HELP Davao Network:

A PLATFORM FOR MANAGING THE WATER-FOOD NEXUS IN SOUTHERN PHILIPPINES

Presented under the session on

Theme 3: Platform for strengthening collaboration between water and agriculture fields.

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Corporate Secretary, HELP Davao Network

Regional Director, Department of Science and Technology XI

Davao City, Philippines

TALKING POINTS

- Introduction
- Agriculture in Mindanao
- Water-Related Problems in Agriculture
- HELP Davao Network
- Way Forward: How HELP can help in Managing the Water-Food Nexus in Mindanao

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Hydrology for Environment, Life, and Policy

The Philippines

- **An archipelagic Southeast Asian nation of approx. 106M Filipinos (2017)**

- **Is generally blessed with abundant water resources:**
  - **Has 18 major river basins**
  - **Has 421 principal river basins**
  - **Has 72 natural lakes**
  - **Has coastlines stretching to 266,000 sq. km**

Dependable surface water supply:
125,790 MCM/year

Groundwater potential:
around 20,200 MCM/year


Laguna Lake

Davao River


Maria Cristina Falls

Water Resources in the Philippines and Mindanao

Philippines enjoys abundant water resources:

- Has 18 major river basins
- Has 421 principal river basins
- Has 79 natural lakes
- Has coastlines stretching to 17,460 km

18 Major River Basins	
1.	Cagayan River Basin
2.	Mindanao River Basin
3.	Agusan River Basin
4.	Pampanga River Basin
5.	Agno River Basin
6.	Abra River Basin
7.	Pasig-Laguna River Basin
8.	Bicol River Basin
9.	Abulug River Basin
10.	Saug-Libuganon River Basin
11.	Ilog-Hilabangan River Basin
12.	Panay River Basin
13.	Tagoloan River Basin
14.	Agus River Basin
15.	Davao River Basin
16.	Cagayan De Oro River Basin
17.	Jalaur River Basin
18.	Buayan-Malungon River Basin

Surface water is the main water source and an important resource for fishing, agriculture, transport and manufacture.

Groundwater is important for domestic and drinking use.

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Davao City :

A City of 8 Watersheds

Watershed	Area in Davao City (Has)	No. of Brgys.
1. Davao River	121,385	113
2. Lasang River	29,132	8
3. Talomo River	21,578	26
4. Bunawan River	18,328	21
5. Tuganay River	18,120	2
6. Lipadas River	16,796	19
7. Sibulan River	10,782	5
8. Matina River	7,879	10
TOTAL	244,000	204

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Water Resources in Davao Region

85.7% of the total water supply comes from surface water and only 14.3% comes from ground water.

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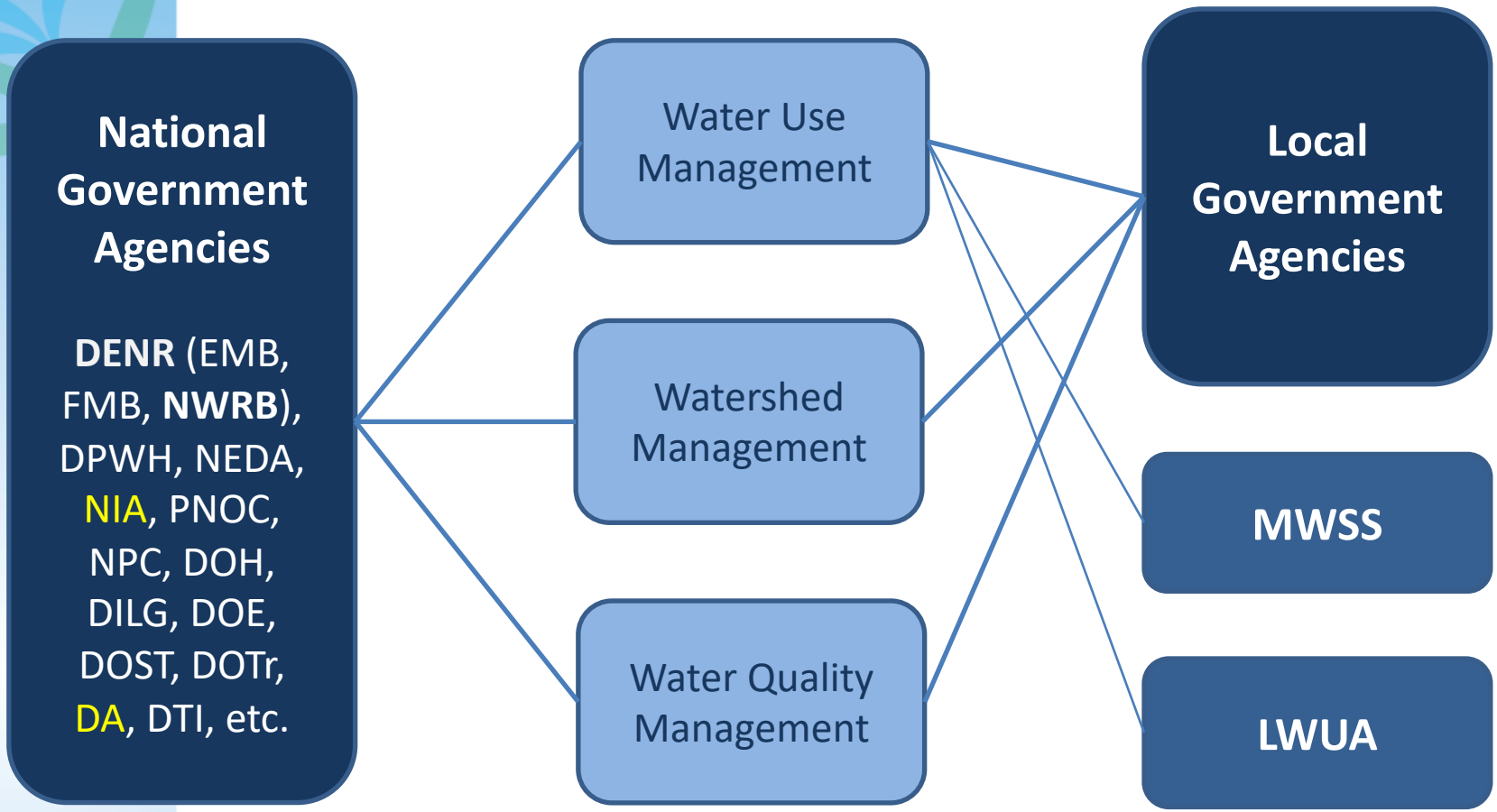
Water Management in the Philippines:

A two-tier system between the national and local government agencies



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National Legislations on Conservation of Water Resources:

Conservation of Water Quality
PD 9275 Clean Water Act of 20014

→ **Objective**: to protect, abate and control pollution of water, air, and land for more effective utilization of resources

DAO 35 (1990) Revised Effluent Regulation

→ **Objective**: rules and regulations shall apply to all industrial and municipal wastewater effluents

DAO 34 Revised Water Usage and Classification Water Quality Criteria

→ **Objective**: Shall classify all bodies of water and comply with the water quality criteria

Conservation and Protection of Laguna Lake

→ **Objective**: to promote and accelerate the development of balanced growth of Laguna Lake Area

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National Legislations on Conservation of Water Resources

Marine Water Resources Protection
PD 979 Marine Pollution Decree of 1976

→ **Objective**: To control pollution discharge from ships

Conservation of Water Resources ownership, development and exploitation
PD 106 Water Code

→ **Objective**: consolidate legislation relating to ownership, development, exploration, and conservation of water resources

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Davao City Ordinances on Water

Davao City Water Code of 2001 → **Objective**: identifies the recharge zone, aquifer and conservation areas that need to be protected and institutionalize a multisectoral body called the **Watershed Management Council** to implement the said code

Marine Protected Ordinance of 2007 → **Objective**: Establishment and management of Davao City Marine Protected areas

Comprehensive Fisheries Ordinance → **Objective**: Promote sustainable development, conservation and management of the fisheries and aquatic resources

Rainwater Harvesting Ordinance of 2009 → **Objective**: Promote harvesting, storage and utilization of rainwater as viable alternative source of water supply

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Davao City Ordinances on Water

Ecological Solid Waste Management	**Objective**: Creation of Solid waste Management Board and 10-year Solid Waste anagement Plan
Septage and Sewerage Ordinance	**Objective**: establish a program for septage and sewerage system for Davao City
Watershed Protection, Conservation and Management Ordinance	**Objective**: identifies the recharge zone, aquifers and conservation areas and institutionalize the **Watershed Management Council** to implement the code
Organic Agriculture Ordinance	**Objective**: Advance the right of all citizen to food sufficiency, sovereignty and safety in accord with harmony of nature through organic agriculture mainstreaming

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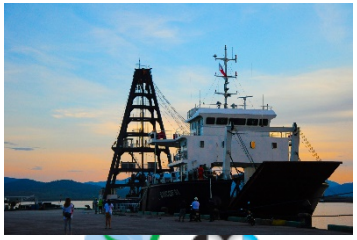
Mindanao at a glance…

MindaDOST STI Hubs



39%

of country's total area

- Large contiguous area for agriculture

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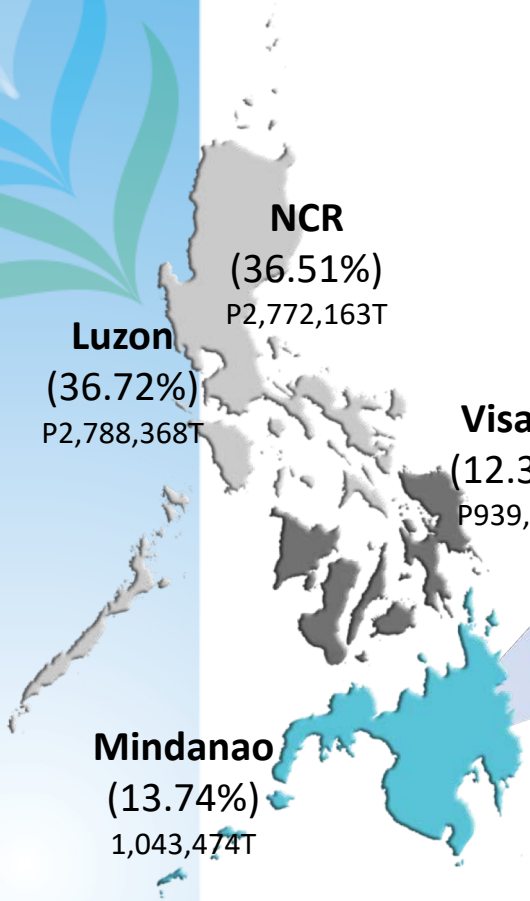
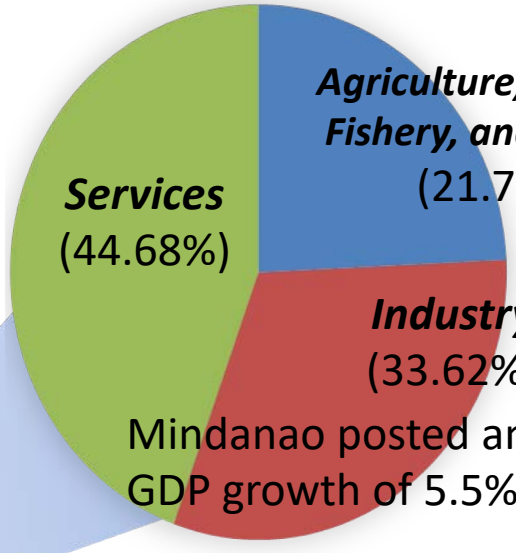
MindaDOST STI Hubs





Mindanao posted an average annual GDP growth of 5.5% from CY2001-2015

✓ **Mindanao contributed 14.4% to the Philippine Economy in 2015 and posted 5.6% GDP growth**

Source: Philippine Statistical Authority (PSA)

