THE FUTURE OF
GLOBAL
DISASTER
RISK REDUCTION

# PROTECTING THE ENVIRONMENT AND REDUCING VULNERABILITIES OF WATER RESOURCES IN THE PHILIPPINES

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*Professor, UPLB School of Environmental Science and Management*
*Chair, UPLB Interdisciplinary Studies Center for Water*

STRENGTHENING THE RESILIENCE of MEGACITIES THROUGH SCIENCE, TECHNOLOGY & INNOVATION

# THE PHILIPPINE CONSTITUTION AND THE ENVIRONMENT

In the **1987 Philippine Constitution,** environmental protection has been recognized. The **Article II, Section 16** stipulates 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"** which is anchored on the Sustainable Development Principles.

**Article XII, SECTION 2** states "All lands of the public domain, waters, minerals, coal, petroleum, and other mineral oils, all forces of potential energy, fisheries, forests or timber, wildlife, flora and fauna, and other natural resources are **owned by the State.**"

# VULNERABILITY

internal characteristics of a system that determine its susceptibility to harm based on :

I. **sensitivity** *(the degree to which a system is affected by external stress)* and,
II. **adaptive capacity** *(the ability to adjust to changing conditions).*

**Environmental degradation** *can cause* ***reduction to the capacity of ecosystems*** *to meet the needs of people for food and other products, and to protect them from hazards while*
**Environmental management** *can offer* ***cost-effective solutions to reducing community vulnerability*** *to disasters.*

