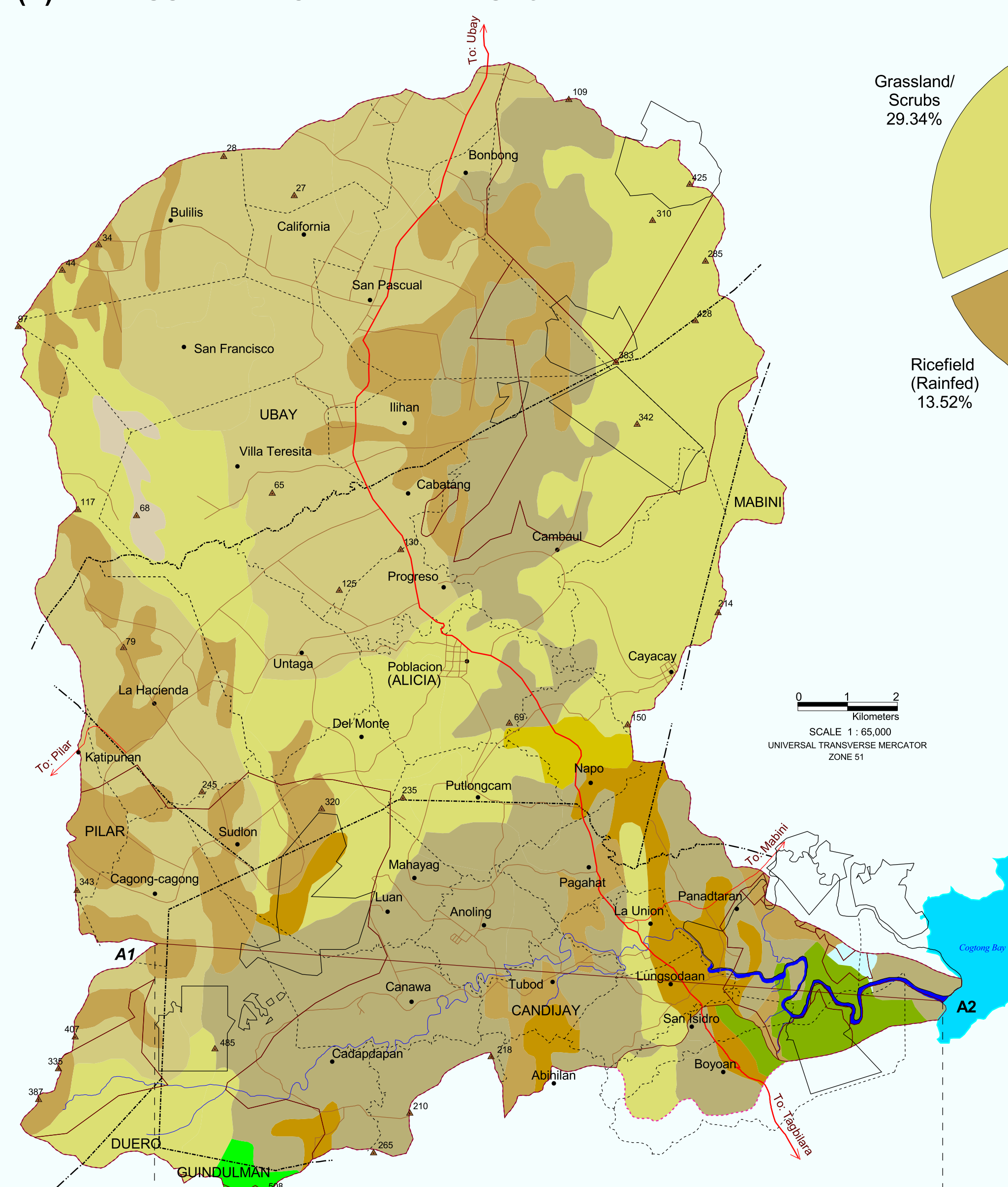
the impact of the rainfall in a watershed is the land cover. In order to illustrate this, the rainfall pattern of Carood is established by the participation of the small group of community people over the last two years and is being related to their land use.