Mindanao: Source of High Value Crops

CACAO
89.42%
Major Source-Region XI

COCONUT
49.32%
Major Source-Region IX

RUBBER
99.99%
Major Source-Region IX

OIL PALM
90.82%
Major Source-CARAGA

COFFEE
73.59%
Major Source-Region XII

PINEAPPLE
88.85%
Major Source-Region X

BANANA
82%
Major Source-Region XI

SEAWEEDS
57.35%
Major Source ARMM

Source of data: BAS

MindaDOST

STI

Hubs

Department of Science and Technology

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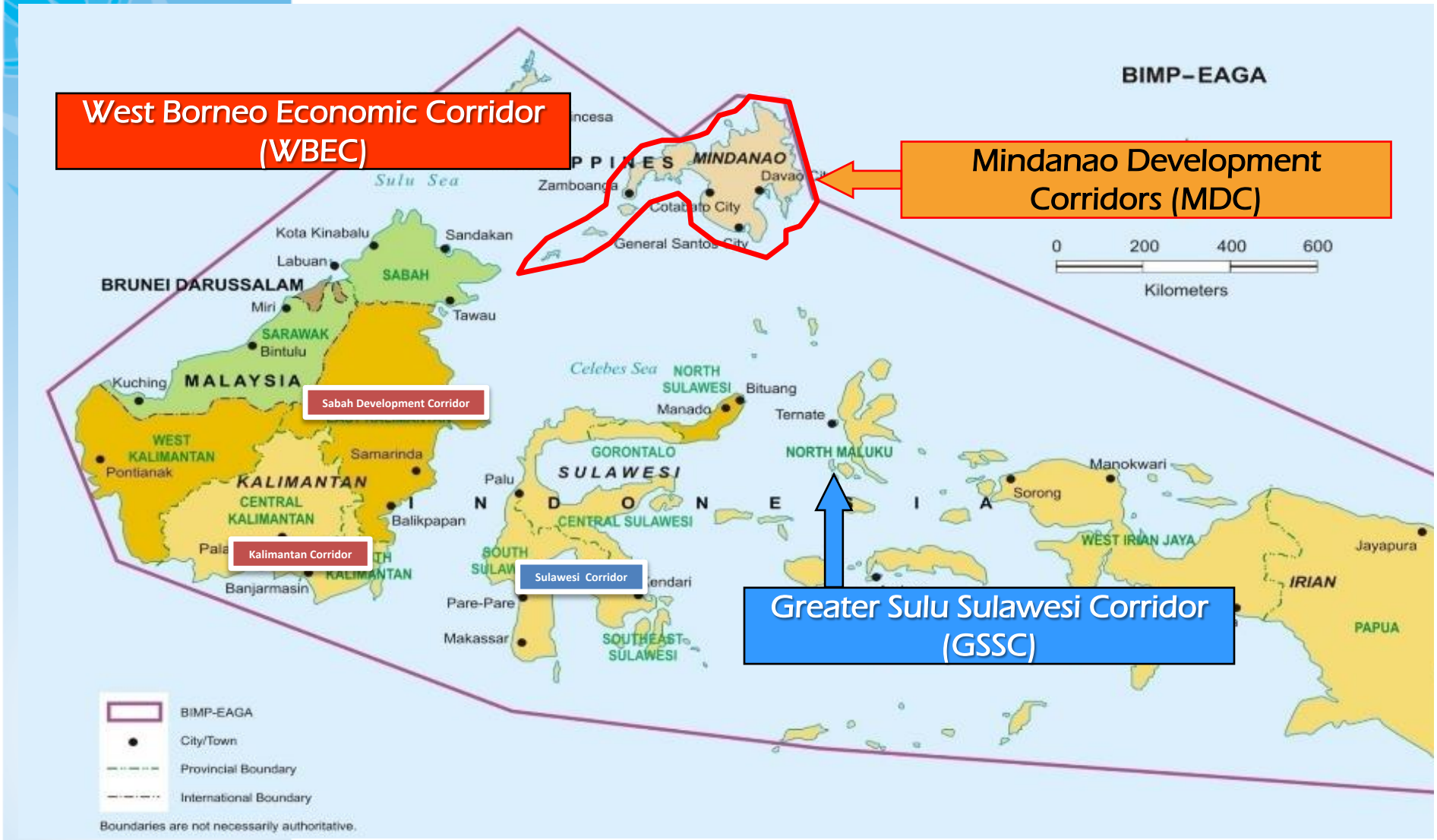
West Borneo Economic Corridor (WBEC)
Mindanao Development Corridors (MDC)
Greater Sulu Sulawesi Corridor (GSSC)
BIMP–EAGA
Sulu Sea
Celebes Sea
MINDANAO
Davao
Zamboanga
Cotabato City
General Santos City
Kota Kinabalu
Sandakan
Labuan
SABAH
BRUNEI DARUSSALAM
Miri
Tawau
SARAWAK
Bintulu
Kuching
MALAYSIA
Sabah Development Corridor
WEST KALIMANTAN
Pontianak
KALIMANTAN
CENTRAL KALIMANTAN
Samarinda
Balikpapan
Kalimantan Corridor
Banjarmasin
NORTH SULAWESI
Manado
Bituang
Ternate
NORTH MALUKU
GORONTALO
SULAWESI
Palu
CENTRAL SULAWESI
Sulawesi Corridor
Pare-Pare
Makassar
SOUTHEAST SULAWESI
Manokwari
Sorong
WEST IRIAN JAYA
Jayapura
IRIAN
PAPUA
0 200 400 600
Kilometers
BIMP-EAGA
City/Town
Provincial Boundary
International Boundary
Boundaries are not necessarily authoritative.

Ecosystem Thresholds

Increasing Population, Urbanization Industrialization

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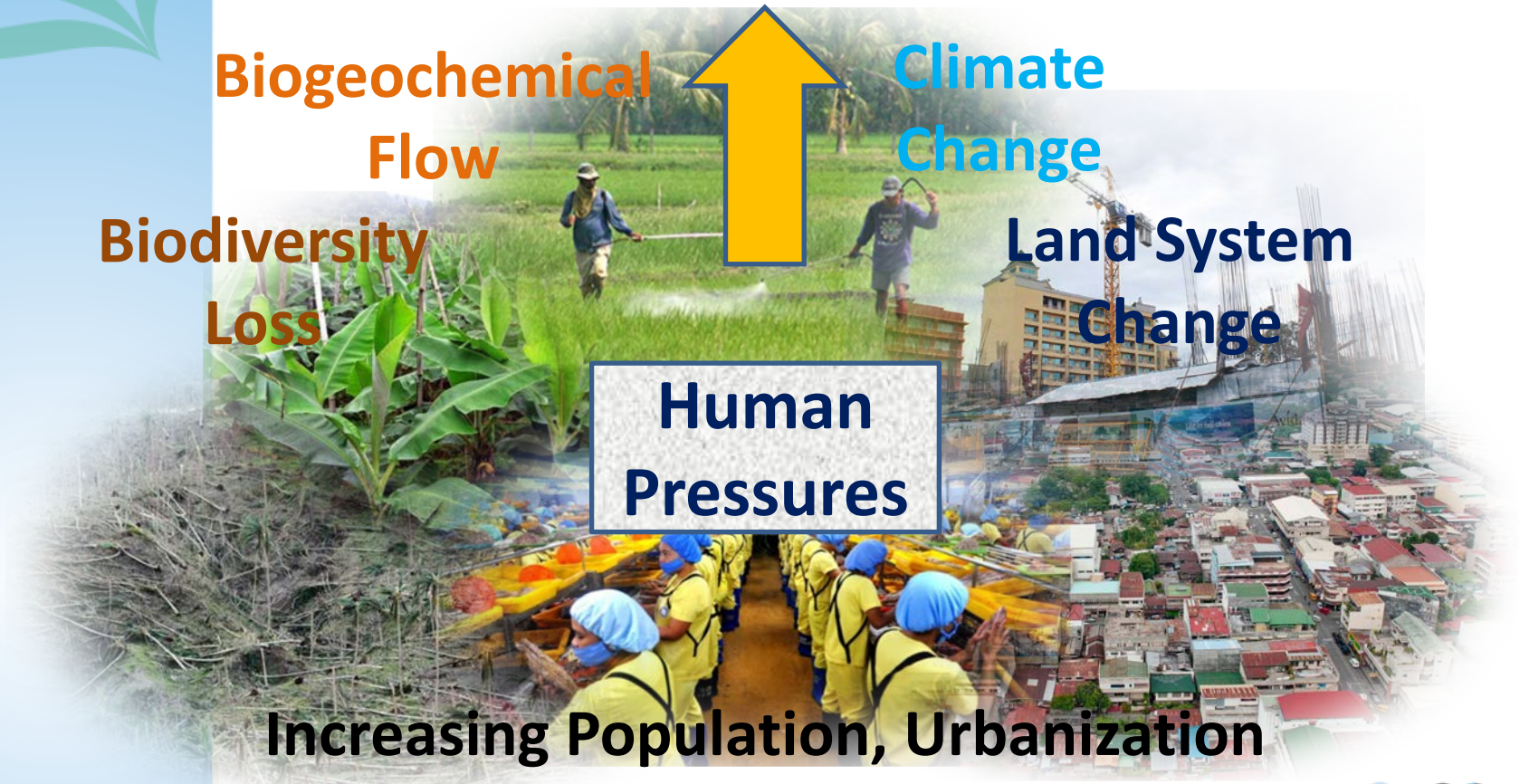
Ecosystem Thresholds



Increasing Population, Urbanization
Industrialization

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Challenges in Water for Agriculture

- Flooding
- Drought
- Irrigation
- Specific issues in Davao City Watershed

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Flooding and losses in Agriculture, Davao Region

Year	Major Flooding Events	Losses (in PHP)
February 2011	Continuous rain due to the Tail-end of Cold Front	555,008,062
November 2012	Flooding incidence due to Intertropical Convergence Zone	17,924,000

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Losses in Rice Production due to Flooding in Davao City

YEAR	TOTAL AREA AFFECTED (HA)	PRODUCTION LOSS	
		VOLUME (MT)	VALUE (PhP) MILLION
2004	365,031.00	650,083.00	1,697.73
2005	131,972.00	226,937.00	645.58
2006	411,578.00	710,251.00	3,398.89
2007	215,198.53	105,623.98	1,881,876.37
2008	379,222.60	258,627.05	5,015,258.88
2009	713,037.33	1,345,658.19	23,574,631.11
2010	661,097.00	936,901.71	15,559,066.74
2011	930,536.05	1,162,572.08	17,842,484.47
2012	227,559.65	170,297.15	3,878,438.12
2013	452,176.40	459,256.71	7,138,924.99

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Drought and impact in Agriculture

- water supplies dry up
- crops fail to grow
- animals die
- malnutrition and ill health become widespread

Davao City, being the food basket of Region XI will be facing the ***challenges on food security, low supply of agricultural products and the need for additional investments in terms of seedlings and other farm inputs to cope up with the damage*** *in the region with the projected temperature increase.*

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Irrigation as a major challenge in expanding economic opportunities in Agriculture in Davao Region

As of 2015, only 1.7 million hectares (ha) or 57 percent of the 3.0 million ha potential irrigable area has been irrigated. Irrigation development has been slow due to the long and tedious process of designing and constructing large-scale irrigation systems. On the other hand, the construction of small-scale irrigation systems has been limited and many of the existing irrigation systems need rehabilitation or restoration to improve their efficiency.

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Davao City major watershed issues:

- Unregulated water extraction
- Deforestation
- Land use conflicts
- Improper cultivation of hilly lands
- Poor waste management
- Limited government resources for watershed management.

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HELP DAVAO NETWORK

Who are we?

- is a SEC registered non-stock, non-profit **Multi-Sector Network of volunteers and professionals** with various backgrounds in technical, political economic, planning and development, social, and environmental advocacies, commonly working together in **ensuring that stakeholders have access to sound science that can be used to better inform complex decisions and hard choices in water management**

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Who are our member-stakeholders?

- City Mayor of Davao
- Government Line Agencies *(DOST, DENR, DA, DOT, DOH, NCIP, DCWD)*
- Non-government organizations *(PCEEM, HELP-Davao, KFI, CRS, SALIGAN, IDIS, Davao Medical Society, RECORD Foundation)*
- Private Sectors *(Federation of Davao Chamber of Commerce, Aboitiz, HEDCOR, PBGEA)*
- People Organizations *(Protect Davao River Movement, Protect Bunawan River Movement, Federation of Federations of Urban of Poor, Mindanao)*
- Media(*Environmental Media in Action, PIA, SunStar*)
- Management Councils (*Watershed Management Coordinating Committee, Watershed Youth Management Council, Davao Gulf Management Council)*
- Academe *(University of the Philippines, Ateneo de Davao University, University of Southeastern Philippines, University of immaculate Concepcion, Southern Philippines Agri-business and Marine and Aquatic School of Technology)*

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What do we do?

To be involved in the process of policy and/or critical decision making and planning in water management

- **Acted as technical mediator** when DCWD and Aboitiz competed for the use of the same surface water for drinking and hydropower
- Consulted when the City declared a ban on the practice of aerial spraying by banana and pineapple plantations

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What do we do?

To promote pro-active participation in planning for water and watershed management programs



- In the aftermath of the Matina River Flooding in 2011, HELP Davao Network enjoined key stakeholders to a **series of workshops in 2011 that espoused the IWRM approach**. One of the outputs is the formation of **Davao Water Partnership (DWP**) and its **5-year Action Plan**. The plan was consequently adopted by the RDC

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What do we do?

Enhance capability in water and watershed management
By facilitating participation of water leaders and water advocacy groups in trainings, consultations and cross visits

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What do we do?

To develop a model on water and watershed management, conservation, and protection for replication by other watershed management bodies

Customized IWRM Guidelines for Davao City and Region XI

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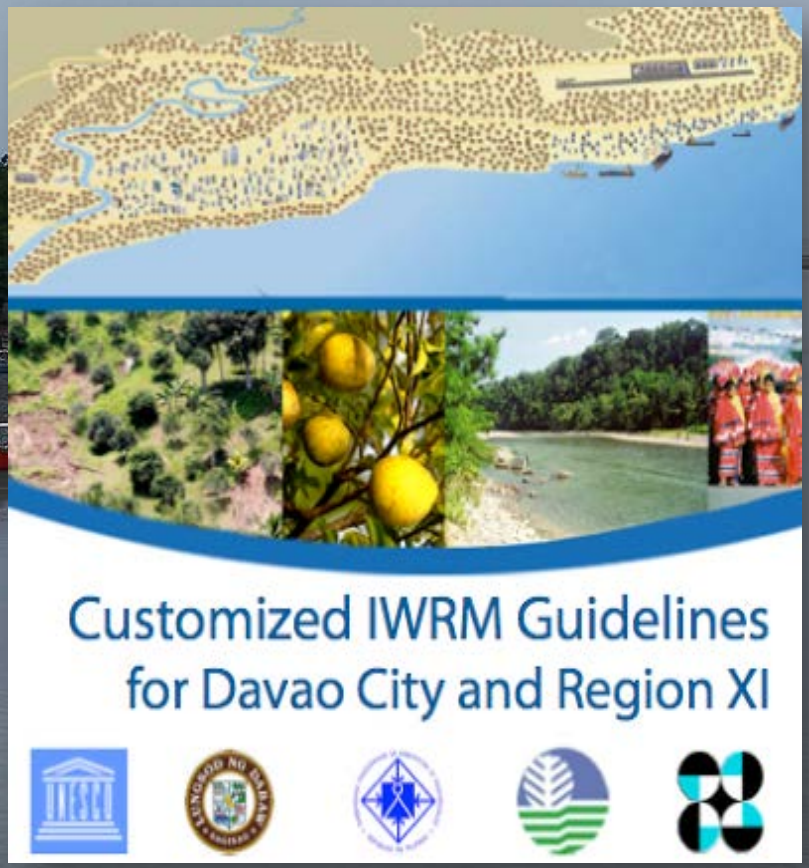
Developed the interdisciplinary material – **Customized IWRM Guidelines for Davao City and Davao Region** – which is a relevant input to water education initiatives

UNESCO IWRM Guidelines was localized and customized based on the actual experiences of Davao City and Davao Region thru the participative engagement of all stakeholders involved in planning of the Davao Water Action Plan and drafting the resolution for the Region-wide adoption of IWRM Guidelines.