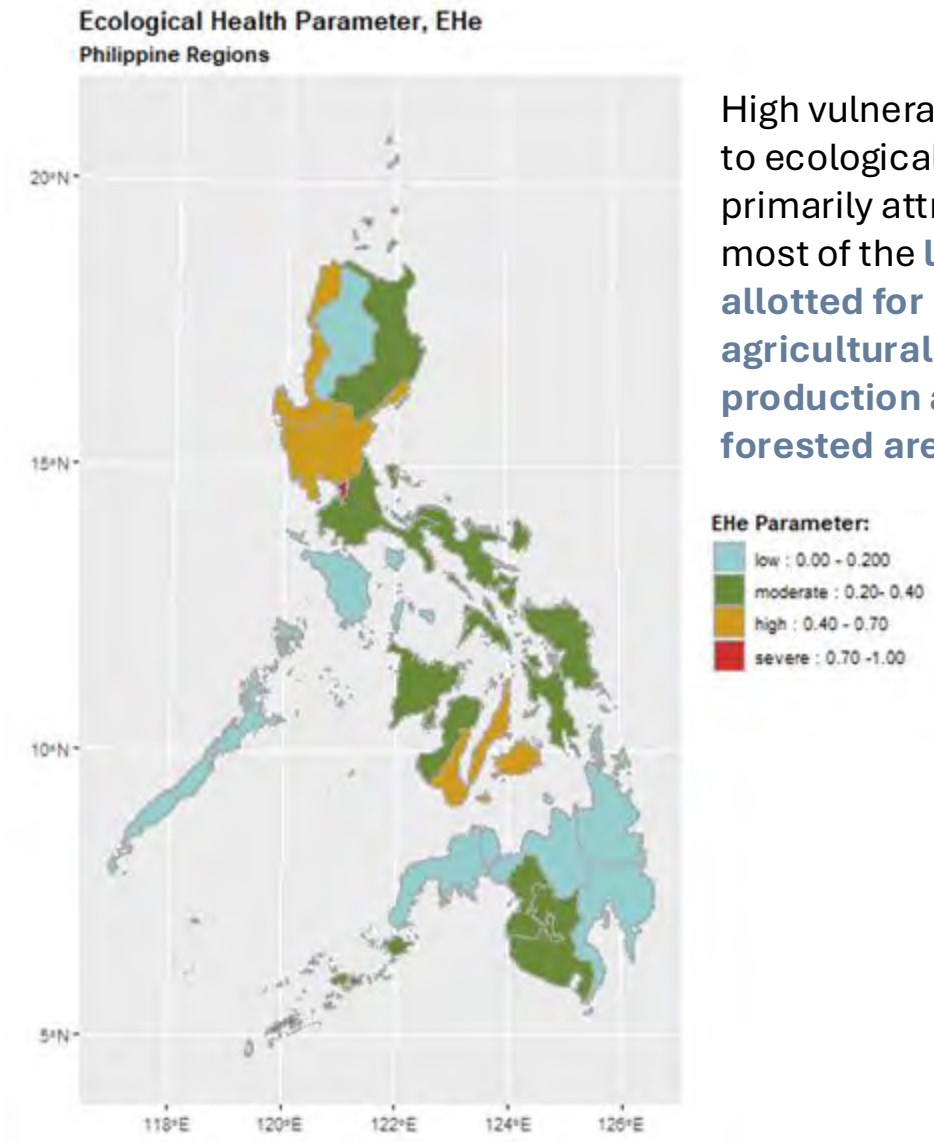
# ADDRESSING VULNERABILITY THROUGH ENVIRONMENTAL MANAGEMENT LEGISLATION

Case of Vulnerability of Philippine Freshwater use and management and the current legislative agenda


**In General,**

**The vulnerability of Philippine Freshwater Resources and Use** *must be ready in facing major challenges through technical or managerial capacity building based on the assessed vulnerability structure. .*

**Central Visayas is the most vulnerable region** *mostly due to the development pressure and its ecological health.*




High vulnerability due to ecological state is primarily attributed to most of the **land use is allotted for agricultural production and low forested area.**

Legislation that can address this vulnerability

## Sustainable Forest Management Act

## Forestland Limits Act

## National Land Use Act

Policy and sectoral alignment for these legislations

## PHILIPPINE MASTER PLAN FOR CLIMATE RESILIENT FORESTRY DEVELOPMENT

*"...Important legislations are the congressional approval of various bills declaring the forestland boundaries and the sustainable forest management act."*

Provides venue for harmonizing the operations of 117 policies and management arrangements especially in areas with overlapping tenure instruments.

## FORESTRY INVESTMENT ROAD MAP

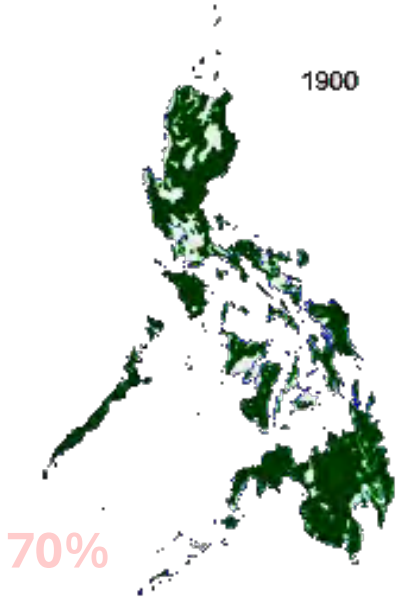
*Sustainable Forest Management (SFM) will replace Forestry Reform Code to address current and future trends in forestry.*

Investors in forest lands and forest products shall practice sustainable consumption and production patterns to prevent over extraction of resources and minimizes significant loss of biodiversity

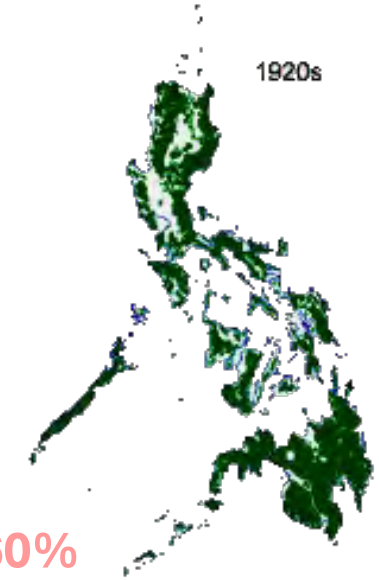
## NATIONAL ADAPTATION PLAN

*Expand and improve upon ecosystem zoning and mapping including Spatial planning that designates areas for different uses and conservation priorities/actions,*

