HyDEPP

SATREPS
Science and Technology Research Partnership for Sustainable Development Program

The Project for Development of a Hybrid Water-Related Disaster Risk Assessment Technology for Sustainable Local Economic Development Policy under Climate Change in the Philippines

気候変動下での
持続的な地域経済発展への政策立案のための
ハイブリッド型水災害リスク評価の活用

Presenter: **Patricia Ann J. Sanchez, PhD**
Professor, University of the Philippines Los Baños

UPLB Interdisciplinary Studies Center for Water

VISION

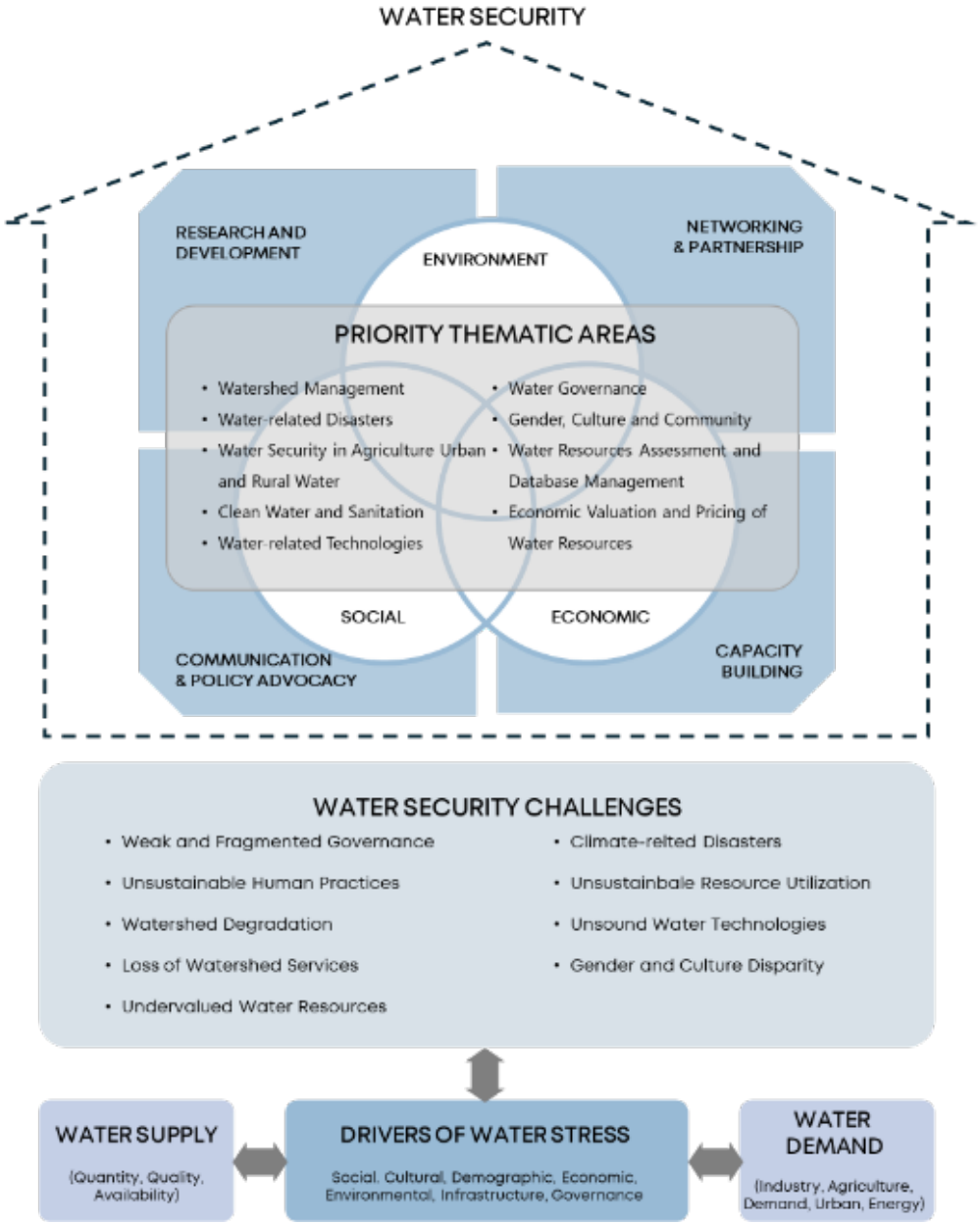
Center for excellence in research, development and extension towards water security for all

MISSION

Generate science-based information for efficient, equitable and sustainable management of water resources

GOAL

Sustainably manage water resources for national development through interdisciplinary research, responsive policy, partnership and capacity-building



University of the Philippines Los Baños
Interdisciplinary Studies Center for Water

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PARALLEL INTERNATIONAL PROJECT

◆Project Title

The Project for Development of a Hybrid Water-Related Disaster Risk Assessment Technology for Sustainable Local Economic Development Policy under Climate Change in the Philippines

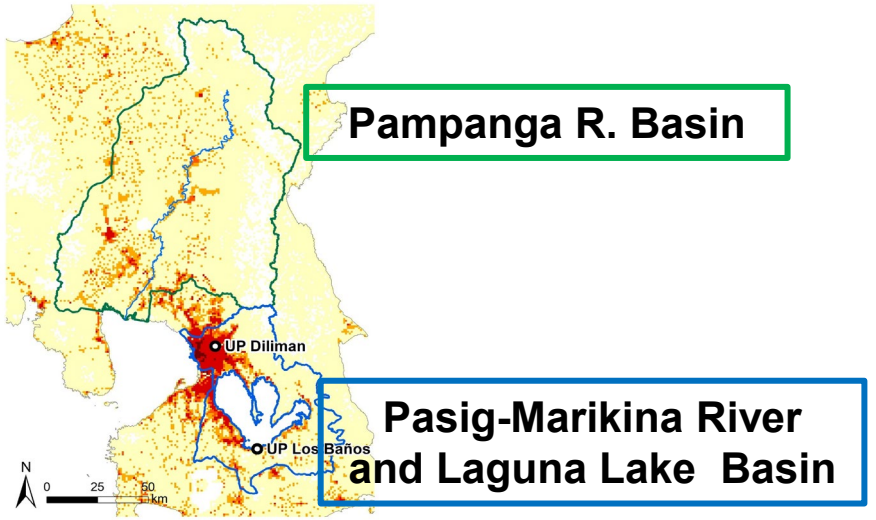
◆Project Purpose

Policy recommendations for sustainable economic development in urban and rural areas under climate change are formulated based on hybrid water-related disaster risk assessment technology covering climate change, hydrology, agriculture, and socio-economic activity in target basin.

◆Principal Organizations

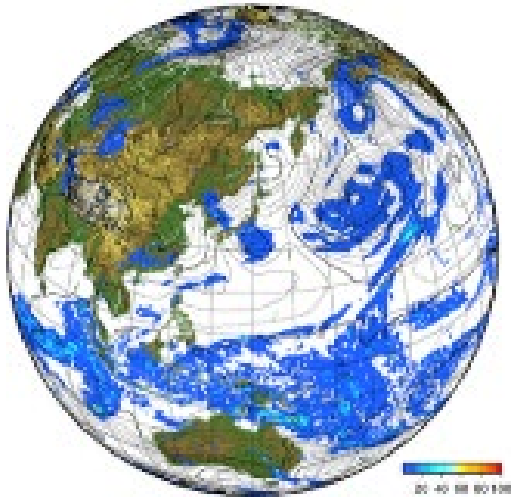
Philippines: University of the Philippines Los Baños (UPLB)
Japan: The University of Tokyo(UT)