The rainfall distribution is echoed in the Remote Sensing image that shows general cloud distribution in the approximate areas of highest rainfall. Discharge has been established through analysis of data gathered from the Gabayan River by the Bureau of Research and Standards and extrapolate it for the rest of the watershed. The projected evapotranspiration rates can also be related to the general land use pattern. In this way, the different elements of drawing up an initial budget give an indicative understanding of the hydrological dynamics within the watershed. This in turn, raises many questions about the value of gathering better data analysis and many further points for local government consideration and action.

RAINFALL AND WATERSHEDS, BOHOL



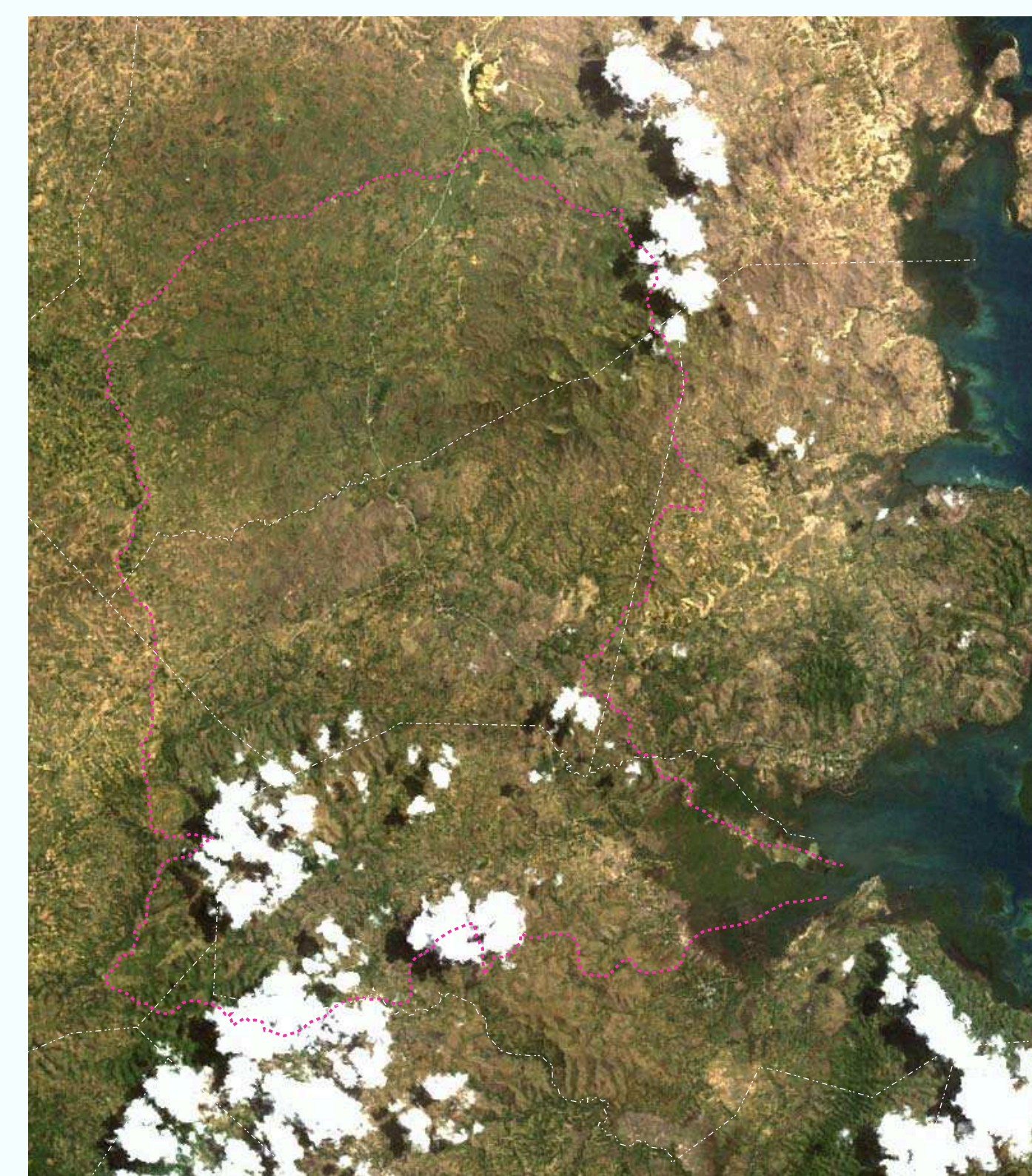
(A) LAND USE MANAGEMENT TRANSECT



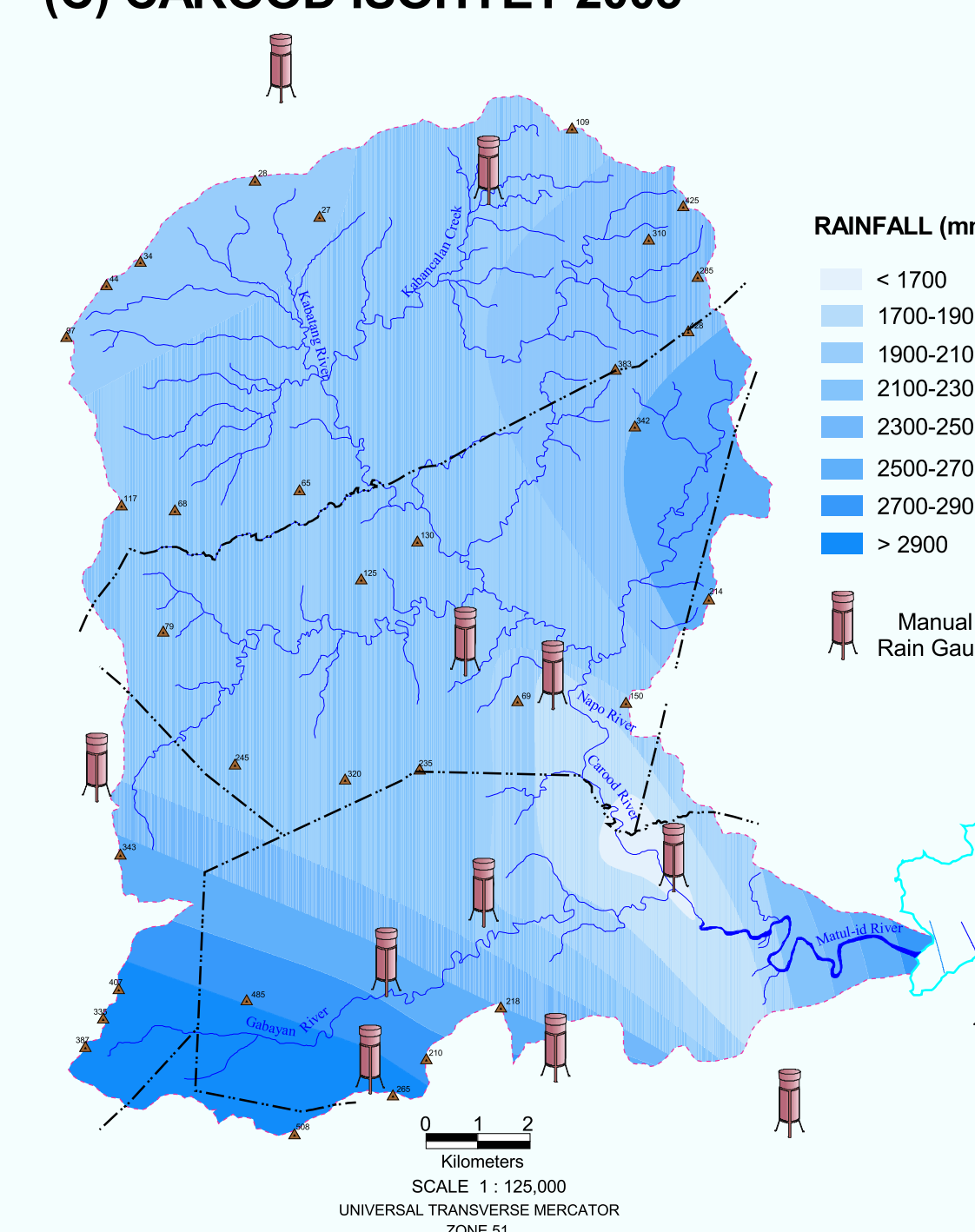
LEGEND:

- CBFM AREA (DENR-BOHOL 2002)
- CIVIL RESERVATION (DENR 2002)
- WATERSHED DIVIDE
- MUNICIPAL BOUNDARY
- BARANGAY BOUNDARY
- NATIONAL ROAD
- PROVINCIAL ROAD
- MUNICIPAL/BARANGAY ROAD
- RIVER/CREEK
- COASTLINE
- CORAL REEF
- TRIG POINTS (m)
- PROVINCIAL CAPITAL
- MUNICIPALITY
- BARANGAY

(B) CAROOD LANDSAT IMAGE JUNE 1992



(C) CAROOD ISOHYET 2003



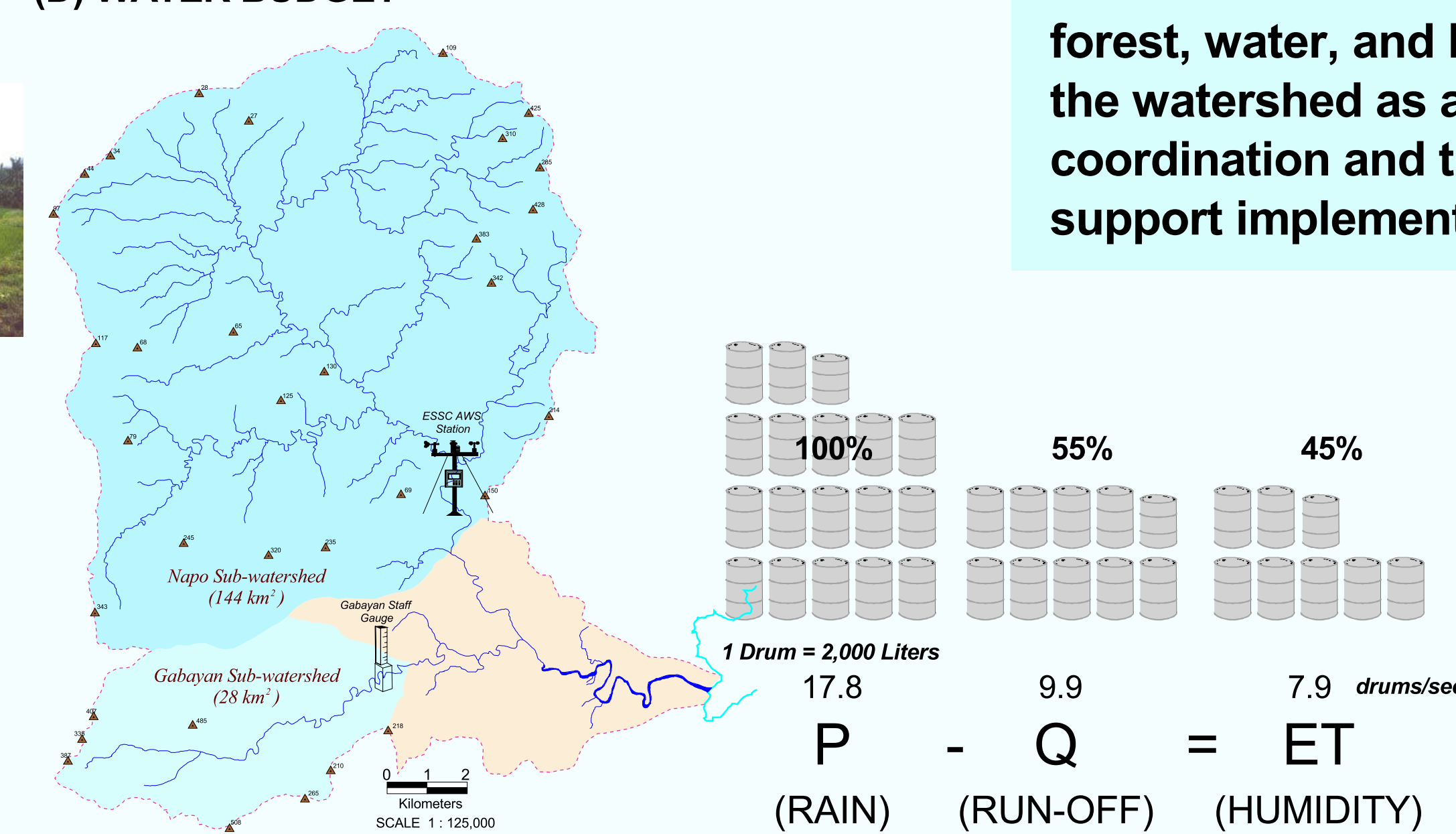
This land use map and management transect (A) is drawn from earlier datasets that need to be updated by a classification derived from the recent remote sensing image (B) so that there is a much greater coherence between mapping datasets and actual land use for further planning.