# Vanishing Philippine Forest

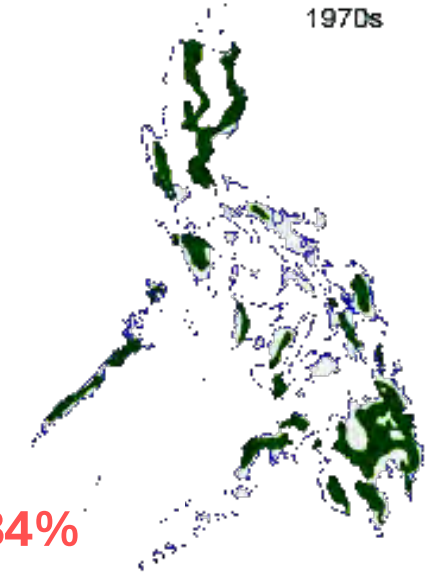



70%

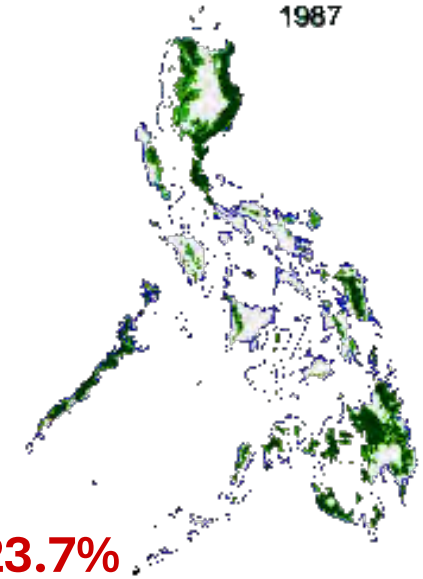



60%

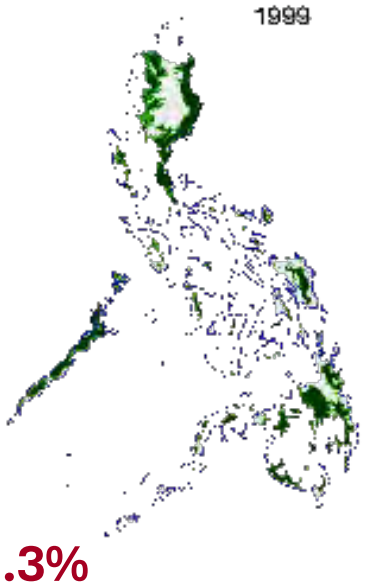

40%




34%




23.7%




18.3%

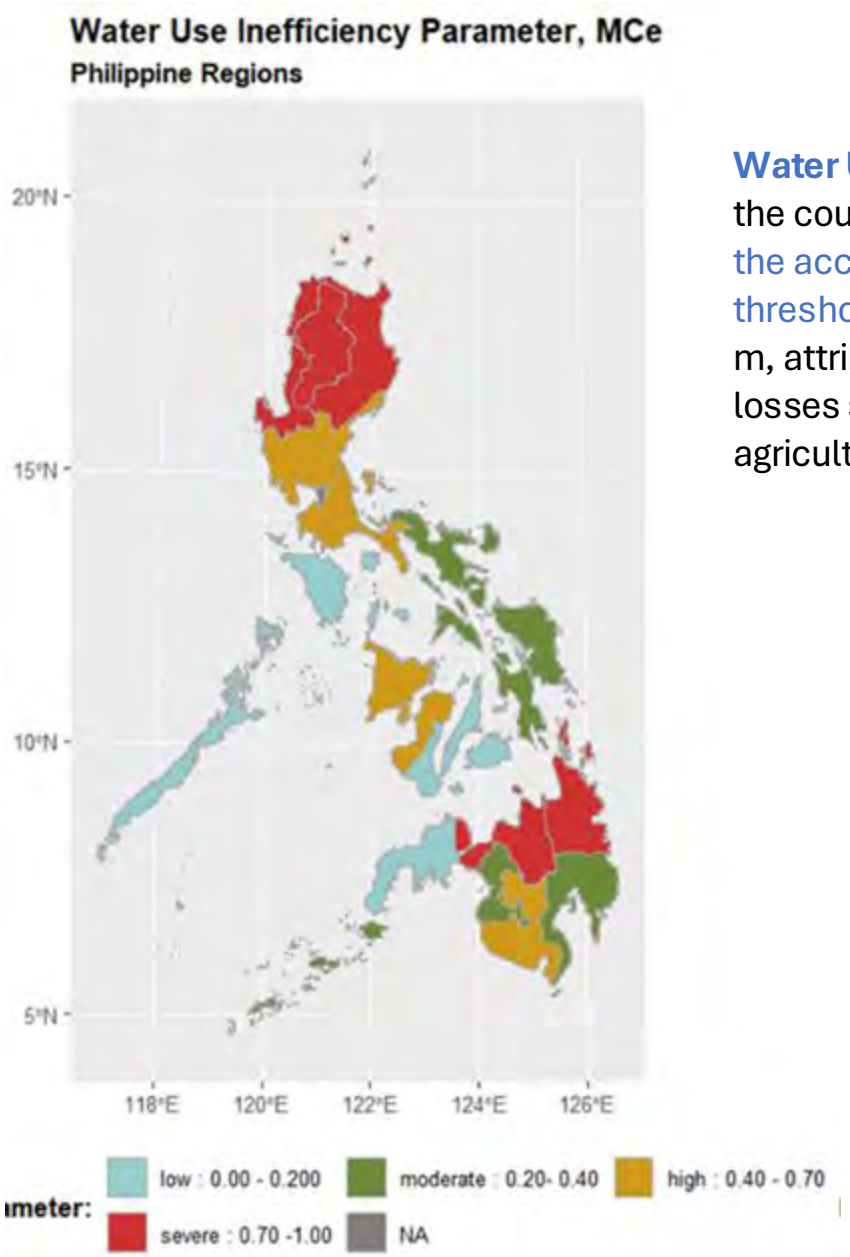
Closed Forest
Open Forest

22.6%

2010 Land Cover Map

24%

2020 Land Cover Map




**Water Use Efficiency** of the country is lower than the accepted global threshold of 40 USD/cu m, attributed to water losses specifically in agricultural water use

Legislation that can address this vulnerability

**Insertions of Additional Water Demand Management Clauses in the**

## Proposed National Water Resources Bill

Promotion and Adoption of WDM to ensure optimized water use, water conservation behaviors, and proper valuation of water economic value to encourage efficient use and conservation among others.

Policy and sectoral alignment for these legislations

## NEDA PHILIPPINE WATER SUPPLY AND SANITATION MASTER PLAN

One of the proposed strategic intervention is to conduct promotional efforts regarding **water demand management** should be supported to minimize wastage and unnecessary use of water.

# Management Capacity Parameter (MC)


**IMPROVED SANITATION INACCESSIBILITY PARAMETER**

wastewater management remains **overlooked, underfunded, and fragmentally implemented** due to the lack of a general and overarching framework and institutional body

**LEGISLATION THAT CAN ADDRESS THIS VULNERABILITY**

**Proposed National Water Resources Bill**

**POLICY AND SECTORAL ALIGNMENT FOR THESE LEGISLATIONS**

**PHILIPPINE WATER SUPPLY AND SANITATION MASTER PLAN**

Upper and Lower Houses to sponsor the creation of an **apex body** for the WSS sector and an independent economic regulator for WSS.