◆Project Period: 2021.6.3-2026.6.2

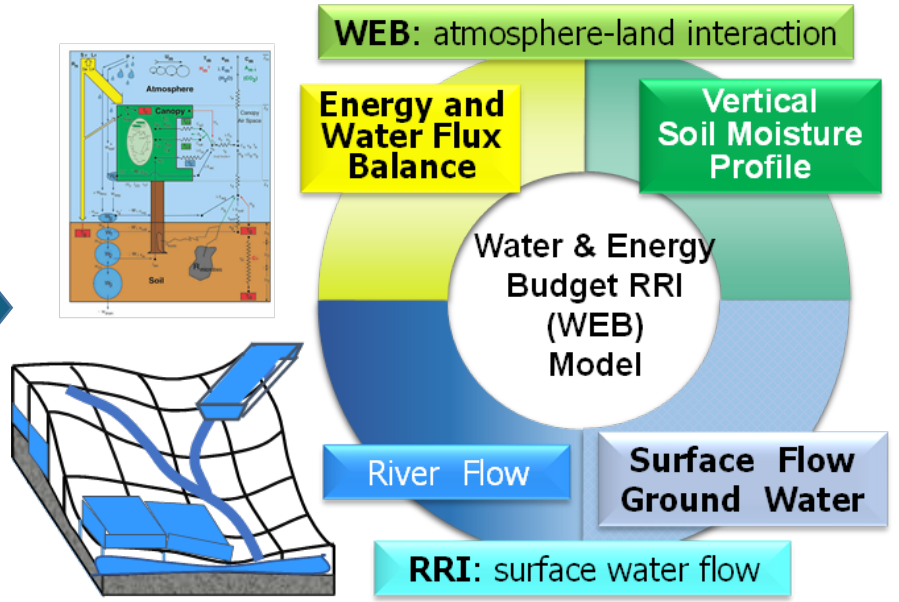


Hybrid water-related disaster risk assessment technology

Climate Model

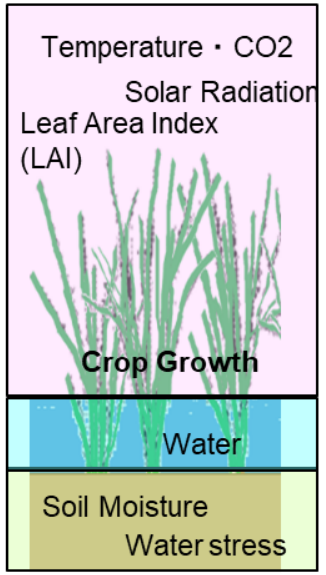


Hydrological model



Agricultural model

(SIMRIW)

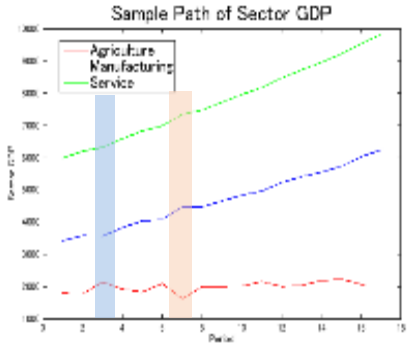


Overall Goal

The policy recommendations are reflected to policies/plans of national and/or local governments, in order to achieve the sustainable economic development by improving water-related disaster resilience and to promote balanced national land development.

Socio-economic model

Prediction of future local development scenario with/without adaptation measures



Estimation of yield loss due to flood and drought

Implementation Structure

As of June 30, 2021

Joint Coordinating Committee

Philippine side

Cooperative Organization

- Department of Science and Technology (DOST)
- Department of Public Works and Highways (DPWH)
- Laguna Lake Development Authority (LLDA)
- Metropolitan Manila Development Authority (MMDA)

Project Director

Fernando C. Sanchez Jr.,

University of the Philippines Los Baños (UPLB)

Project Manager

Patricia J. Sanchez,
School of Environmental Science and Management (SESAM), UPLB

Members

Representative Research Institution

- UPLB

Cooperative Research Institution

- University of the Philippines Diliman (UPD)
- University of the Philippines Mindanao (UPMin)

Japanese side

Research Team Member
(ICHARM/ Cooperative Organizations)

Project Leader: Dr. Miho Ohara

Long-term expert
- Coordinator

Short-term experts
- Application for data uploading
- Flood and drought risk assessment
- Resilience assessment
- Simulation of future scenarios of local economic development

Cooperating Organization

- University of Tokyo
- Tohoku University
- University of Shiga Prefecture
- University of Nagoya
- Kyoto University

JICA

- Member of Mission Dispatched by JICA
- JICA Philippine Office
- Other person(s) concerned appointed by JICA

Observer/Support

- Embassy of Japan
- Japan Science and Technology Agency (JST)

HyDEPP | Four Study Groups

Group 1: Data Collection and Sharing

Dr. Roger A. Luyun, Jr
College of Engineering and Agro-Industrial Technology, UPLB

Dr. Masaki YASUKAWA
Earth Observation Data Integration & Fusion Research Initiative
University of Tokyo

Dr. Mamoru MIYAMOTO
ICHARM

Group 2: Assessment of flood and drought risk

Dr. Aurelio Delos Reyes, Jr.
College of Engineering and Agro-Industrial Technology

Dr. Koki HOMMA
Graduate School of Agricultural Science, Tohoku University

Dr. Mohamed RASMY Abdul Wahid
ICHARM

Group 3: Assessment of water-related disaster resilience

Dr. Patricia Ann J. Sanchez
School of Environmental Science and Management (SESAM), UPLB

Dr. Kentaro TAKI
University of Shiga Prefecture

Dr. Miho OHARA
ICHARM

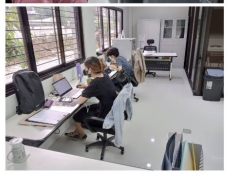
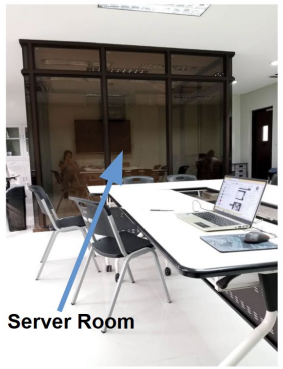
Group 4: Sustainable local economic development

Dr. Ma. Agnes O. Catelo
College of Economics and Management, UPLB

Dr. Agnes C. Rola
College of Public Affairs and Development, UPLB

Dr. Tomohiro TANAKA
Graduate School of Engineering, Division of Civil and Earth Resources Engineering, Kyoto University

HyDEPP | Server room and HYDEPP SATREPS Office set up

- SATREPS office in UPLB already in use by Project staff in UPLB
- Server room ready and awaiting arrival of servers (server racks ready; servers arriving before April)

HyDEPP | Updates

Activities	Status update
• Household Survey (finalize interview sheet for socioeconomic impact of floods and droughts, incorporating resilience indicators and data needs for agent-based model)	


Municipality	Rice Farmers	HVC Farmers	Fisherfolks	Total HH Sample	HH Surveyed	% Completed
Bay	20	0	56	76	76	100
Pila	30	6	84	120	120	100
Sta. Cruz	73	7	71	151	151	100
Total				347	347	100

HyDEPP | Field Visit: for Unit B (Satellite-based inundation/agricultural monitoring)

Ocular visit: SATREPS-Japan (Dr. Homma and Dr, Sumita of Tohoku University, Japan)

last November 2022: Pampanga River Basin






HyDEPP | Output 1.6: Training on Databasing

Group1 Training in Japan

July 25 – August 2, 2023

date	content	location
2023/07/25(Tue.)	Orientation	PWRI
2023/07/26(Wed.)	Fundamentals and applications of data management	IIS, UT
2023/07/27(Thu.)	Learning analysis examples using climate prediction data and visiting Earth simulator	JAMSTEC
2023/07/28(Fri.)	Observe the manufacturing of IT platform products	Hitachi: Kanagawa Factory
2023/07/29(Sat.)	Arakawa flood control learning	UT,Arakawa
2023/07/30(Sun.)	CMIP6 Data analysis training	Tokyo
2023/07/31(Mon.)	See examples of solving social issues in the digital age	Hitachi: Origin Park
2023/08/01(Tue.)	Flood control facility tour	Metropolitan Area Outer Discharge Channel
2023/08/02(Wed.)	JAXA facility tour Presentation in Closing ceremony	JAXA PWRI

Trainee:

- Engr. Allan T. Tejada, Jr. (UPLB)
- Francis John F. Faderogao(UPLB)

HyDEPP | Training in Japan



HyDEPP | Visits and training in the Philippines in August and September

August

Dr. Rasmy provided WEB-RRI model training at UPLB

September

-Dr. Taki (Univ of Shiga Prefecture) and Dr. Nakamura(Nagoya Univ.) first visited Philippines under our project.