Series of Consultations and Planning Sessions among a Full Spectrum of Stakeholders in Davao Region in 2011

Outcomes



- Davao Water Partnership
- Water Vision for Davao Region
- 5-year DRR Action Plan for Matina Pangi River
- Regional Development Council Resolution for the Adoption of IWRM Davao Water Partnership Action Plan

Visit http://rdc.nro11.neda.gov.ph/docs/iwrm.pdf

IWRM TRAINING FOR LGUs

"Application of Integrated Water Resources Management (IWRM) Concepts and Other S & T Approaches Towards Hydro-Hazards"

3-day event organized by HELP Davao Network, in partnership with Department of Science and Technology Region XI, Department of Environment and Natural Resources Region XI, City Environment and Natural Resources Office and Mindanao Development Authority

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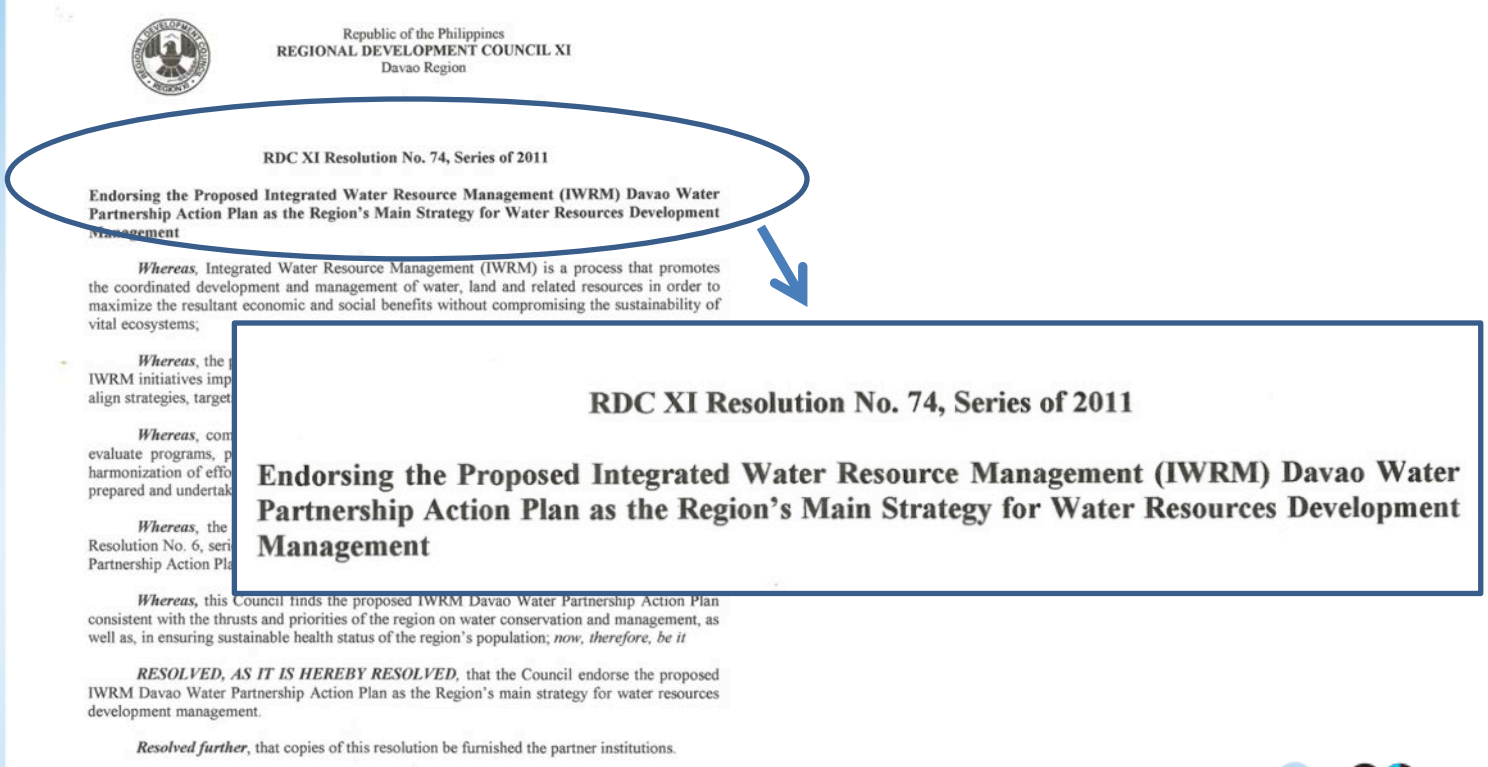
What do we do?

Promote innovative ideas in on science-based information on water and watershed conservation and protection



Republic of the Philippines
REGIONAL DEVELOPMENT COUNCIL XI
Davao Region

RDC XI Resolution No. 74, Series of 2011

Endorsing the Proposed Integrated Water Resource Management (IWRM) Davao Water Partnership Action Plan as the Region's Main Strategy for Water Resources Development Management

Whereas, Integrated Water Resource Management (IWRM) is a process that promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social benefits without compromising the sustainability of vital ecosystems;

Whereas, the
IWRM initiatives imp
align strategies, target

Whereas, com
evaluate programs, p
harmonization of effo
prepared and undertak

Whereas, the
Resolution No. 6, seri
Partnership Action Pla

Whereas, this Council finds the proposed IWRM Davao Water Partnership Action Plan consistent with the thrusts and priorities of the region on water conservation and management, as well as, in ensuring sustainable health status of the region's population; *now, therefore, be it*

RESOLVED, AS IT IS HEREBY RESOLVED, that the Council endorse the proposed IWRM Davao Water Partnership Action Plan as the Region's main strategy for water resources development management.

Resolved further, that copies of this resolution be furnished the partner institutions.

RDC XI Resolution No. 74, Series of 2011

Endorsing the Proposed Integrated Water Resource Management (IWRM) Davao Water Partnership Action Plan as the Region's Main Strategy for Water Resources Development Management

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What do we do?

To establish community-based water and watershed watch groups

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What do we do?

To promote water accessibility to marginalized sectors

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What do we do?

To conduct constant community-based consultation and information dissemination

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What do we do?

Conduct baselines studies, surveys, and researches in water resource management

- A **nationwide assessment of water safety systems and procedures of water services** providers including those in Davao Region is now being conducted by HELP Davao Network.

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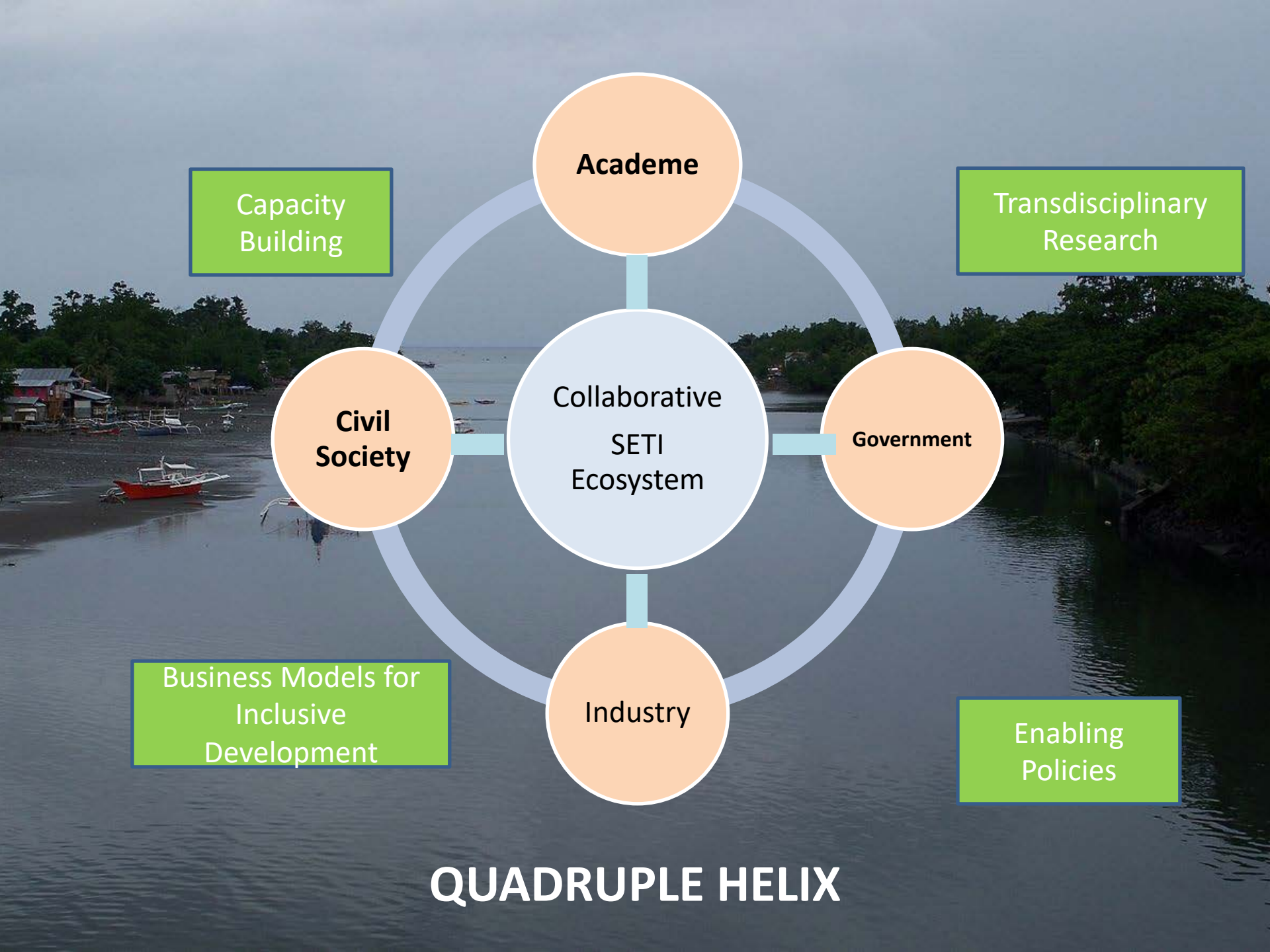
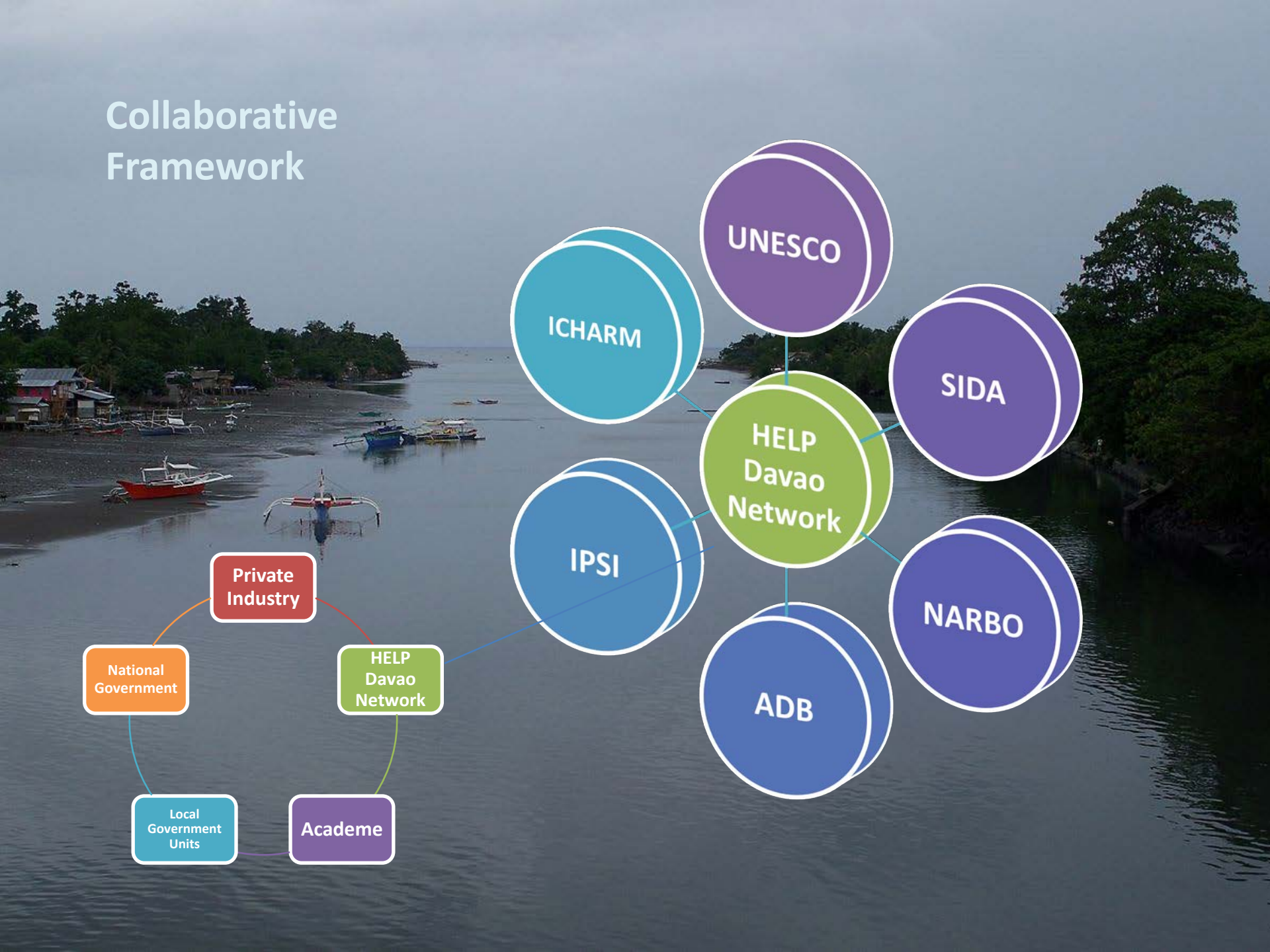
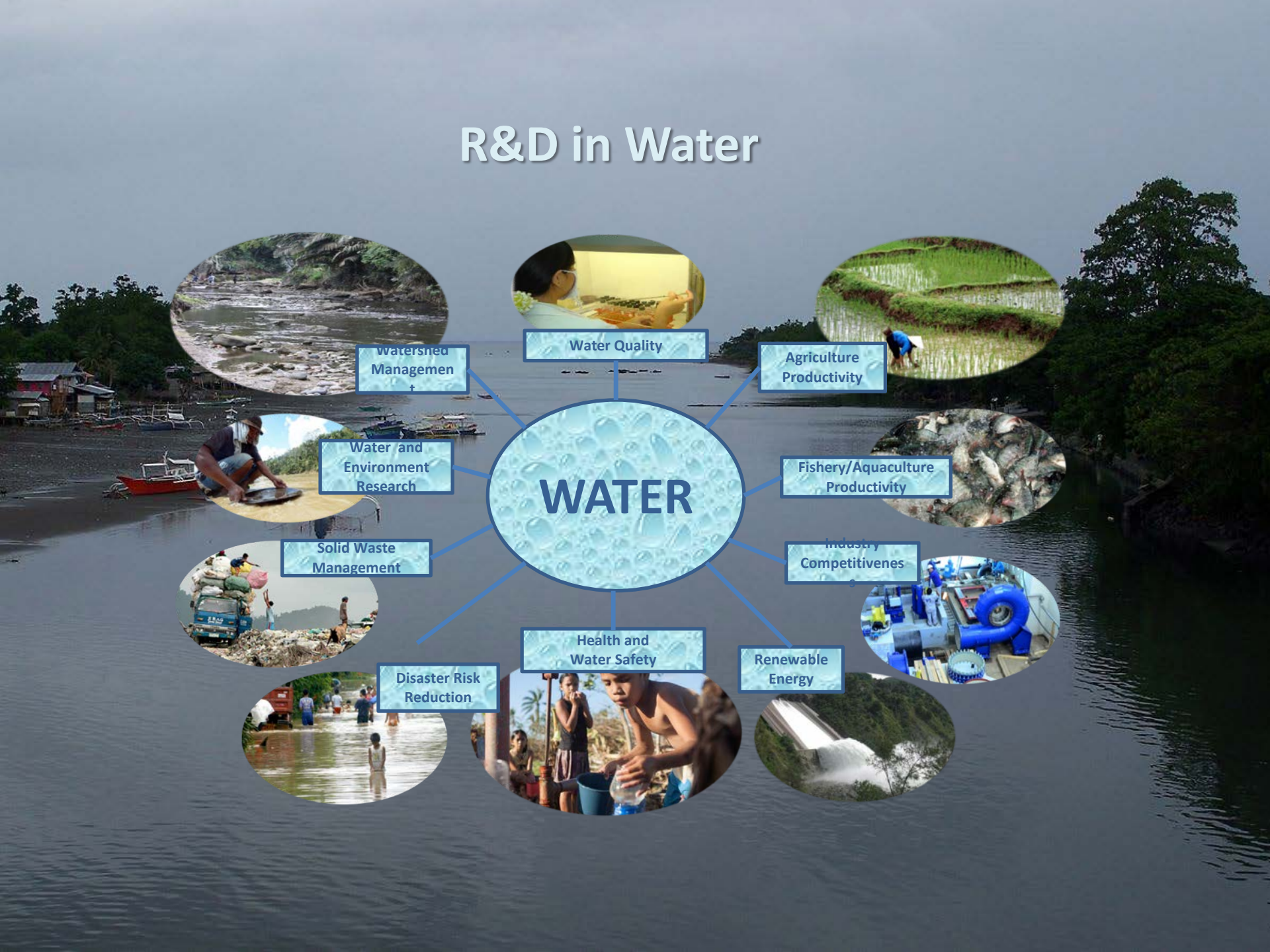