Formulate a policy on the imposition of fees or charges needed for water resources conservation and protection, such as:

a. **Polluter's Fee,** based on the net waste load depending on the wastewater charge formula (R.A. 9275 Clean Water Act);
b. **Raw water price**, determined by the Apex Body, considering water scarcity;
c. Appropriate **structures for payment of environmental services**.

# Management Capacity Parameter (MC)

**IWRM CAPACITY**

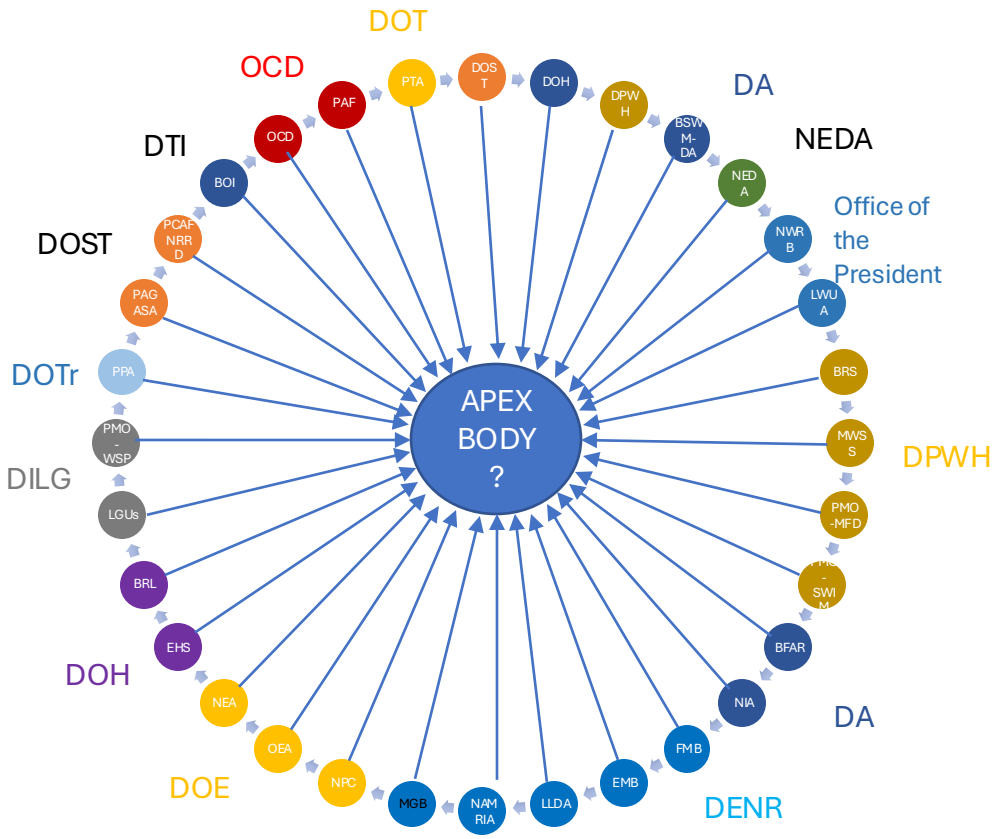
- National policies supporting IWRM ensure **alignment and harmonization, translation into actionable points, and tracking of progress.**
- IWRM subnational implementation **lack of technical personnel expertise and capacity, lack of coordination, and limited data collection**.
- **Multiple agencies** with water-related responsibilities leads to **fragmentation**.
- Challenge in financing IWRM due to **competing development priorities** in the national and subnational levels and insufficient funds for local government units.

**LEGISLATION THAT CAN ADDRESS THIS VULNERABILITY**

## Proposed National Water Resources Bill

- creation of an **Apex body**
- Establish and maintain a **centralized water resources data center**

## WATER-RELATED GOVERNMENT AGENCIES




> *"There are more than 30 water-related agencies working on water and water-related issues in the philippines. Preliminary findings of National Water Security pre-summits found that an apex body is recommended by NEDA's PDP, academe, these government agencies, private sector, etc.*

# CLIMATE CHANGE

**Moderate and/or rapid economic development** (reliant on fossil fuels) with average to **little focus on mitigation efforts could affect the intensity and distribution of precipitation and temperature** in the Philippines.