The transect gives a simple cut of the basic landscape and emerging strategies. It also needs to take into consideration not only slope but the rates of precipitation, infiltration, evapotranspiration, and runoff; there are going to be different rates for each vegetation type and slope.

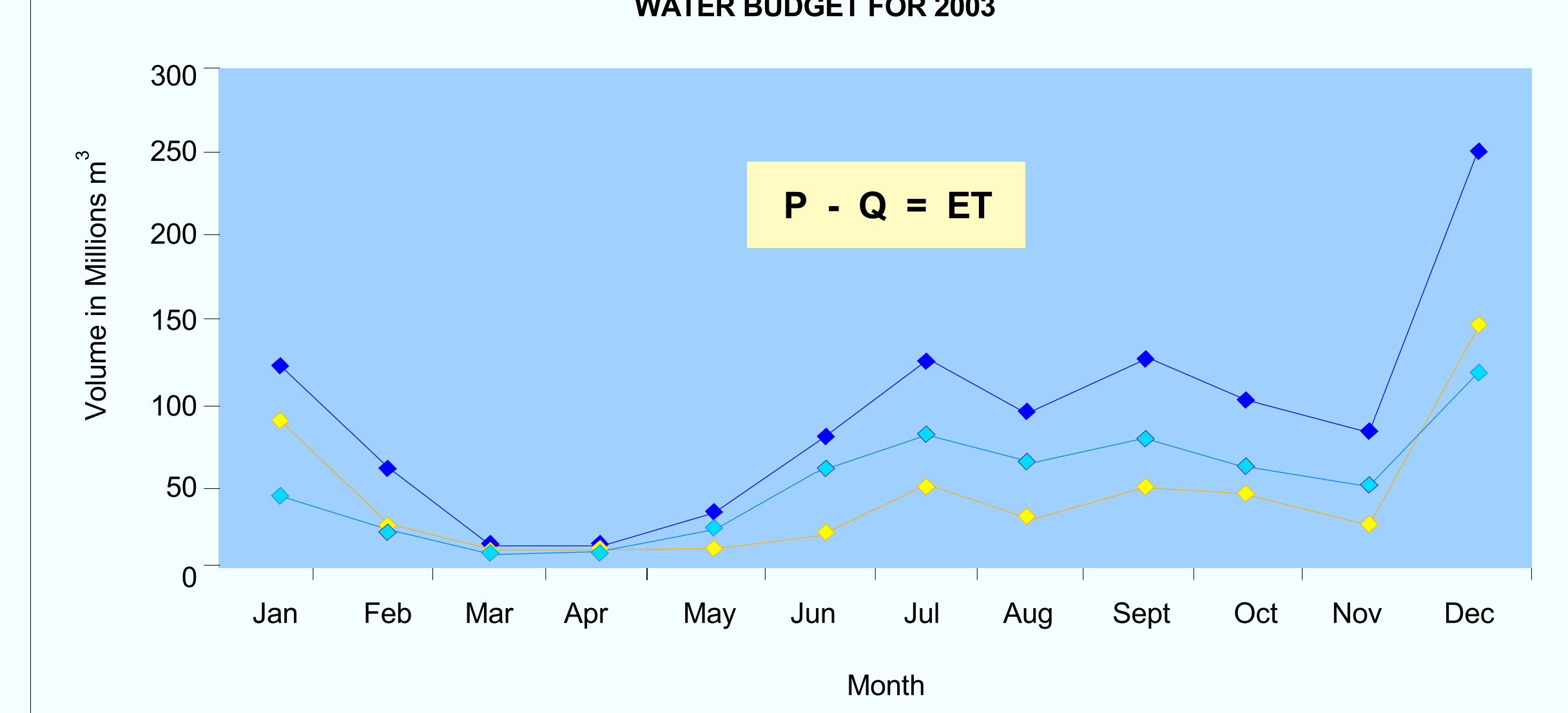
The Isohyet Map (C) provides the illustration of rainfall distribution in the watershed where greater precipitation is found in higher elevation and near coast areas. This also provides input in calculating water budget in the area.