QUADRUPLE HELIX

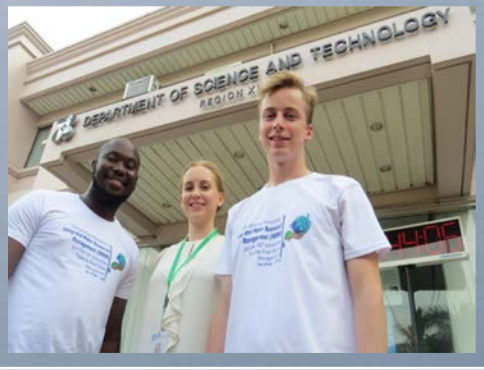
Collaborative Framework



R&D in Water


WATER
Water Quality
Watershed Management
Agriculture Productivity
Water and Environment Research
Fishery/Aquaculture Productivity
Solid Waste Management
Industry Competitiveness
Health and Water Safety
Disaster Risk Reduction
Renewable Energy

Furthering Knowledge thru
Research and Development



Title	Lead Researchers/Partners	Key Findings
Microclimate in Davao City	Van Larenstein Hall University, DOST XI, HELP Davao Network	Urbanization results to Davao City as Heat Island (increased temperature);Need for additional weather stations; and Need for improved data sharing and management
Tides and Floods and Davao City	Van Larenstein Hall University, DOST XI, HELP Davao Network	Need for improvement in drainage systems and flood control infrastructures; Need for improved reporting/recording of flood incidences
Assessment of the extent of implementation of standards and procedures for water safety in the Philippines	DOST XI, HELP Davao Network, UIC	Low level of implementation of water safety plans among drinking water providers ;Quality of drinking water in certain areas do not comply with the PNDSW of 2007; Need for development of a comprehensive advocacy, partnership and networking strategy to enforce PNSDW 2007
Assessment of the water situation and the safety of wastewater and sanitation in selected parts of Davao City	Oulo University, DOST XI, HELP Davao Network	Domestic and industrial waste management practices affect the level of contamination of the wastewater of the locations; There is need for reinforcement of the laws on waste management should be strengthened; Conversion from waste to energy is highly needed

Sustainability Science Project

The major outputs of the multi-sector Sustainability Science Project "Demonstration Site in Enhancing Resilience of Urban Water Systems" in Mindanao" was the development and turn-over of Barangay hazard maps and distribution of IEC materials to the LGUs and key stakeholders, the identification of most vulnerable barangays against hydro-hazards, as well as the 15- year Sustainability Science Plan for Davao City.

Enhancing Sustainability of MSMEs and the Communities Through Low-Cost Sanitation Technology: the **Vertical Helophyte System**

Continuous professional development for scientists, engineers, managers and policy makers in the water sector

Conducted several technical for a for local actors and stakeholders of water
-continuing

Australian Awards Fellowship Program
"Disaster Risk Reduction for Community Resilience and Safeguarding Livelihoods in the Philippines"
14th October – 12th November 2015
International WaterCenter, Australia

Sent key participants to the NARBO IWRM Training Programs
2012, 2014, 2015

Furthering Understanding thru Consultations

Series of Consultation and Planning Session among a Full Spectrum of Stakeholders in Davao Region for the Development of Customized IWRM Guideline and Davao Water Action Plan (2010, 2011)

Mindanao-wide consultation on priority issues and conflicts in water use and management (BIMP-EAGA Summit, October 2014) :
food, agriculture and fisheries; domestic and industrial use; energy; **climate change and hydro hazards**; special concerns of Indigenous communities, women and youth

Consultation with Local Government Units and key stakeholders on demonstrating disaster resilience of urban water system in Davao City (2016)

Sustaining Implementation thru Enabling Policies, Resolutions and Programs

- Regional Development Council Resolution for Adoption of IWRM Davao Water Partnership Action Plan
- BIMP-EAGA Resolution for the Mindanao-wide Adoption of IWRM
- Designation of Davao River as Water Quality Management Areas
- Organic Agriculture
- Watershed Code of Davao City
- Marine Protected Areas
- Solid Waste Management Ordinance
- Comprehensive Land Use Plan
- Davao River Master Plan
- Rainwater Harvesting Ordinance
- Banning of Aerial Spray
- MindaNOW (Nurture our Water) Program
- Davao Water Partnership

Engaging and capacitating
women, youth and grass-root communities
in water advocacy programs

Establishment of community-based learning centers where local water initiatives can be shared among the youth, women, and the general public

Training indigenous people on how to safeguard upland water resources and on how to implement a sitio-level water safety plan

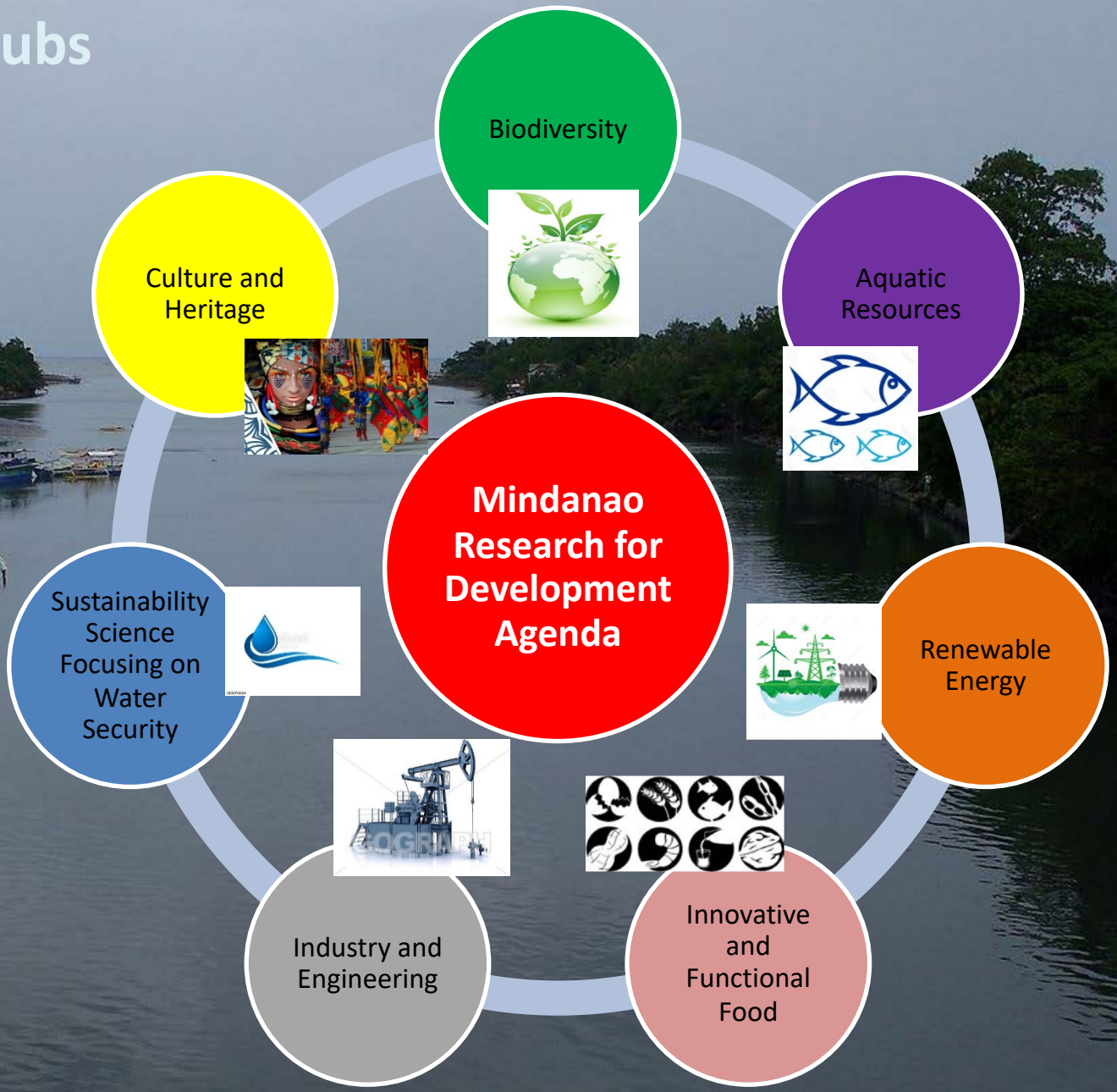
Encourage participation of youth and women in various initiatives

Emerging role of women as water leaders and providing avenues for continuous professional development