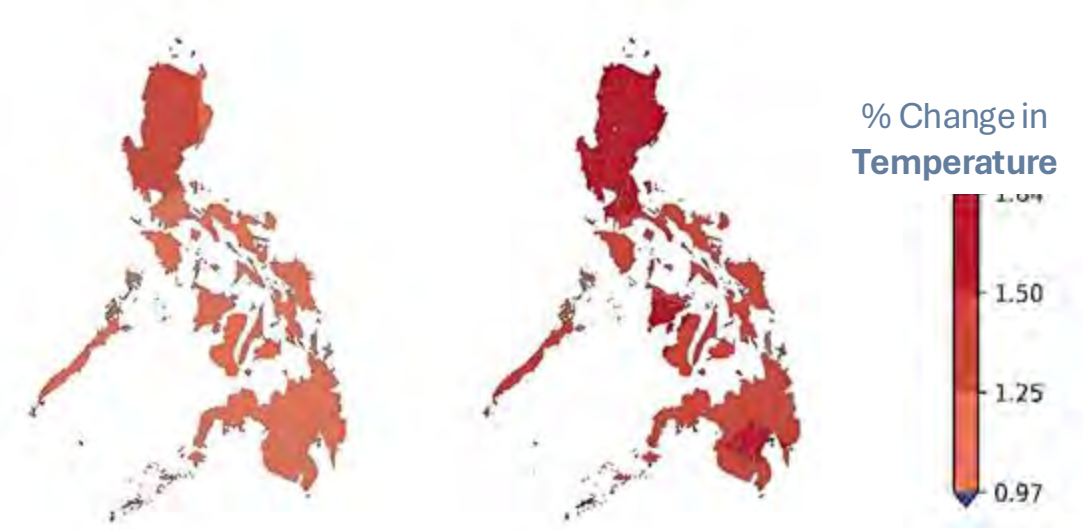
## "Business as Usual" Scenario

The current development plan, with average technological progress and moderate climate change mitigation and adaptation efforts, could result to higher temperature and rainfall in the future across the Philippines.

## "Worst-Case" Scenario

When the development is heavily reliant on fossil fuel, with less emphasis on climate change mitigation and adaptation efforts, could result to higher temperature and reduced rainfall (on certain areas) in the future across the Philippines.

**Future (2041-2060) Projections under Different Climate Change Scenarios in the Philippines**



# CLIMATE CHANGE MITIGATION AND ADAPTATION

**LEGISLATION THAT CAN ADDRESS THIS VULNERABILITY**

## HB No. 9609 : Climate Accountability (CLIMA) Bill

Establish institutional mechanisms addressing adverse effects of climate change in the Philippines

## HB7705 : Low Carbon Economy Bill

An act promoting a low carbon economy, establishing for this purpose and emission trading system and implementation mechanism to achieve National climate target

## Institutionalize mechanisms for CDRFI

RA 10121 (NDRRRMA 2010) provides legal basis for CDRFI

**POLICY AND SECTORAL ALIGNMENT FOR THESE LEGISLATIONS**

## Nationally Determined Contribution (NDC) Implementation Plan 2020-2030

Implement sector-specific mitigation actions (Transport Roadmap, Philippines Energy Plan) while having economy-wide transformation as the core impact objective such as:

- 75% reduction and avoidance of greenhouse gas emissions from 2020 to 2030.
- Incentives for private sector participation.
- Removal of barriers in areas such as transport, energy, and municipal solid waste management,
- Reviewing and addressing obstacles in regulations, budgeting, and local government powers.