-ICHARM group provided Rainfall-Runoff- Inundation-Sediment model.



HyDEPP | Status of equipment

Agricultural Monitoring

Plant canopy analyser

Chlorophyll Meter

Soil Moisture Sensor

River flow monitoring

Microwave Doppler Non-contact Current Flow Velocity Meter

Bottom Sampler

Acoustic Doppler Current Profiler (ADCP)

Lake flow monitoring

x-y velocimeter

Turbidity sensor

Water quality meter

Some fun HYDEPP-SATREPS activities:

- Data Center
- Instrumentation
- Field Surveys
- Data sharing
- Training in instrumentation use
- Training for Technology Transfer
- Cascading training: University, National and local government officers
- Sponsored PhD students in Japan (3); BS, MS and PhD students from PH and JP

BRIDGING THE GAPS IN WATER RESOURCES MANAGEMENT POLICIES & PROGRAMS IN PAMPANGA RIVER BASIN

PATRICIA ANN J. SANCHEZ, *Ph.D.*
Professor, UPLB SESAM
Chair, UPLB IdSC Water

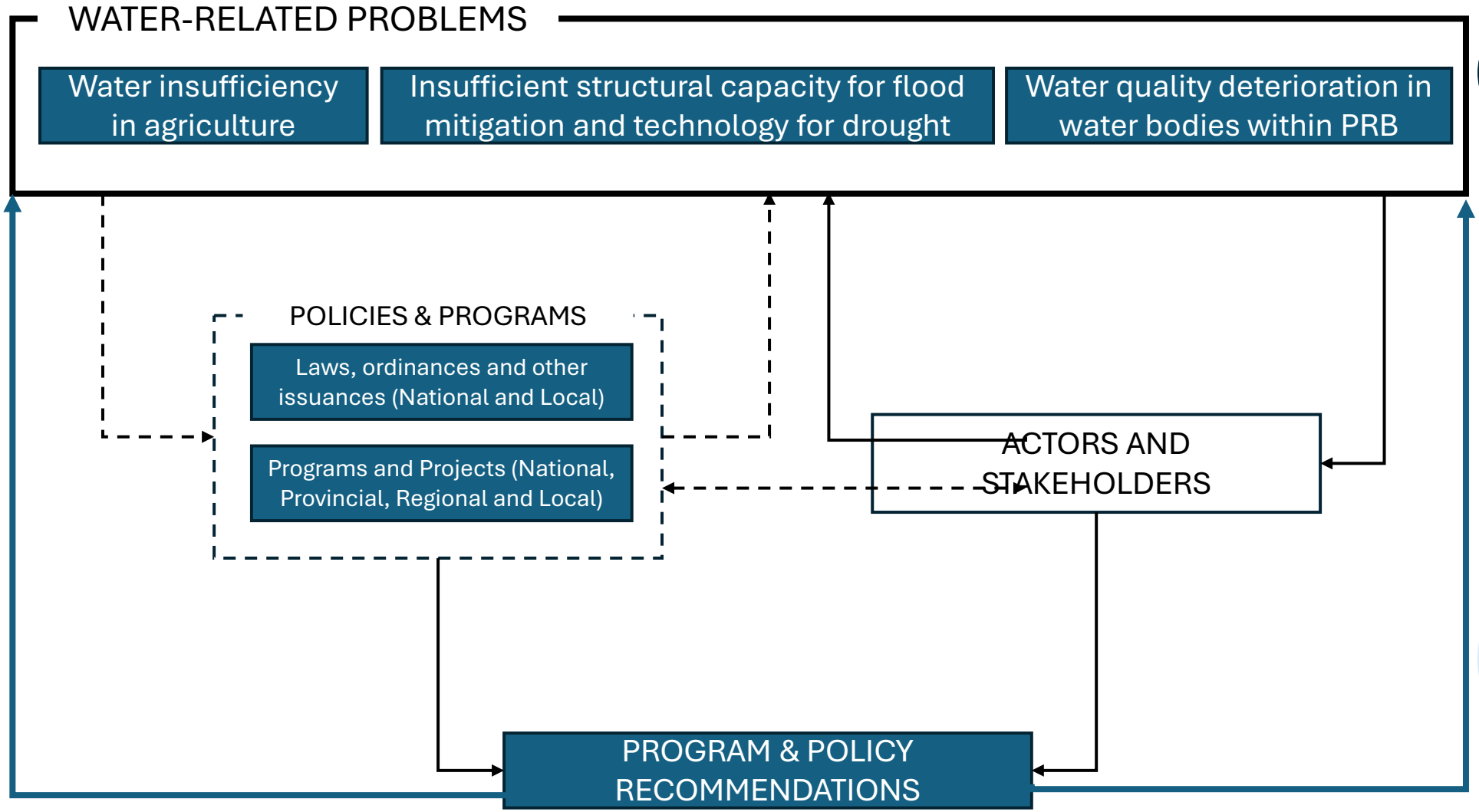
BACKGROUND

Pampanga River Basin (10,061 km^2) is situated in Central Luzon servicing the provinces of Bulacan and Pampanga.

Economic importance: **source of water for irrigation, hydropower, domestic and industrial** uses.

Major source of livelihood within the basin: **farming, fishing and cottage industries** providing rice, corn, sugarcane and tilapia as major agricultural products (*Sanchez, Wang and Koike, 2011*).

The study aims to augment a collaborative project with Japanese universities and research organizations by current state of water resources in Pampanga River Basin by setting up baseline information on what existing policies and programs are in place



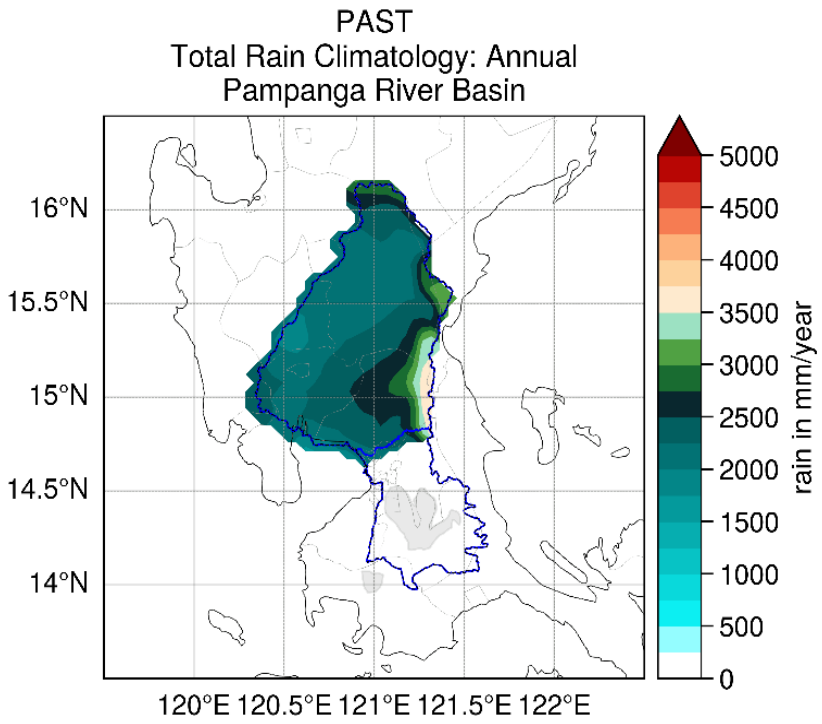
Conduct preliminary hydrological simulations in relevant sites of Pampanga River Basin for quantifying water supply, possible water-related hazards, etc.