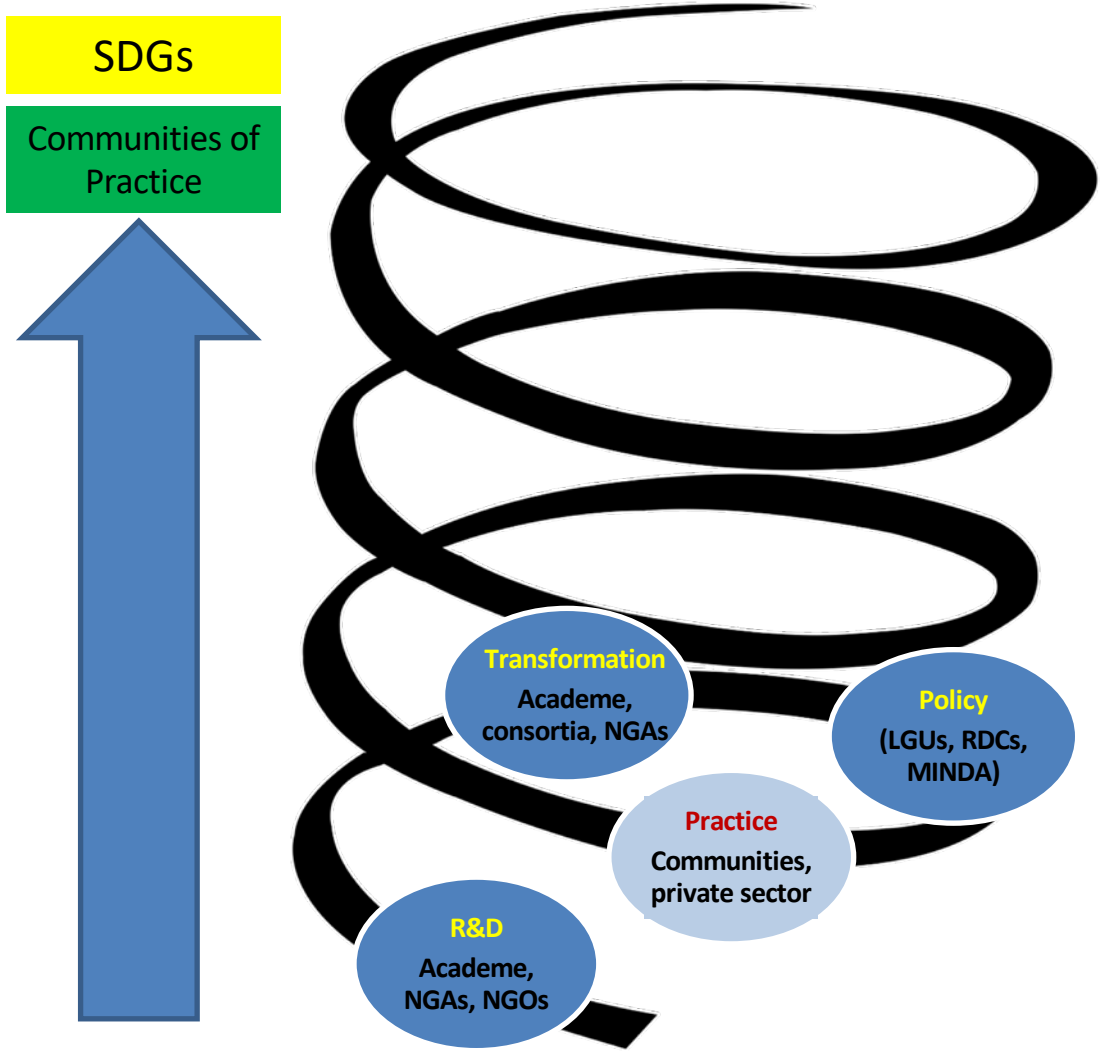
Mindanao STI Hubs

Innovation ecosystem conducive for creativity and participation of different stakeholders in the translation of innovations into applications and commercializations.

MINDANAO:
One Island,
One Science



Research Ecosystem for Development and Innovation (REDI) Framework



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APFAST Project

Fostering Partnerships in Accelerating SETI Frameworks Towards Attainment of SDG in Mindanao:

A closer look into Water Security

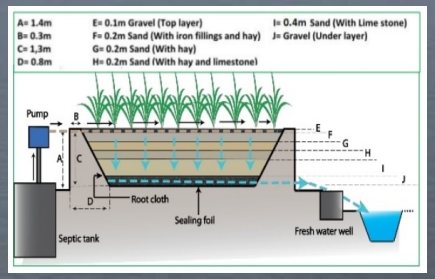
OBJECTIVES:

1. Building, strengthening and sustaining partnerships in SETI.
2. Accelerating development in SETI research, techno-transfer, commercialization, innovation and policy advocacy.
3. Harnessing SETI in the Mindanao Development Corridors.
4. Assessing outcomes and impacts of the project on the SDGs in Mindanao.

Proposed Niche Center for R&D:

Water Sustainability Science

Ensuring water quality and quantity in the cities



OBJECTIVES:

1. To help achieve sufficiency in water supply in the region by adopting water harvesting and recycling
2. To promote the use of GIS-Technology Innovation Tools in agri-business farms
3. Analyze indigenous practices in conserving water and sustaining food supply in extreme events like flood and drought and propose their inclusion in the Disaster Risk Preparedness Program of the Region

Ban of Aerial Spraying in Davao City

Davao City passed the Ordinance No. 0309-07, or "Banning Aerial Spraying as an Agricultural Practice in all Agricultural Activities by all Agricultural Entities in Davao City"

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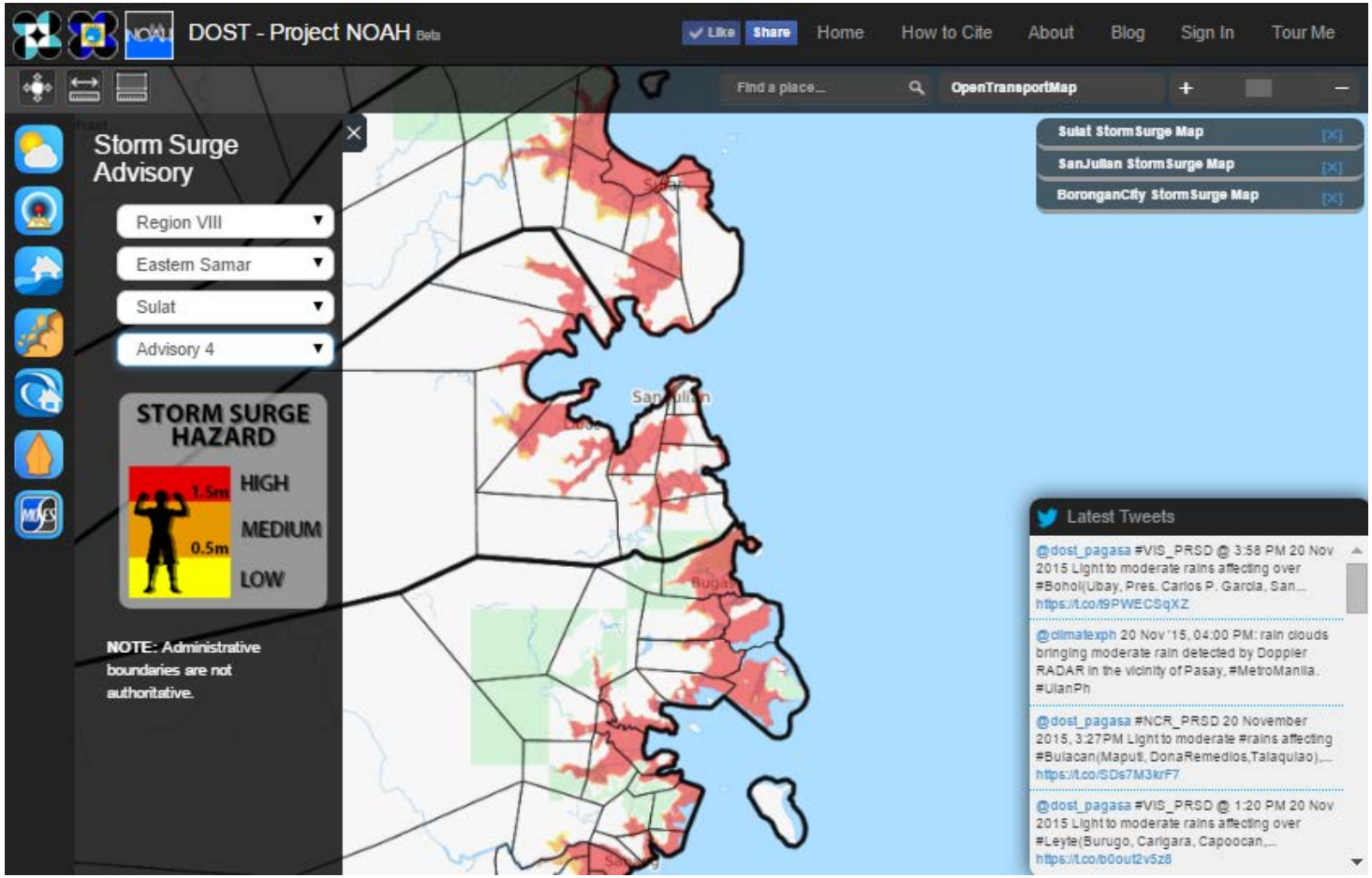
DOST Project on Nationwide Operation Assessment of Hazards or Project NOAH



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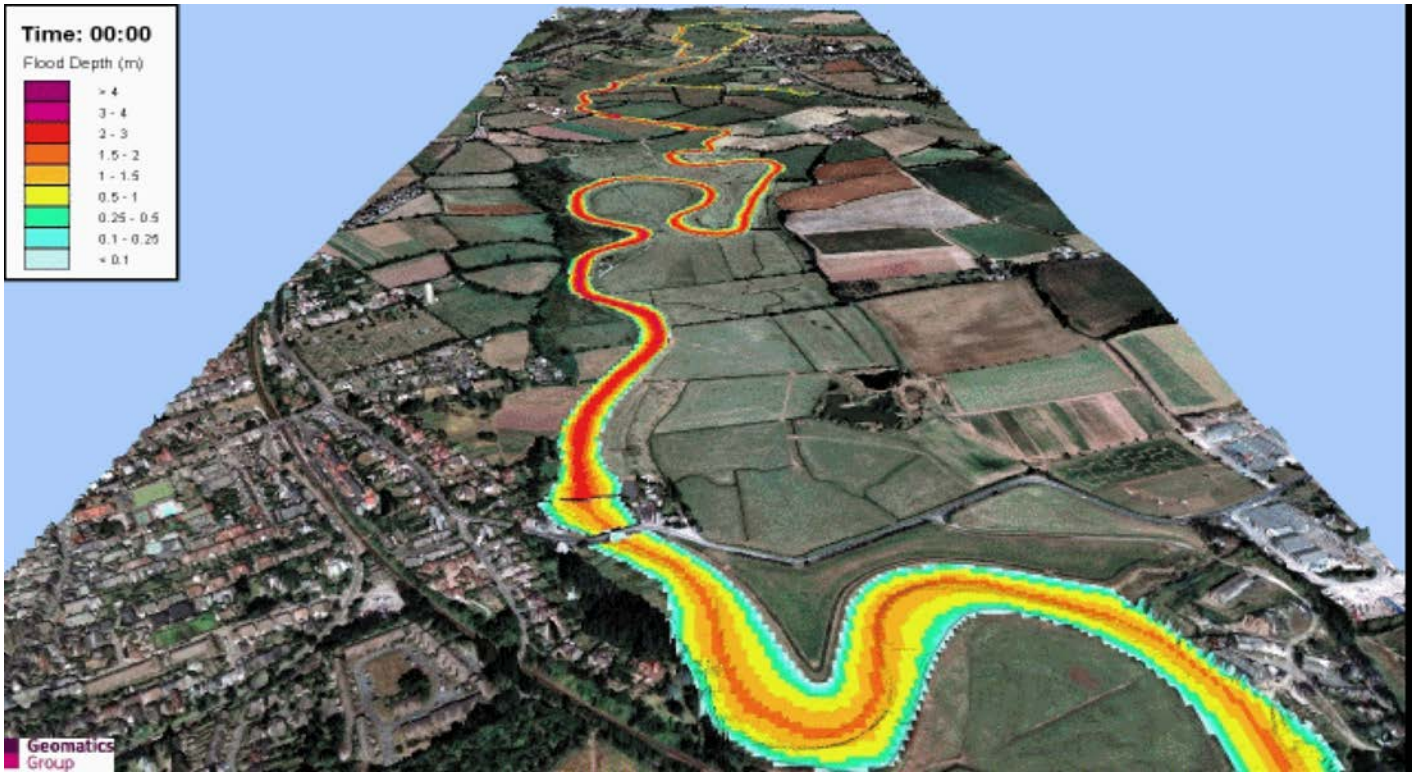
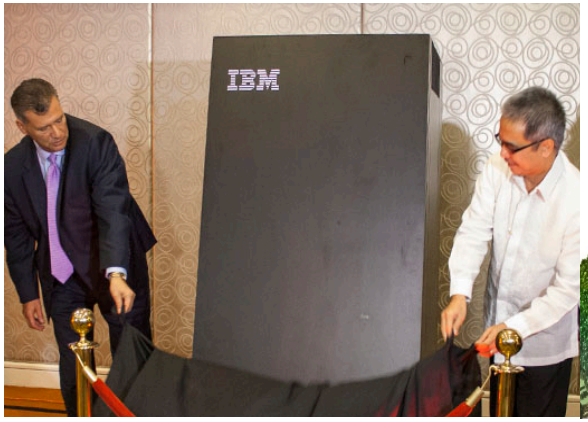
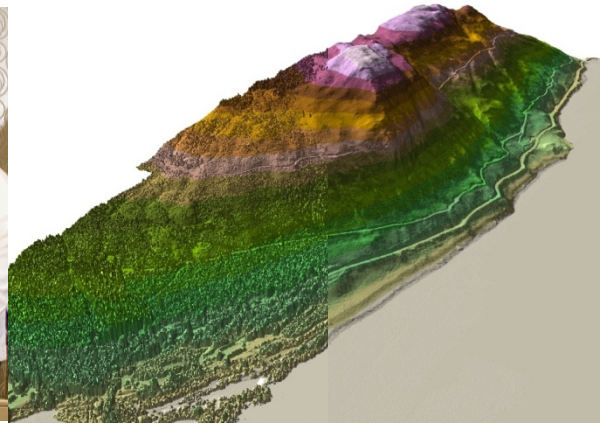
Flood and Hazard Mapping