The water budget (D) is roughly calculated using the percentage proportion between P and Q in the lower sub-catchment and rainfall that occurs within and nearby watersheds. However, vegetation, topography and slope, and soil elements are not considered in this initial calculation.

(D) WATER BUDGET



WATER BUDGET FOR 2003



Observations

- Discharge follows within 50 - 70% of rainfall, the rest is accounted for as evapotranspiration.
- During the dry months, March and April, Q is very close with P levels and can be even greater than P levels due to water accumulated in the preceding wetter months.
- Moisture built-up during rainy season is critical in maintaining levels of soil moisture during the dry month. This is best done by uncompacted soil with permanent dense cover naturally accomplished by forests.
- With exposed soils when there is no seepage from neighboring forestland and high levels of surface evaporation and transpiration from crops, wilting of the crops can often result if not, loss of the entire crop.
- During the rainy season, if there are no naturally hold drainage patterns both within the soil and by the surface vegetation, flood waters may carry with them both the soil and debris that make for a more catastrophic outcome that might otherwise occur.

Now that we have this general picture of the interrelationships of land, forest, water, and human interaction, there is the basis for actualising the watershed as a management unit along with the line agency coordination and the political will of the local government to support implementation, monitoring and evaluation.

FIGURES AND FACTS:

Bohol Province

Area: 411,726 ha
Population: 1,137,268
No. of municipalities: 47 + 1 city
Population: 1,137,263
Driest month: April, 408.3 mm
Wettest month: October, 1,083.9 mm
Annual rainfall: 1,708.1 mm
No. of major watersheds: 12

Priority watersheds for protection (BEMO):

Loboc 64,914 ha
Wahig-Inabanga 63,855 ha
Abatan 36,626 ha
Ipil 28,252 ha
Cabidian and Matul-id (Carood) 22,060 ha
Duero (Alijawan-Cansuhay Watershed) 5,200 ha

Water resources management development concerns:

Non-systematic approach to water resource management
Water crisis due to inefficiency of essential water infrastructure facilities
Continued pollution and exhaustion of water tables and permanent destruction of the valuable aquifers
No karst landscape management program
Few major water conservation agricultural areas
Few urban water conservation program

Carood Watershed

Area: 20,479 ha, rank 5th
No. of municipalities: 6
Population: approximately 60,000 households
Extent of River: 40.52 km
Driest month: March, 343.9 mm
Wettest month: December, 7,005.5 mm
Annual rainfall: 2,318.1 mm
Municipalities:

Municipality	Area (ha)	% Municipal (in a Watershed)	% Watershed (in a Municipality)
Alicia	6,921	37	33
Candijay	10,772	50	26
Gundulman	9,840	2	1
Mabini	9,307	2	1
Pilar	9,908	12	6
Ubay	29,896	23	33

Resource base concerns:

No integration of water resource management in Carood
Seasonal flooding (approximately 3,000 ha) and unregulated extraction of sand and gravel (10 km along riverbanks)
Improper waste disposal (affected area for water quality and quantity approx. 1,000 ha)
Unknown impact on water resource of developing oil palm plantations (50 ha)
Lack of empowerment in areas for community Natural Resource Management areas (2,616 ha) and forest plantation fires (716+ ha)
Extensive unproductive land use (within range of 10,000 ha)
Limited data available on land use
Extreme areas of soil erosion and siltation in many river banks
Illegal fishing practices (2,000 ha of coral reef in Coglong Bay)

Acknowledgments:

Local Government Units of Alicia, Candijay, Guindulman, Mabini, Pilar, and Ubay and PO representatives of Alicia Federated Tree Planters Association, Inc. (AFTPA), Boyan Mangrove Association (BOMA), Municipal Agriculture and Fisheries Council (MAFC), Mabini Reforestation Association, Inc. (MRAI), San Jose United Fisherman's Association (SANUFASS), and Ubay Federated Tree Planters Association, Inc. (UFTPA).
Rain gauge observers: Marciano Cordua, Asterio Maglana (Katiunan, Alicia);

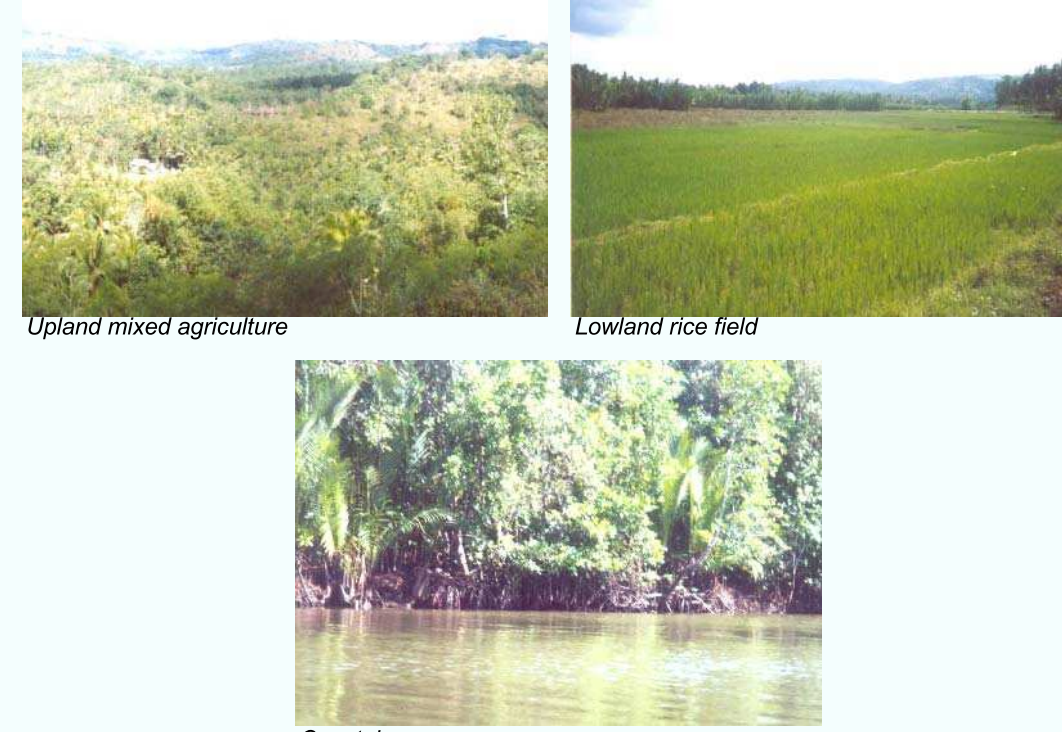
Godelia C. Lumogdang, Hipolita Ayuban (Poblacion, Alicia); Quinceo Ayuban Jr., Ofelia B. Sulthen (Napo, Alicia, including AWS); Emmanuel Hirampas, Mading Lacaran (Anoling, Candijay); Bryg. Capt. Bienvenido C. Buscano (Panadtaran, Candijay); Cipriano Pirocho (Cansuwa, Candijay); William B. Palma (Cadiapapan, Candijay); Segundino A. Palma Sr. (Abihilan, Candijay); Francisco S. Berin Jr. (Poblacion, Candijay); Josea Glendira (Coglong, Candijay); Cecilia M. Golemano, Amancia Medillin (BES-Gabi, Ubay); and Nestor M. Pamulaktakin Sr. (Bongbong, Ubay).