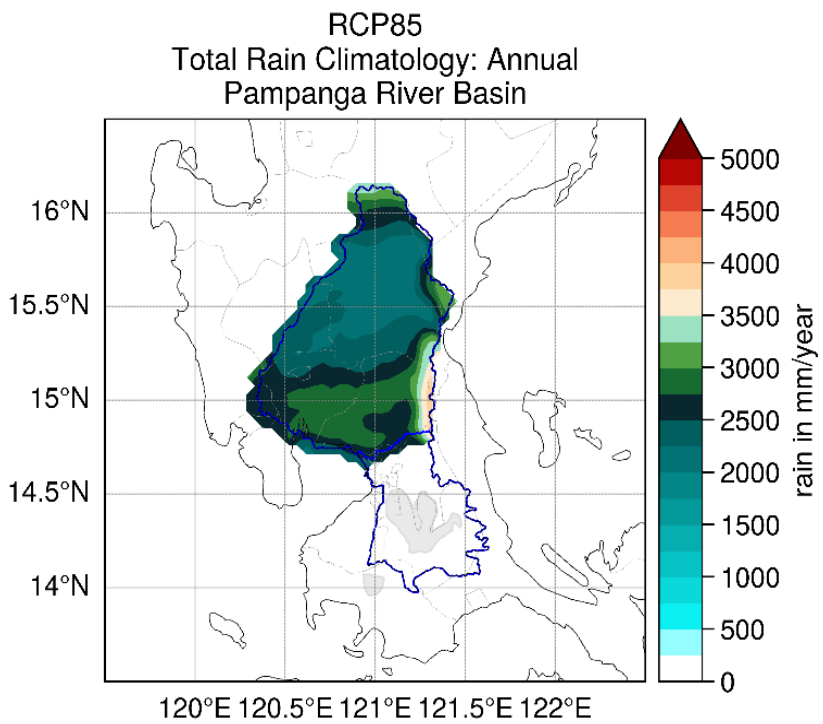
Conduct networking and coordination activities with different CUs and agencies (private and government)

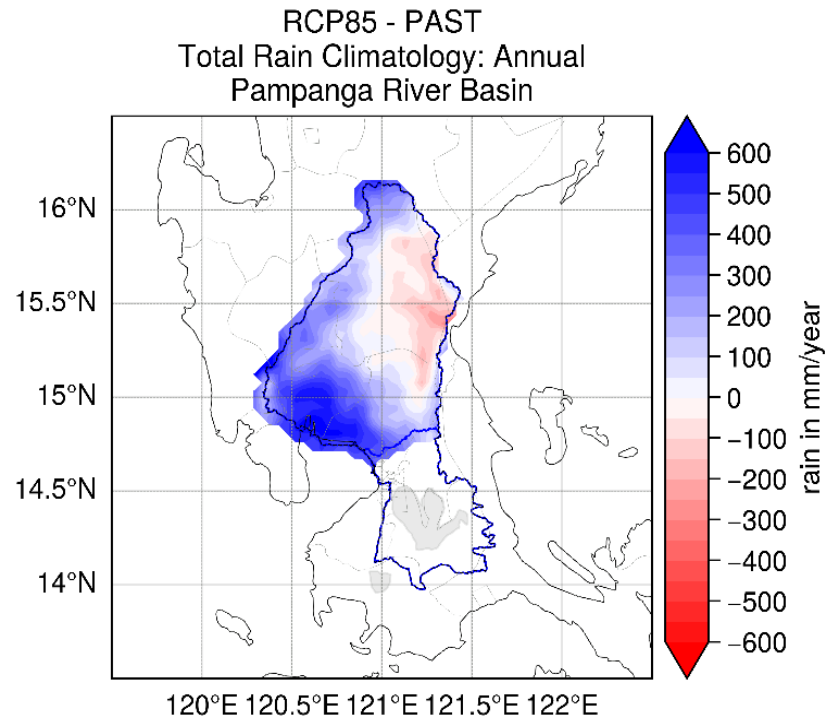
Capacitate local government units and other agencies in various technologies for floods and droughts)

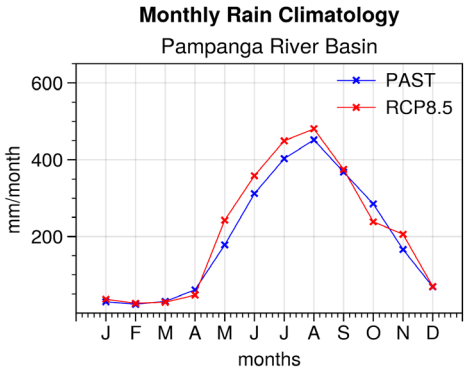
To identify policy gaps by conducting extensive review of literature on policy and programs (in both national and local policies) for water resources, climate extremes, and water quality management in Pampanga River Basin

CHANGE IN ANNUAL RAINFALL CLIMATOLOGY (RCP 8.5 scenario)







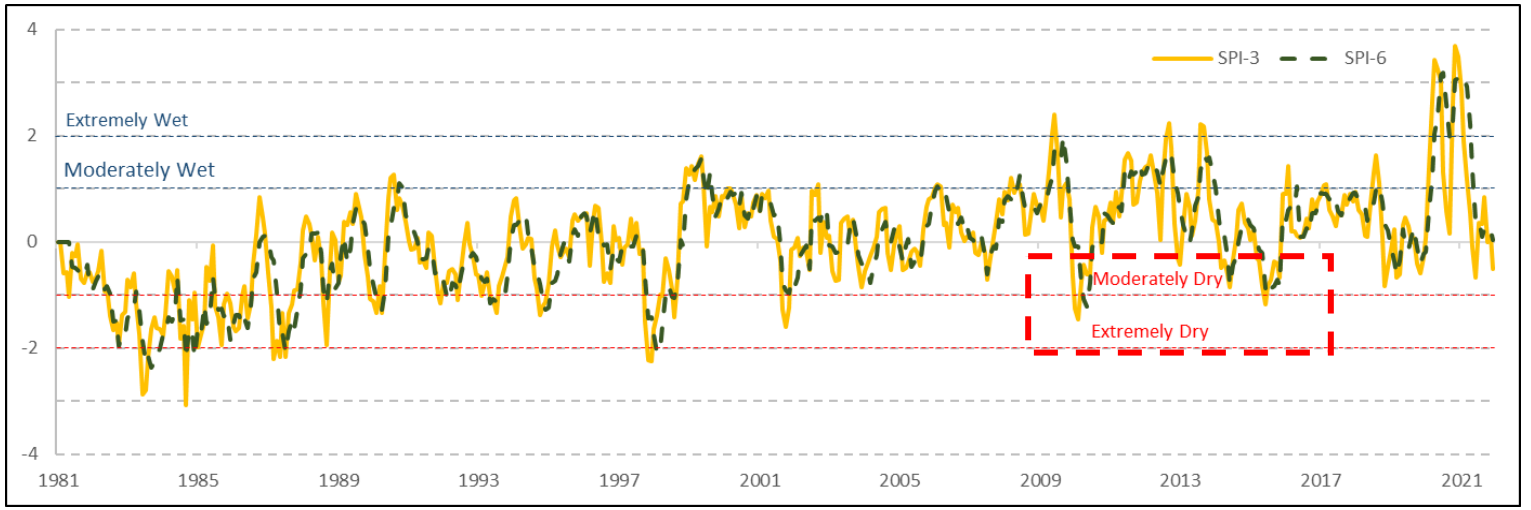


- Increase in mean annual rainfall over Pampanga-Marikina-Laguna-Lake Basin
- **Increase** in **western portion** of Pampanga River Basin
- **Decrease** in **eastern portion** of Pampanga River Basin
- According to the dynamically downscaled climate model, future climate change is projected to result in higher temperatures, increased rainfall during the rainy season and associated increases in river discharge, more frequent extreme rainfall events, and an advance in the timing of the rainy season.