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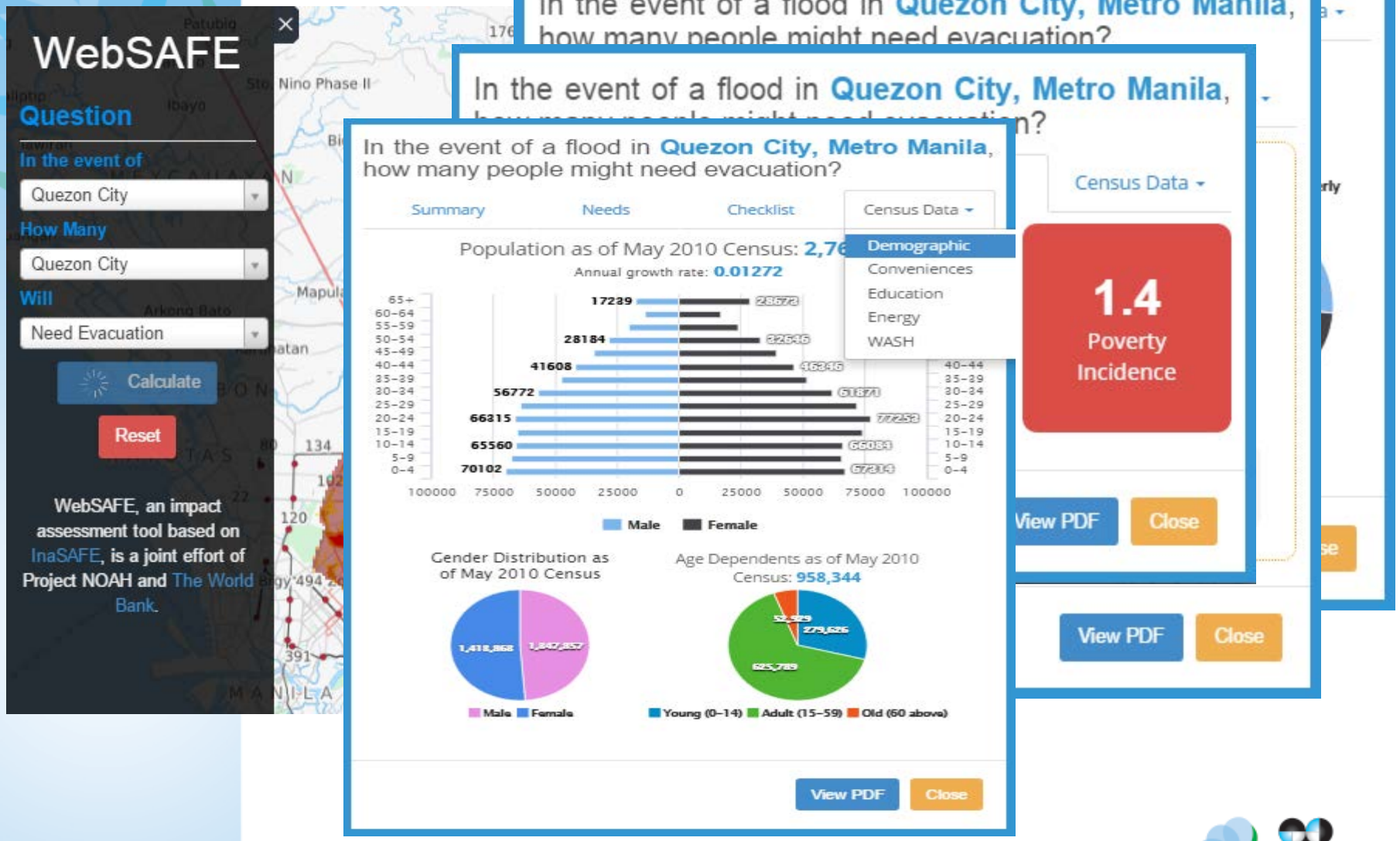
WebSAFE :



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WAY FORWARD

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Project SARAI

ICMF
Integrated Crop Monitoring and Forecasting System

The research program Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines (Project SARAI) started in November 2013, and was funded by DOST-PCAARRD. Its main goal is to provide agricultural stakeholders with site-specific and near real-time crop-weather advisories such as planting dates, status of crop health, possible pest infestations or water stress.

Project SARAI was able to develop a proactive monitoring mechanism using available satellite images from NASA and European Union (EU). The University, through the Office of the Chancellor and the Office of the Vice Chancellor for Research and Extension, approved and provided initial funding for two researchers to institutionalize the Integrated Crop Monitoring and Forecasting System (ICMF).

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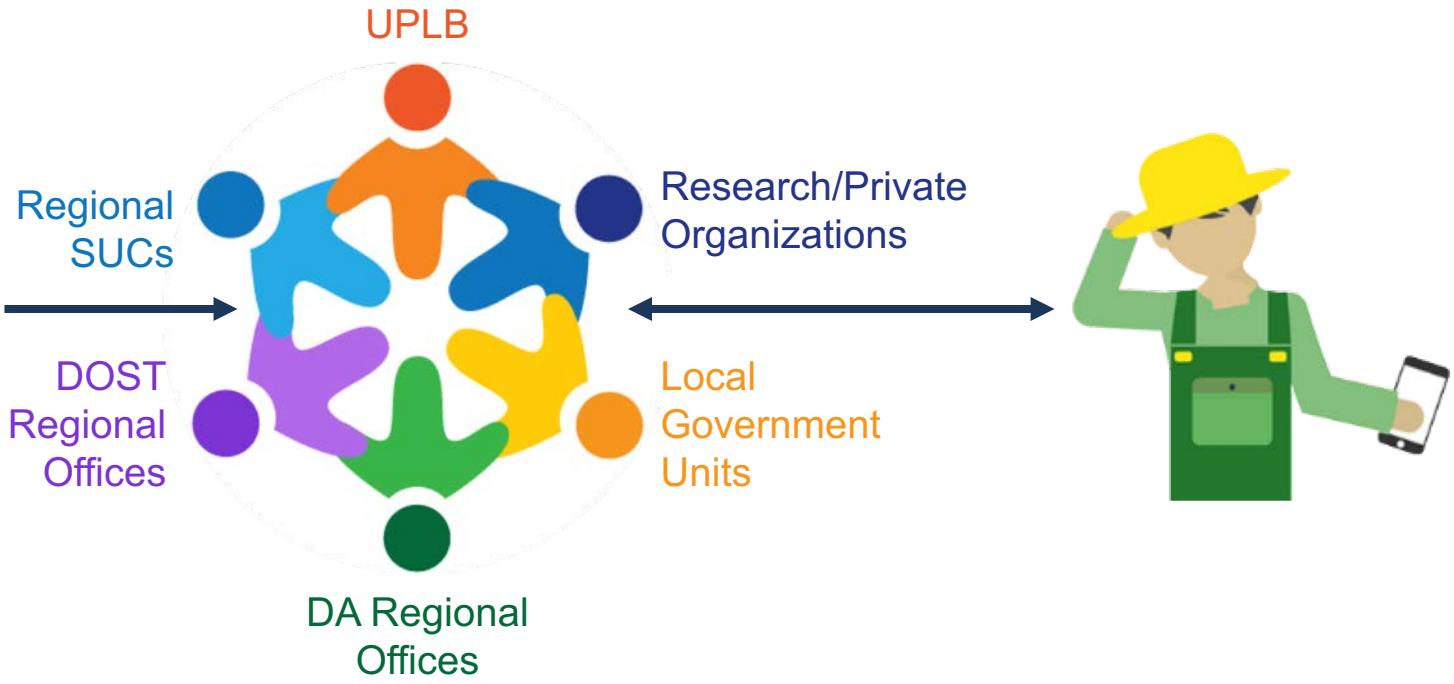

SARAI-ICMF envisions to process the available satellite data from NASA and EU and bring it to levels usable by various stakeholders, but most especially by the farmers. The system is only able to do this through establishing partnerships with SUCs, DA, DOST, LGUs, and other research organizations. To date, SARAI-ICMF has already partnered with and trained officers from Regions 2, 3, and 12. These partnerships enable SARAI-ICMF to establish a regional hub where farmers can easily go to for quick weather-agricultural information. The partnerships also enable the an active field validation mechanism; the partners provide their real-time field situations, and SARAI-ICMF cross checks the information with the gathered satellite images.

Ultimately, the goal is to empower our farmers with site-specific and near real-time crop-weather information.

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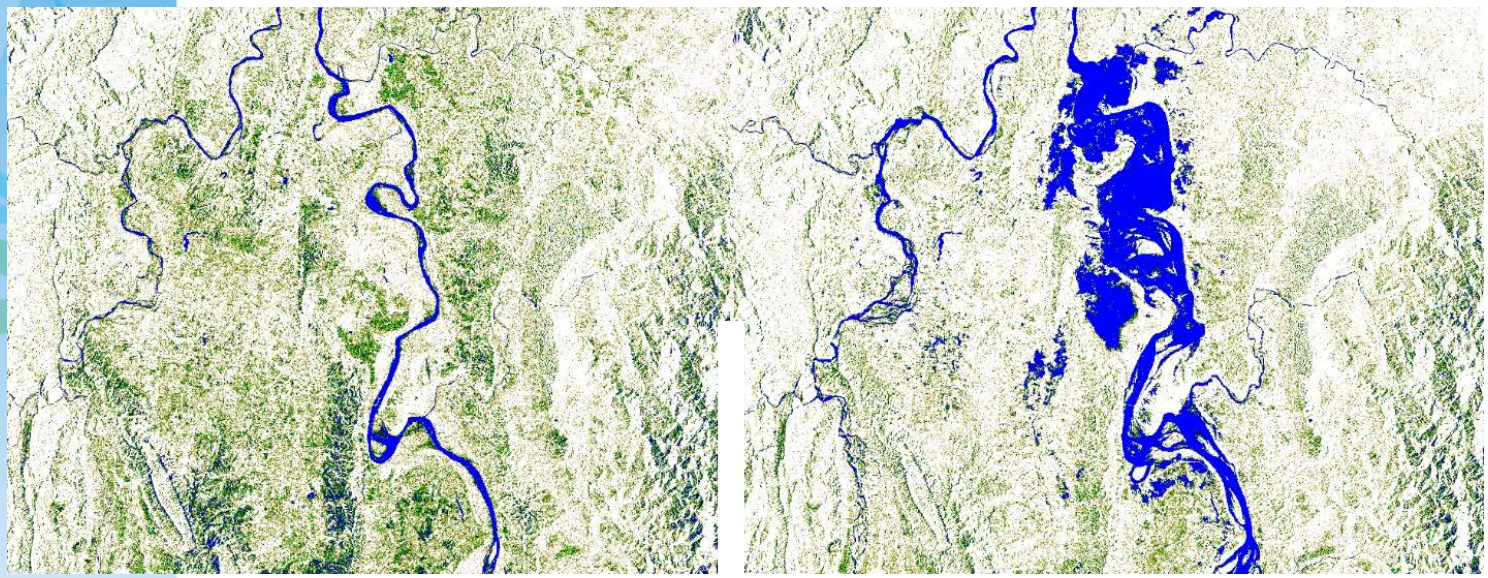
Flood Monitoring in Alcala Cagayan

Typhoon Lawin, 2016



Before
(October 8, 2016)

After
(October 20, 2016)

Flooded area : 19,764ha

SARAI-ICMF has produced a number of monitoring outputs. One of the most useful output for the Department of Agriculture is the post-typhoon flood assessment. SARAI-ICMF is able to compute for the total flooded area after Typhoon Lawin in October 2016. The assessment was done two to three days after the typhoon hut Alcala, Cagayan. One of the highlights of the assessment is that it is able to produce data on how many agricultural areas have been actually damaged – the damages can be further classified according to the DA's crop-damage classifications. This was sent to the DA Operations to help them validate field reports, and eventually monetize the agricultural losses.

SARAI-ICMF also conducts continuous and near real-time monitoring of rice and corn areas; and together with the regional partners, SARAI-ICMF is able to refine the system, and produce crop advisories to be sent to the regional offices, LGUs, and later on to the farmers.

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Addressing Climate change

S&T Action Frontline for Emergencies and Hazards Program (SAFE)

Development and submission of S&T strategies/proposals that will mitigate and manage the effect of disasters in the Agriculture, Aquaculture and Natural Resources (AANR) sectors.