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Carood Rainfall Data, 2003
Bohol Environmental Code of 1998, CY 2004-2009
The Environment Sector. Draft October 2003.
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ESSC (no.). Dialogue: A Component of the Water Resource

Regeneration through Environmental Governance (NWRREG) Program, Internal Document.
ESSC (no.). Draft Concept Paper of the Proposed Carood Watershed Management Council, Internal Document.
National Statistics Office. Census 2000
UMA Environmental (1996). Watershed Action Guide: A Practical Guide for Building Partnerships, Projects and Processes for a Sustainable Watershed. UMA Engineering, Canada.

Land use	Mixed Agriculture (Coconut, Cassava, and Corn)	Rice fields (Irrigated and Rainfed) Grassland and Scrubs	Mangrove
Management Problems	Poor soil condition Soil erosion Less crop variety Land use data quality Contract reforestation projects that did not work	Seasonal flooding Salination Soil erosion Inappropriate land use	Unclear tenure Siltation Not viable mud-crab production Illegal fishing practices
Management Opportunities and Institutional Strategies	Inter-municipal engagement (CWMC) CBFMA CSC ISF Communal Irrigation System Contour farming Agro-forestry	Inter-municipal engagement (CWMC, CLEC) CSC Organic fertilizer use Integrated Pest Management	Inter-municipal engagement (CWMC, CLEC) CBFMA CSC Emerging ecotourism
Slope	> 18%	3 -18%	< 3%



Acronyms:

CBFMA - Community-Based Forest Management Agreement
CLEC - Coastal Law Enforcement Council
CWMC - Carood Watershed Management Council
CSC - Certificate of Stewardship Contract
ISF - Integrated Social Forestry

SOURCES:

ESSC Watersheds of Bohol 1999
Bohol Environmental Management Office (BEMO) Natural Resources Database of Bohol 2000
DENR-CENRO Tagbilaran and Talibon CBFM data as of 2003
BOHOL RAINFALL DATA, Philippine Atmospheric, Geophysical and Astronomical Administration; National Irrigation Administration
LAND USE: Bureau of Soil and Water Management Central Visayas
Present Land Use/Vegetation Map 1993, 1:250,000
CAROOD IMAGE: S0022000 LANDSAT - ETM BOHOL
SATELLITE IMAGE
ISOHYET MAP: ESSC Manual Rain Gauge 2003
BASE MAP: National Mapping and Resource Information Authority, Topographic Map 150/200, Sheet Nos. 3849-1, 3849-2, 3849-3, 3849-4, 3850-2, 3850-3
PHILIPPINE CLIMATE MAP: HYDON Publishing 2002
Scale 1:2,241,000, Polyconic Projection

PREPARED BY:

ENVIRONMENTAL SCIENCE FOR SOCIAL CHANGE
2/F Calaveras Building, Graham Ave
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