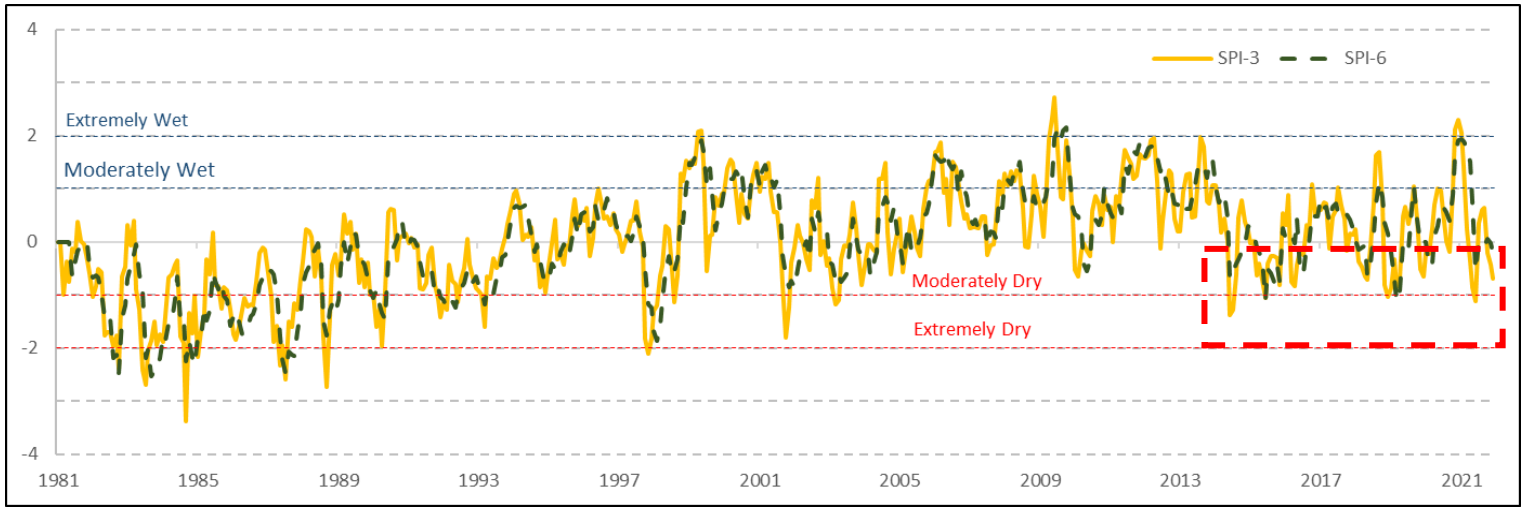
DROUGHT ANALYSIS OVER PAMPANGA RB

Based on calculated 3-month and 6-month Standard Precipitation Index (SPI) using monthly rainfall data from MERRA-2

SPI-3 and SPI-6 graph for Angat Dam from 1981-2021.



SPI-3 and SPI-6 graph for Pantabangan Dam from 1981-2021.



REAL-TIME FLOOD MONITORING SYSTEM (Typhoon Karding flood detection)

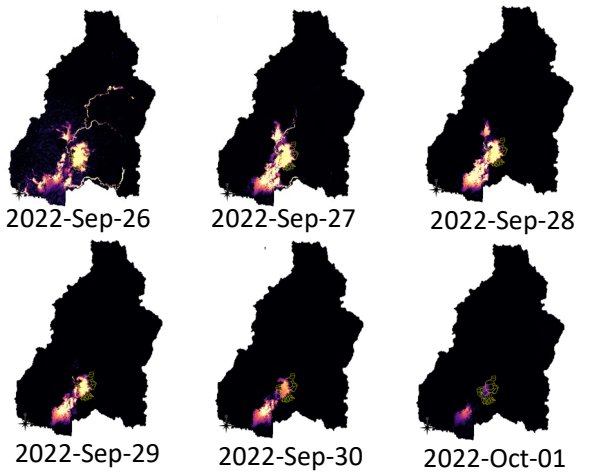


Figure1:RRI Time series inundation simulation results and field survey

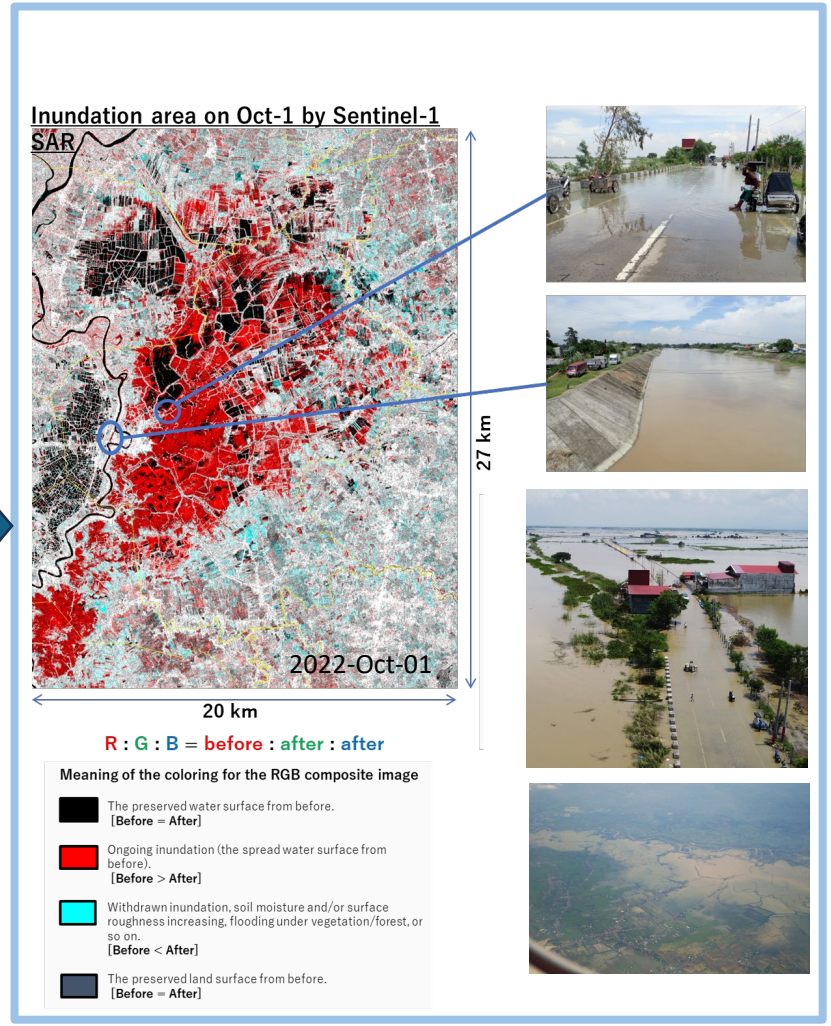
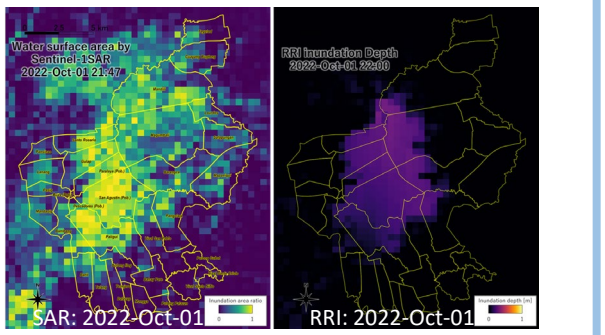
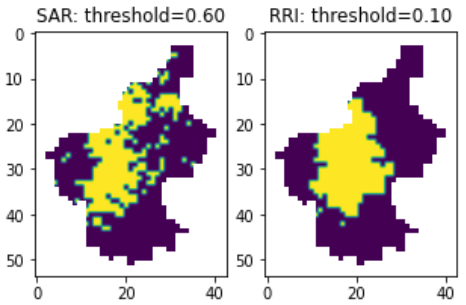