3 programs:
-Ridge-to-Reef approach,
-Marine Protected Areas
-Smarter Technologies for Farmers

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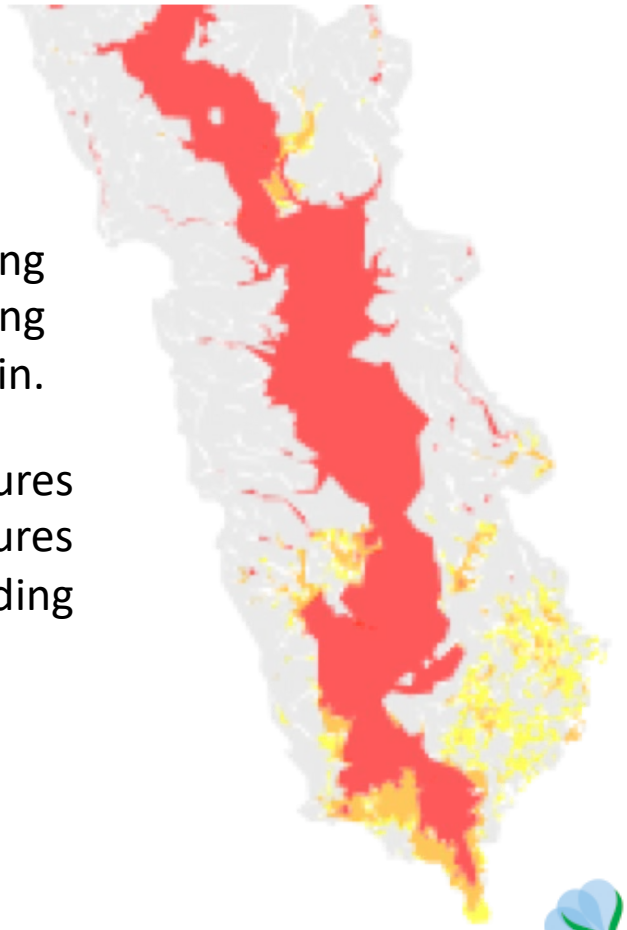
Geo-informatics for the systematic assessment of flood effects and risks for resilient Mindanao (GEO-SAFER Mindanao)

Produces scenario-based flood hazard maps showing areas which can get flooded when rainfall or varying duration and intensity occurs over the basin.

Maps can be analyzed further to locate infrastructures like buildings, roads, bridges and other infrastructures that are at risk to the effects f flooding

Davao 100 Year Flood Hazard Map



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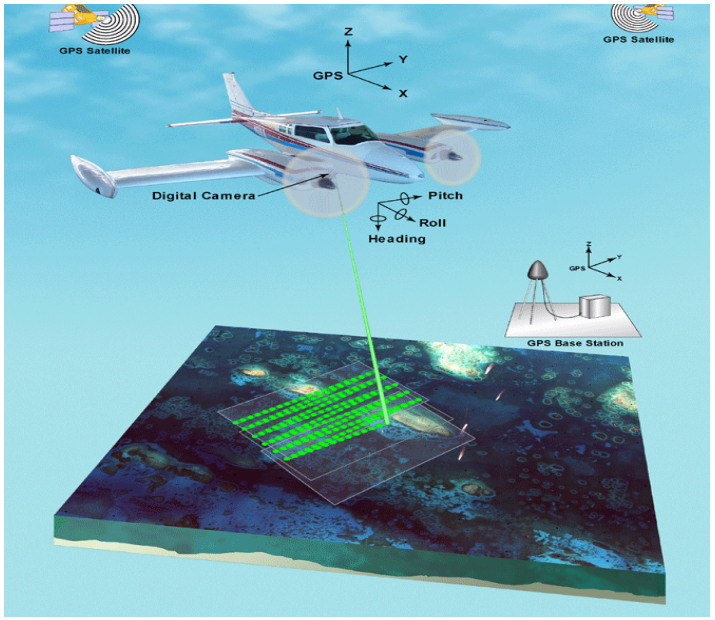
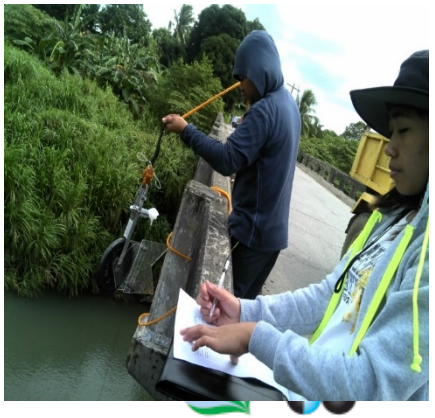
Use of LiDAR data for Resource Mapping

produce detailed resource maps using LiDAR for various applications:

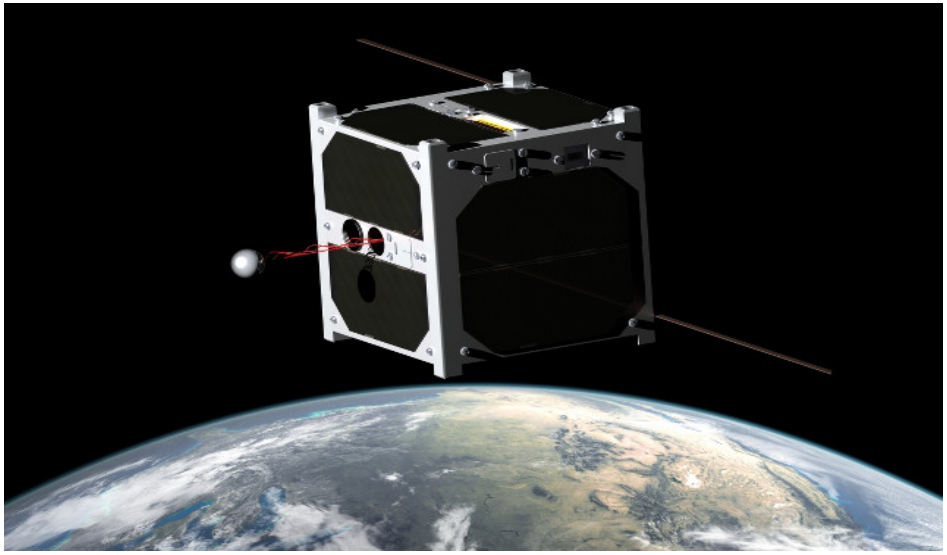
- production of high value crops
- irrigation assessment
- aquaculture production
- forest protection
- discovery of renewable energy sources



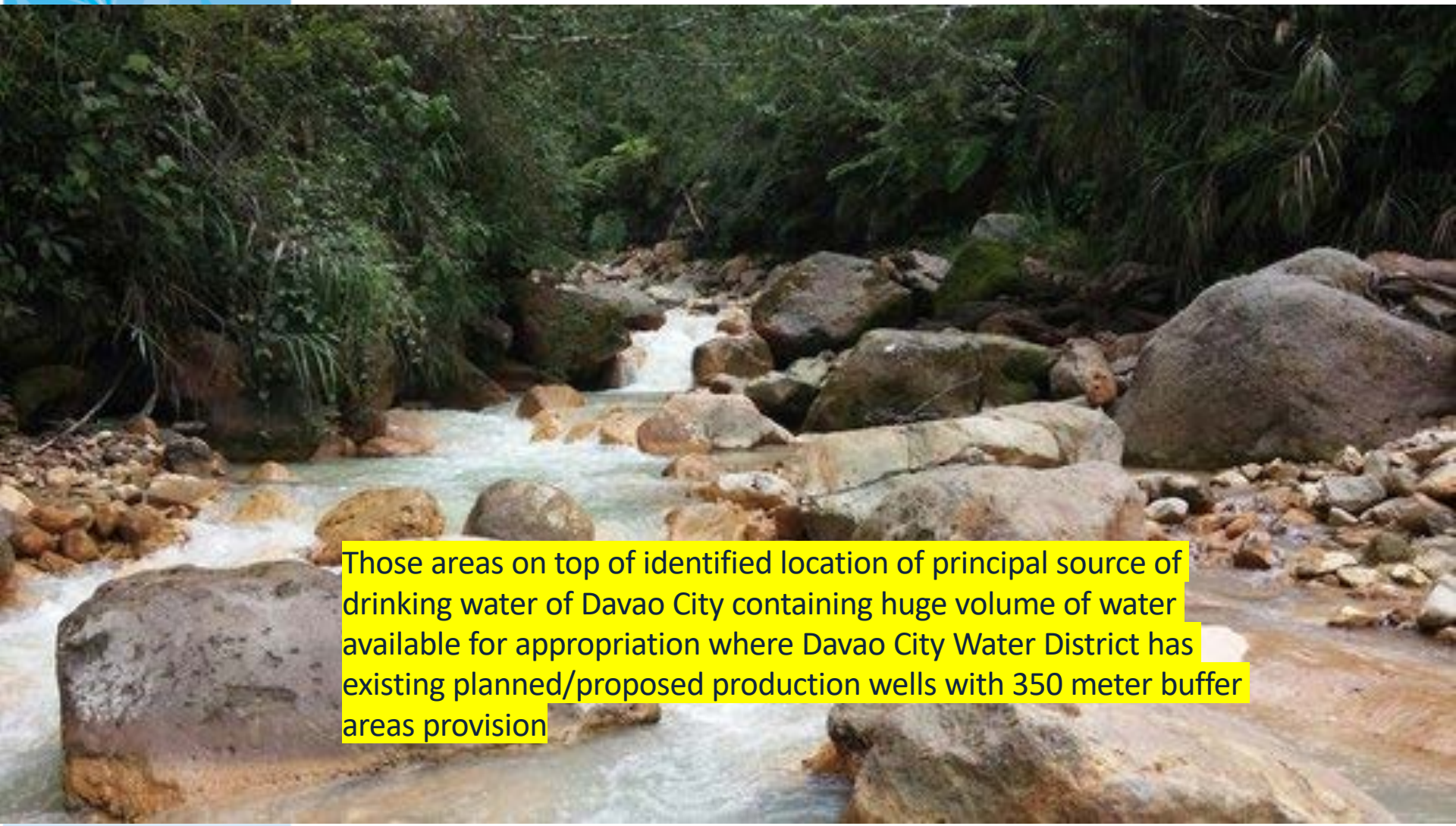


PHL-MICROSAT

provides remote sensing information useful in assessing of damages associated with disasters, as well as studying agriculture, fishery, forestry and changes in the environment



Improving water resource management through Updating of the Davao City Water Resource Zone



Those areas on top of identified location of principal source of drinking water of Davao City containing huge volume of water available for appropriation where Davao City Water District has existing planned/proposed production wells with 350 meter buffer areas provision

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Davao City Water Resource Zone

Mitigating measure: Areas within the Water Resource Zone are declared as Protected Areas. Consequently, all developments in this area will require a complete centralized sanitary sewerage system with primary and secondary wastewater treatment facilities. Disposal of such effluents is subject to the rules and regulations of the governing government agencies.

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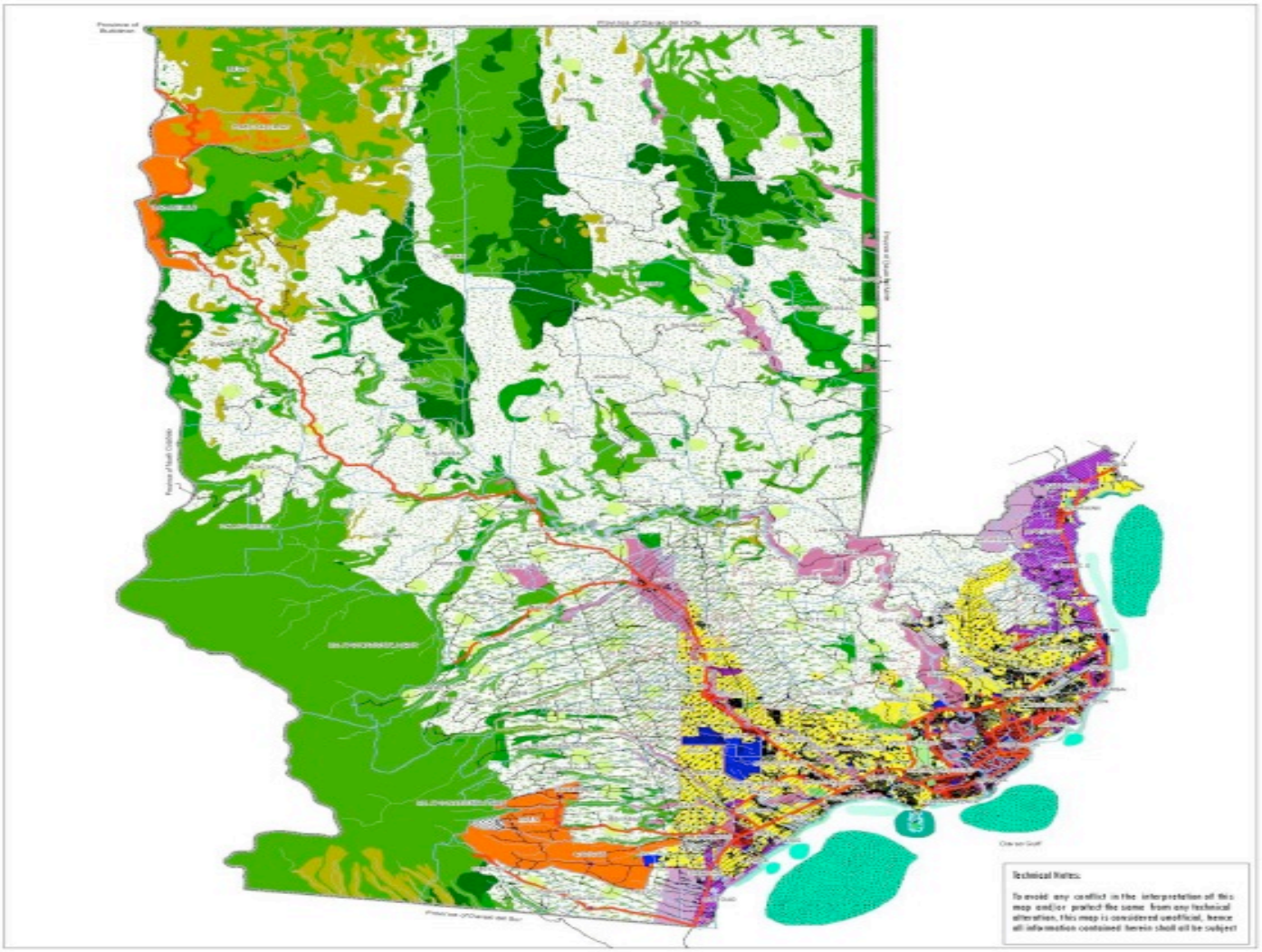

CITY OF DAVAO

REGION 11- DAVAO REGION

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ZONING MAP (2013-2022)
OF DAVAO CITY

Major Urban:

- Low Density Residential Zone (R-1)
- Medium Density Residential Zone (R-2)
- High Density Residential Zone (R-3)
- Socialized Housing Zone (SHZ)
- Minor Commercial Zone (C-1)
- Major Commercial Zone (C-2)
- Light Industrial Zone (I-1)
- Medium Industrial Zone (I-2)
- Heavy Industrial Zone (I-3)

General:
Agricultural Zone (AG):

- Prime Agricultural Land
- Agri-Non Tillage Land
- Marginal Agricultural Land
- Conservation Zone (CZ)
- Forest Zone (FZ)
- Agro-Industrial Zone (Agi)
- Rural Settlement Area

Urban Environment Management:

- Floodway Mitigation Zone
- Landslide Mitigation Zone
- Urban Ecological Enhancement Zone
- Inland Water Zone:
  - Major River
  - Creeks
  - Shoreline
  - Fish Pond
- Proposed By-Pass Highway
- Proposed Road
- Institution Zone (Ins)
- Special Institution Zone (SIns)
- Infrastructure/Utilities Zone (IU)
- Planned Unit Development Zone (PUD)
- Tourism Development Zone (TD)
- Open Space Zone (OSE)
- Buffer/Green Zone (BU)
- Parks and Recreation Zone (PR)
- Special Use Zone (SU)
- Waste Management Treatment Utilization Disposal Zone
- Water Resource Zone

Coastal Water:

- Aquaculture Area
- Eco-Tourism & Research
- Fish Sanctuary
- Fishing Area
- Mangrove Rehabilitation Area
- Marine Protected Area
- Multiple Use Zone
- Recreation Area

Base Data Legend:

- National Road
- City / Barangay Road
- Davao City Boundary
- Barangay Boundary

Map Sources:
City Planning and Development Coordinator Office

Prepared By:
Office of the City Planning and Development Coordinator

Approved By:

Office of the City Planning and Development Coordinator

SP Committee Chairman on Housing, Rural and Urban Development

Vice Mayor

City Mayor

Housing and Land Use Regulatory Board (HLURB)

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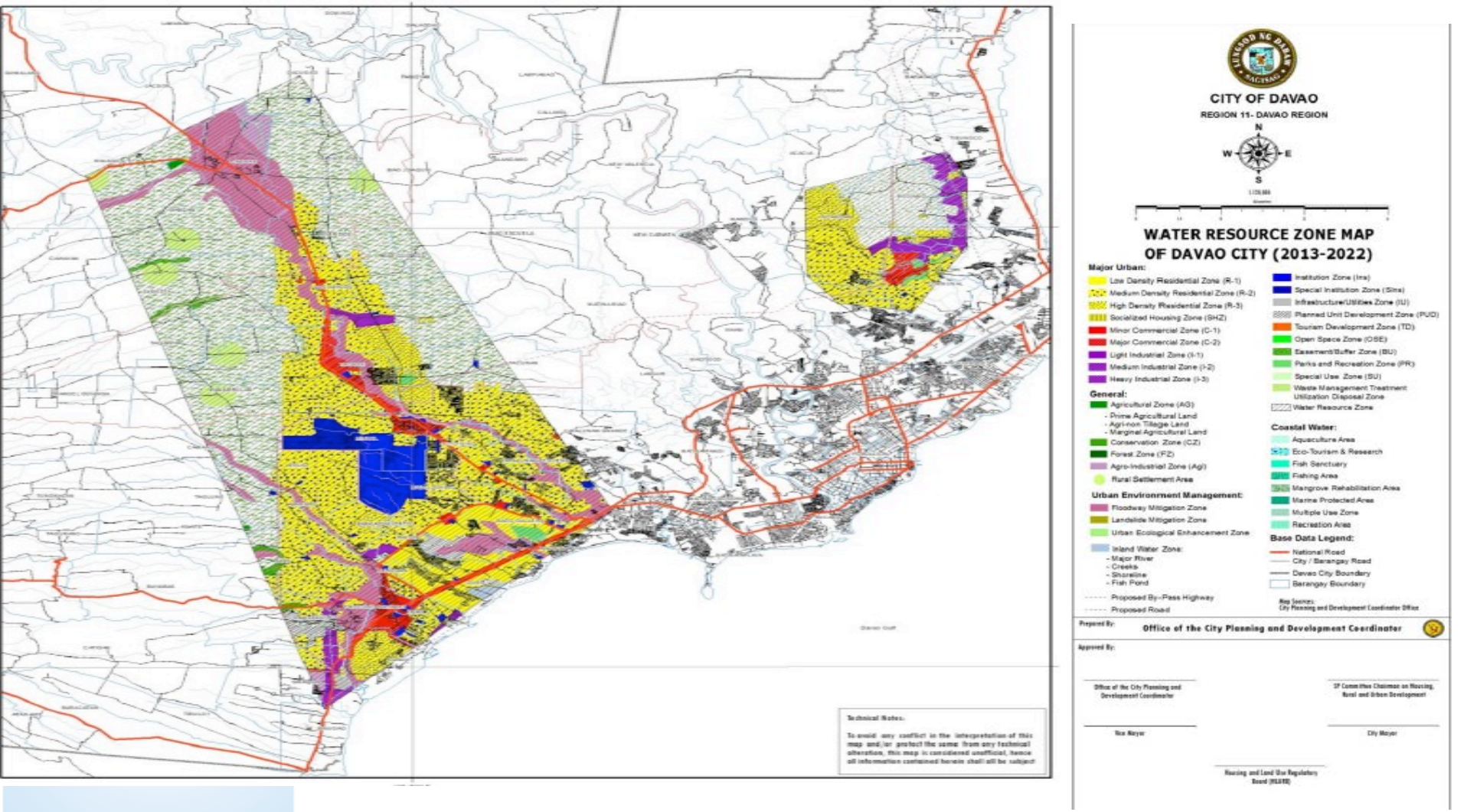

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DOST S&T Action Frontline for Emergencies and Hazards (SAFE) Program

Emergency response program and as an institutional system for both emergency- or hazard-related R&D and technology transfer

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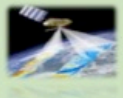
CLIMATE CHANGE

R&D ROADMAP













2017

2018

2019

2020

2021

Assessment of ecosystems services of AANR sector

- Development of decision support systems for selected ecosystems
- Gender-based analysis on the impacts of the project to the community
- Techno-transfer of the outputs of the projects

Development of decision support systems for selected ecosystems

- Development of decision support systems for selected ecosystems
- Gender-based analysis on the impacts of the project to the community
- Techno-transfer of the outputs of the projects

Rehabilitation strategies for critical mangrove and coastal forest

- S and T based rehabilitation of critical mangrove areas
- Gender-based analysis on the impacts of the project to the community
- Techno-transfer of the outputs of the projects

Monitoring and detection of ecosystems changes

- Monitoring and detection of ecosystems changes
- Off-site and on-site studies on the effect of different stressors to selected crops and pest management

S&T Action Frontline for Emergencies and Hazards Program (SAFE)

- Rehabilitation of vulnerable ecosystem to CC
- Enhancement of resiliency of communities

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Davao Region SAFE Program

Establishing Disaster and Climate Resilient Communities: Promoting Sustainable Behaviors towards Biodiversity and Climate Change

COMPONENT I. Developing Adaptive Capacity and Empowerment of Vulnerable Coastal Communities.

COMPONENT II. Restoring Ecological Resilience through locally managed Marine Protected Areas: Opportunities for Better Lives and Livelihood

COMPONENT III. Monitoring, Evaluation and Sustainability

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Accelerate construction of disaster- and climate-resilient small-scale irrigation systems and retrofit existing ones. Irrigation systems must be disaster- and climate resilient and compliant with construction standards. Priority will be given to small and communal irrigation systems, especially water harvesting technologies. Large-scale irrigation systems will be constructed if deemed hydrologically appropriate (i.e., water source is available and stable) and economically feasible.

Improve irrigation services for Filipino farmers

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Effective and efficient water saving and management technologies will be promoted to cushion the impact of El Niño. Moreover, an integrated watershed management approach will be implemented to sustain soil productivity and water efficiency, particularly in the 143 critical watersheds in the country and community-based irrigation projects in areas not served by national irrigation systems (f) prioritize small over large irrigation projects and rehabilitation over construction of facilities; and (g) conduct complete technical work and site validation in the project planning stage to eliminate the causes of delays in project implementation.

Improve irrigation services for Filipino farmers

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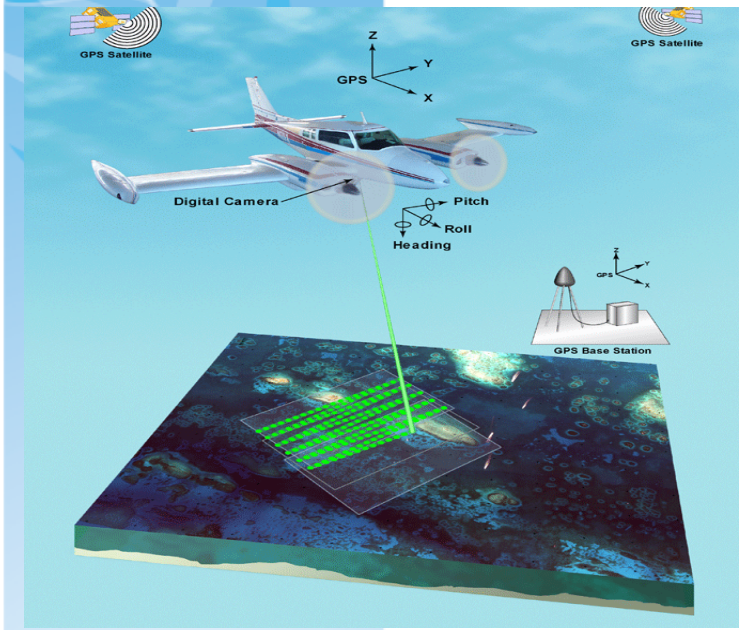

Enhancing geo-hazard maps through LiDAR

Using LiDAR technology and computer-assisted analysis in the identification of areas that are flood prone

Produce detailed resource maps using LiDAR for various applications:

- production of high value crops
- irrigation assessment
- aquaculture production
- forest protection
- discovery of renewable energy sources

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Keys for implementation of strategies:

- Multi-stakeholder engagement, collaboration, and commitment
- Sharing of data, knowledge and expertise, facilities, and other resources
- Capacity-building and investing in technologies
- Aligning efforts by setting the Agenda and Roadmap
- Lobby policy support

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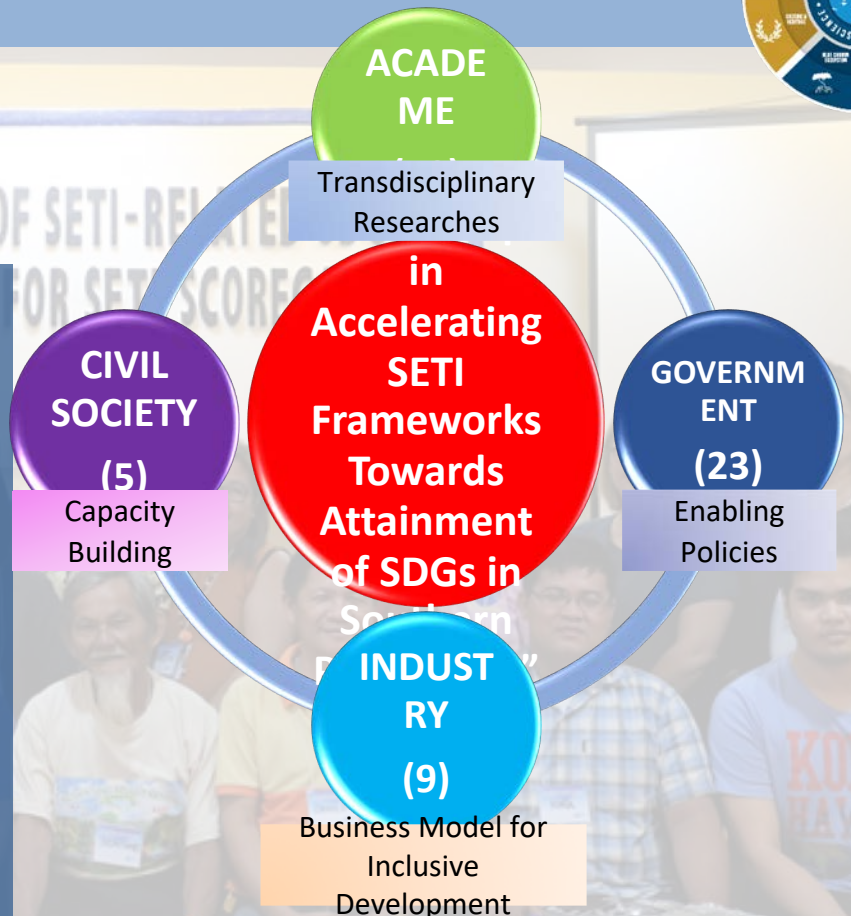
HELP DAVAO NETWORK

SUCCESS STORY OF DAVAO REGION PARTNERSHIP:

BUILDING, STRENGTHENING AND SUSTAINING PARTNERSHIPS IN SETI

- *Sustained partnerships and commitments between and among the Quadruple Helix (Academe, Government, Industry, and Civil Society)*
- *Provide the science for policy and practice*



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