Figure2: Satellite observation (Sentinel-1 SAR) inundation analysis results and field survey



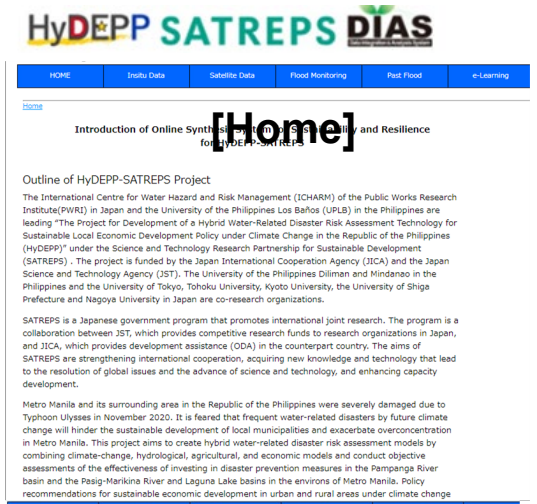


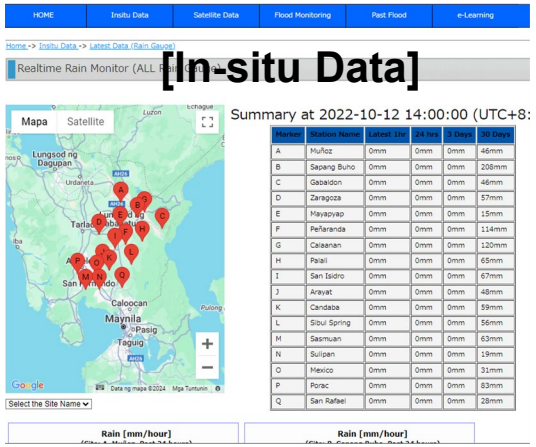
	Predict positive Number of pixels with **Inundation** for RRI	**Predict negative** Number of pixels with **No Inundation** for RRI
Actual Positive Number of pixels with **Inundation** for SAR	**214**	92
Actual Negative Number of pixels with **No Inundation** for SAR	69	**629**

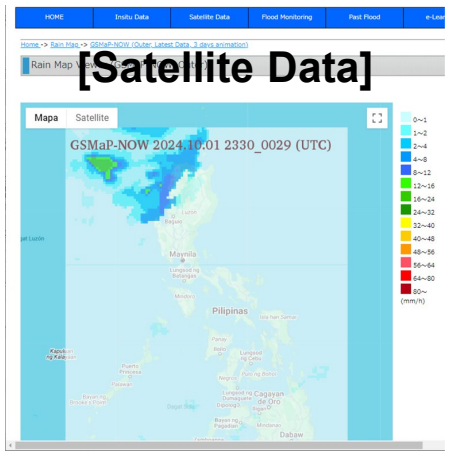
Accuracy = 0.84

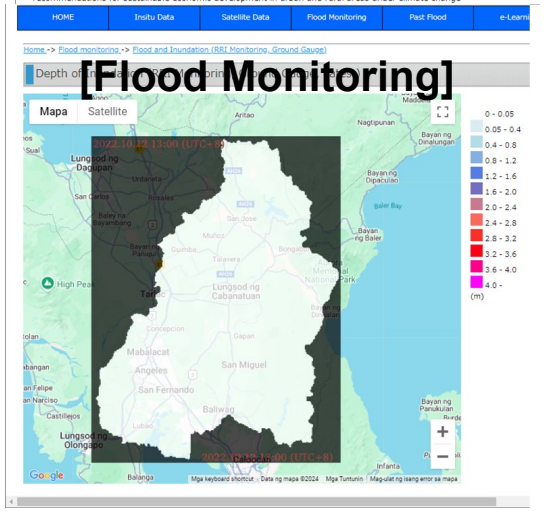
Figure3: Verification of the accuracy of RRI

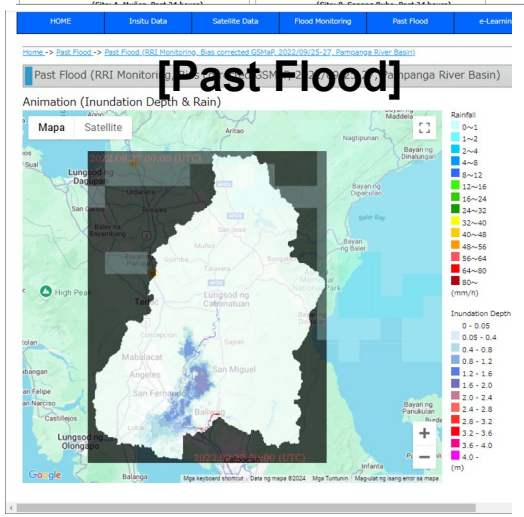
ONLINE SYNTHESIS SYSTEM FOR SUTAINABILITY & RESILIENCE (OSS-SR)

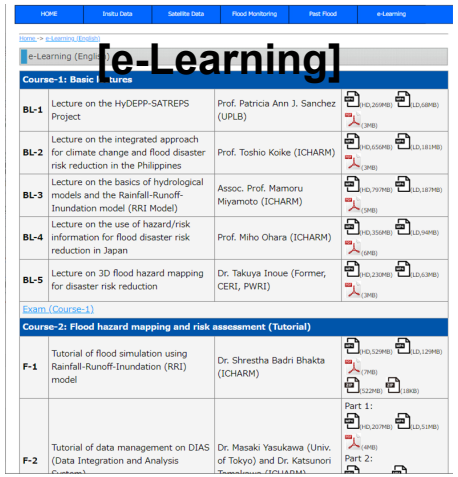


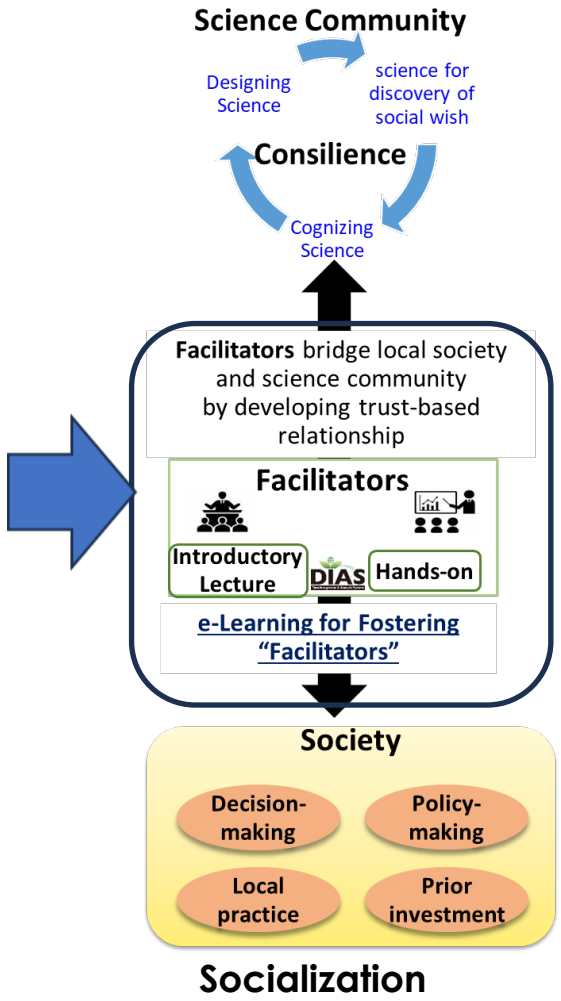




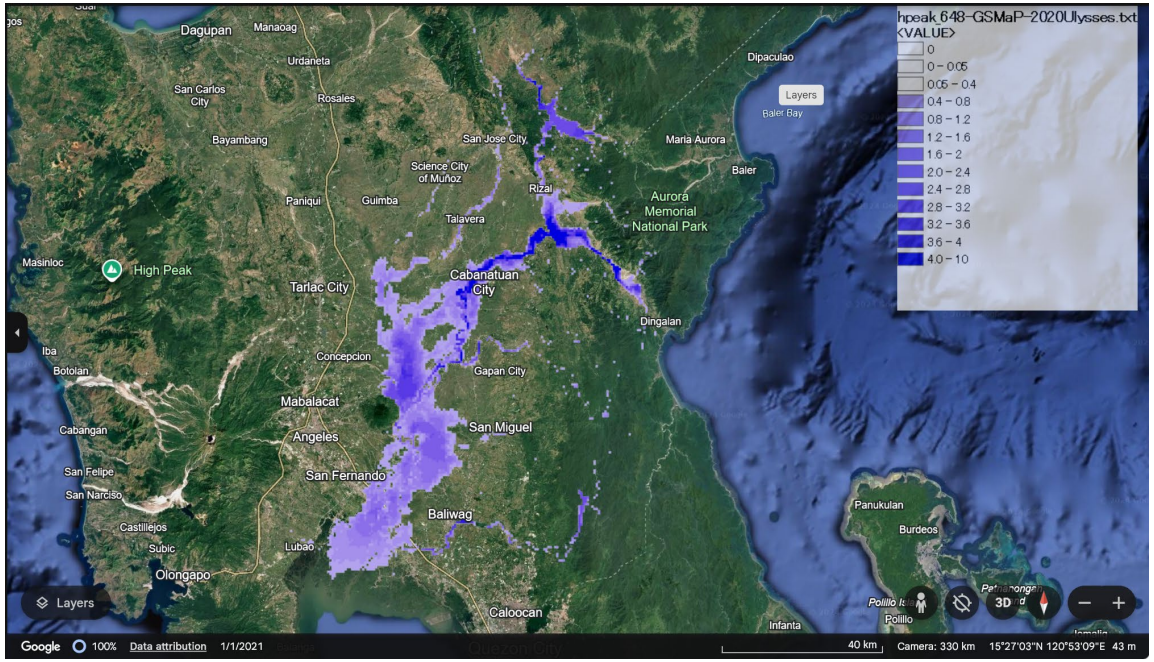




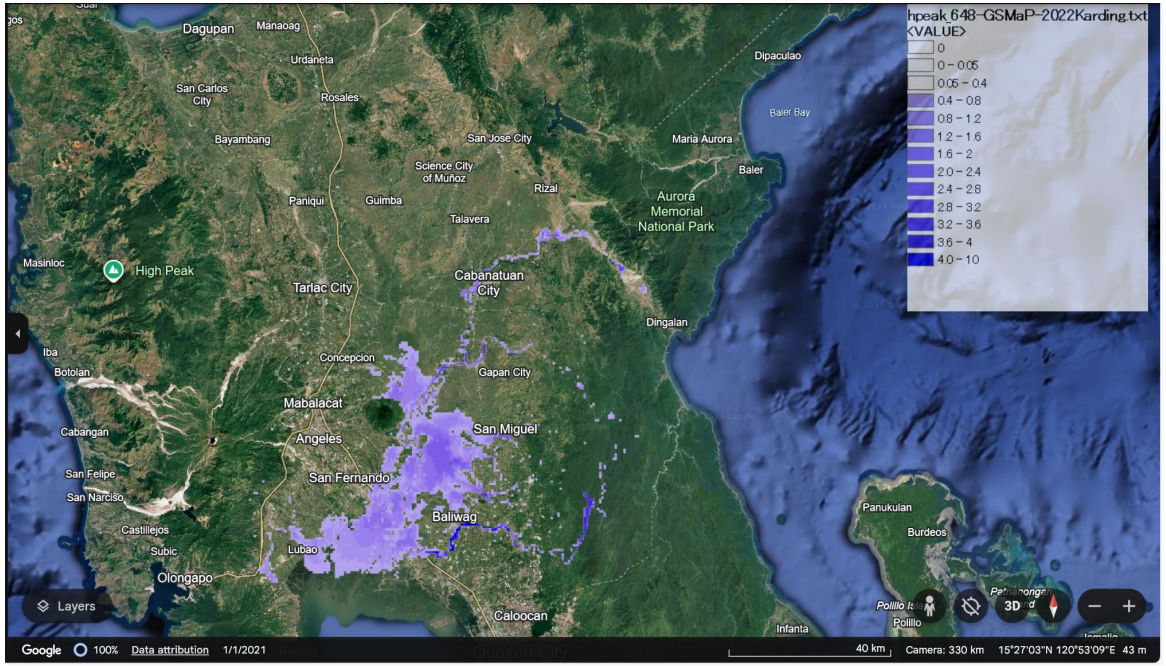




FLOOD MONITORING AND INUNDATION MAPPING FROM OSS-SR



Flooding in Pampanga RB during Typhoon Ulysses (2020)



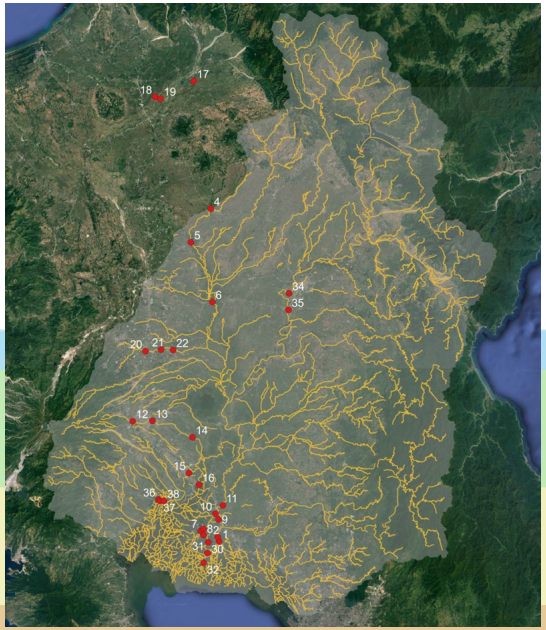
Flooding in Pampanga RB during Typhoon Karding (2022)

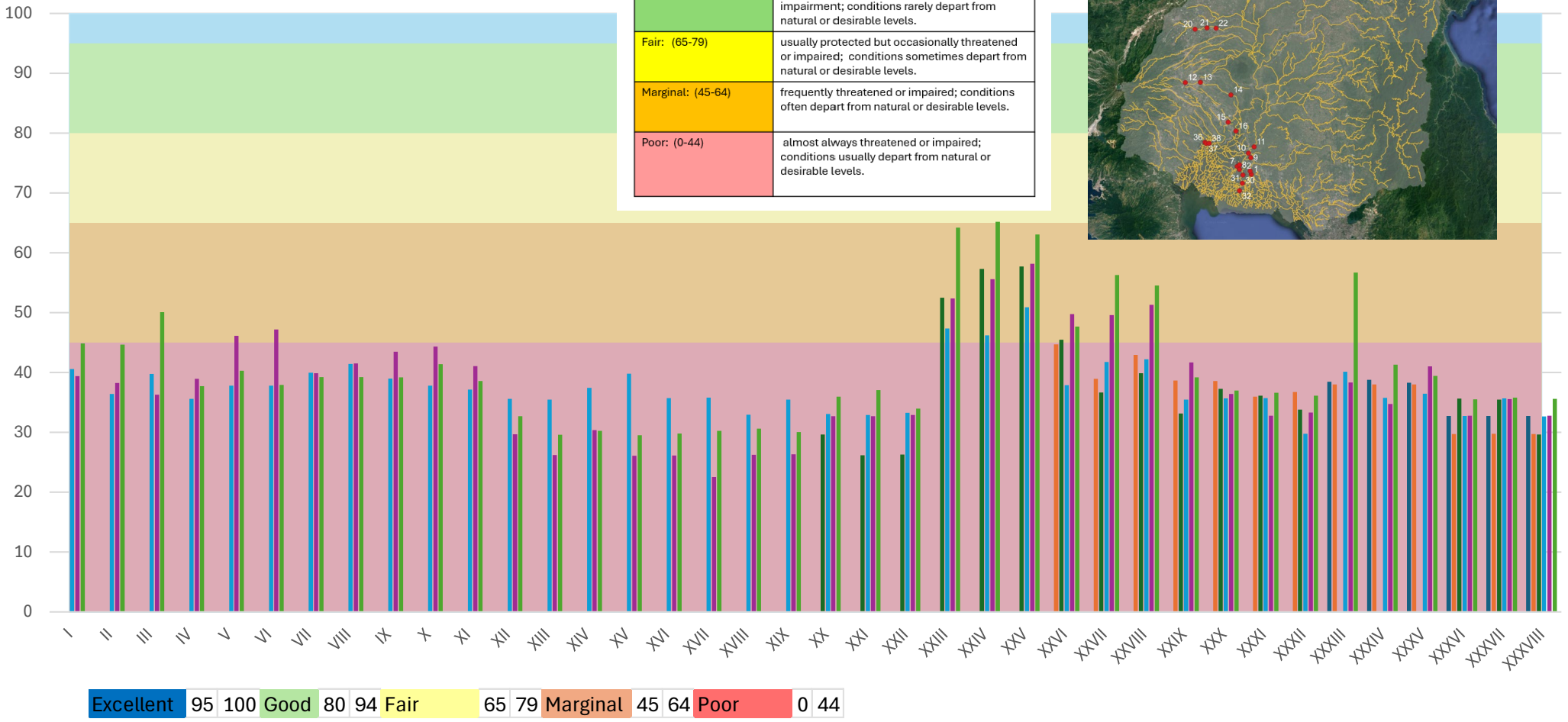
WATER QUALITY INDEX (CCME): *2018-2022*

WATER QUALITY INDEX (CCME)

- Comparison of 38 water quality monitoring stations
- Timeline: 2018- 2022
- Based on the number of failed tests (not meeting the standards) and number of tests conducted in a year

Excellent: (95-100)	protected with a virtual absence of threat or impairment; conditions very close to natural or pristine levels.
Good: (80-94)	protected with only a minor degree of threat or impairment; conditions rarely depart from natural or desirable levels.
Fair: (65-79)	usually protected but occasionally threatened or impaired; conditions sometimes depart from natural or desirable levels.
Marginal: (45-64)	frequently threatened or impaired; conditions often depart from natural or desirable levels.
Poor: (0-44)	almost always threatened or impaired; conditions usually depart from natural or desirable levels.





Excellent	95	100	Good	80	94	Fair	65	79	Marginal	45	64	Poor	0	44

STN No	STN ID
I	Baliwag-Bustos Bridge
II	Pulilan-Plaridel Bridge
III	Expressway Bridge (Angat)
IV	Pasang Inchic Bridge
V	San Vicente Bridge 3
VI	Rio Chico Bridge
VII	Expressway Bridge (Pampanga)
VIII	Sulipan Bridge
IX	Calumpit Bridge
X	Near P. Mercado Residence
XI	Near Villa Lourdes Resort
XII	Angeles River 1
XIII	Angeles River 2
XIV	Mexico River
XV	San Fernando River 1
XVI	Sto. Tomas River
XVII	Minalin River
XVIII	Sasmuan River 1
XIX	Sasmuan River 2
XX	Cut-Cut Bridge
XXI	Santiago Bridge
XXII	Near Green Village
XXIII	Bangkung Malapad
XXIV	Macabebe Point
XXV	Bancal Pugad
XXVI	Near Armando Aguinaldo F.P. Brgy. Consuelo Macabebe Pampanga 300 meters away from Station 1 Brgy.
XXVII	Consuelo Macabebe Pampanga 300 meters away from Station 2 Brgy.
XXVIII	Consuelo Macabebe Pampanga
XXIX	Kalsadang Putol Bridge
XXX	San Juan Bridge
XXXI	San Miguel Bridge
XXXII	Bridge near San Agustin Market
XXXIII	Bongabon River Irrigation System
XXXIV	Vergara Bridge
XXXV	Sta. Rosa Bridge
XXXVI	San Pablo Bridge
XXXVI I	San Pedro Foot Bridge
XXXVI II	Plaza Burgos Bridge

POLICY GAPS AND RECOMMENDATIONS

	IDENTIFIED ISSUES	RECOMMENDATIONS
Water Sufficiency 1. **Flooding**	1.1 Lack of data to study /observe flood patterns in Pampanga - on going collaboration between Pampanga PDRRMO and PAGASA to establish water level markers	1.1.1. Review existing **instrumentations** and **monitoring activities** (e.g. DOST ASTI, DOST PAGASA, NIA, Private companies) to maximize resources. Allot **funds** for ***maintenance, operational and labor costs***. Invest in personnel capacitation and ensure regular positions for sustainability.
Water Insufficiency 2. **Agriculture**	2.1. **Fragmentation** among various national and local agencies - Case 1: ***uncoordinated protocols*** and ***operation adjustments*** for irrigation water supply especially during drought or insufficient water supply (NIA IMO-PAO-MAO-IAs) - Case 2: ***not streamlined functions*** of various agencies segmented by bureaucratic levels resulting to overlaps in functions	2.1.1. **Streamline protocols** and **operation** up to local agencies (ground implementers) through establishment of coordinating bodies (e.g. TWGs) and ensure roles and responsibilities of engaged water actors.
	2.2. **Insufficient** Disaster Fund 2.3. Unmaintained lateral canals	2.2.1. Fund allocation, Insurances (crop insurance, infrastructure insurance, etc.) 2.3.1. Technical support to IAs; Active stakeholder engagement in maintenance and operation of irrigation system

KII Respondents: Pampanga-Bataan IMO, Bulacan IMO, UPRIIS, NEDA R3, Pampanga PAO, Bulacan PAO, PAGASA-PRFFWC, DPWH, Bulacan PDRRMO, Nueva Ecija PDRRMO, DENR R3, Nueva Ecija PENRO, Pampanga PENRO, TARLAC PENRO

POLICY GAPS AND RECOMMENDATIONS

	IDENTIFIED ISSUES	RECOMMENDATIONS
3. **Water Resources**	3.1. Severe stress to water resources (high water abstraction) - Case 3: Total Water Resources R3: **7,944MCM**; Consumptive water use: **16,880MCM**. This indicates population and development needs is much greater than the capacity of its water resources (Sanchez PJ et al., 2024)	3.1.1. Increase ***water efficiency*** (e.g. water saving technologies, minimizes losses in water delivery system etc.) 3.1.2. ***Water resource capacity*** must be accounted for in development of the regional, provincial, and municipal plans
Water Quality 4. **Poor river water quality**	3.1. ***No septic*** treatment facilities (only Tarlac has this)	3.1.1. ***Fund*** allocation. Develop **low technology** but highly efficient treatment facilities. Coordinate closely with water service providers per mandated duty of wastewater treatment. 3.1.2. ***Incentivize*** municipalities and industries with good practices (non polluters)
Overall 5. **Database Management**	4.1. ***Decentralized*** and ***inaccessible data*** from various national and local agencies	4.1.1. ***Centralized database system*** from various national and local agencies which can be used for further analysis to help address local issues/ basis for policies.

KII Respondents: Pampanga-Bataan IMO, Bulacan IMO, UPRIIS, NEDA R3, Pampanga PAO, Bulacan PAO, PAGASA-PRFFWC, DPWH, Bulacan PDRRMO, Nueva Ecija PDRRMO, DENR R3, Nueva Ecija PENRO, Pampanga PENRO, TARLAC PENRO