## Philippine Development Plan (PDP) 2023-2028

Promotion of economic, technological and industrial growth with less reliance on fossil fuels to reduce pollution and carbon dioxide emissions. This could include:

- Potential fiscal measure of carbon tax.
- Provision of correct market incentives for appropriately clean and reliable power
- Explore technology options and financing schemes for SWM based on updated LGU waste data

CENTER FOR WATER

"**Sector Specific Vulnerability** studies can provide additional **legislative basis** for environmental and climate change legislation agenda.

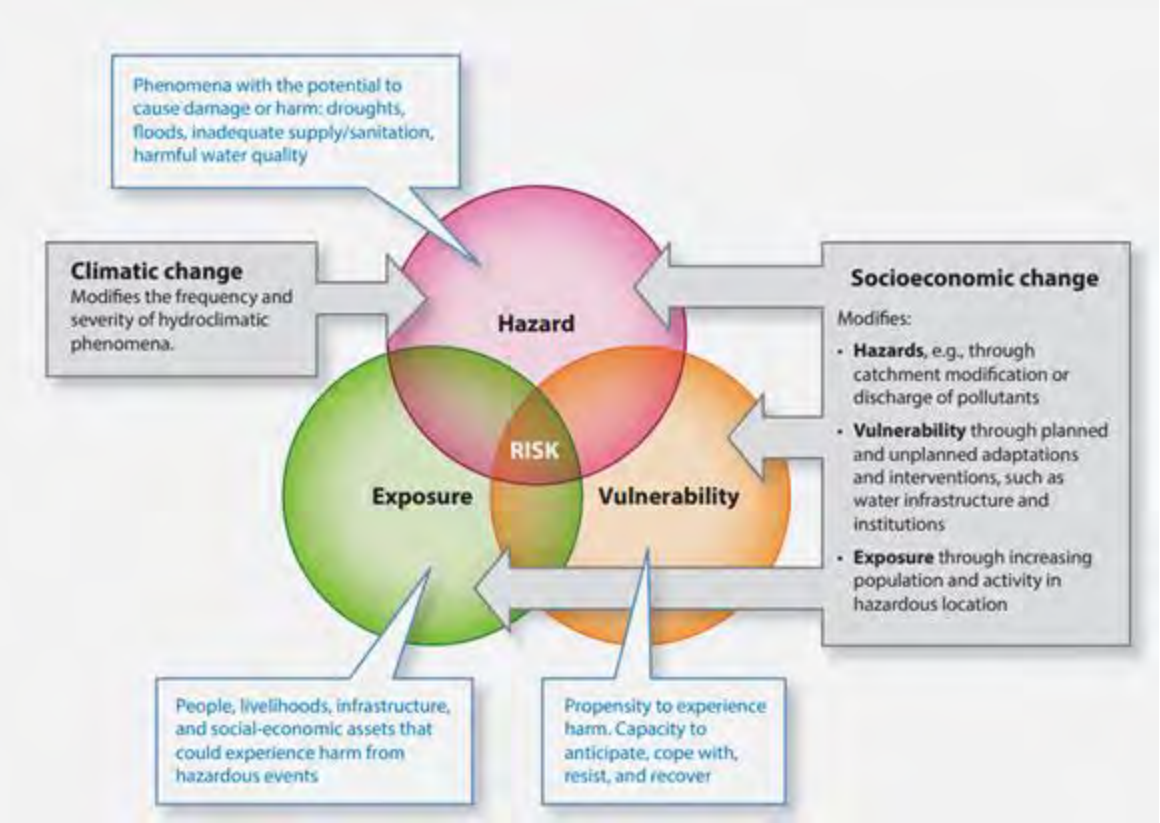
This can also add **additional clauses** that can only be observed through sectoral analysis to address specific vulnerabilities.

Sectoral Vulnerability Analysis can also provide avenue for **Democratic and Representative Legislations.**

# Water security

## associated with managing risks to water resources to acceptable levels.

**Risk-based approaches** to water security involve a comprehensive assessment of conditions that **expose water resource systems** and their management to **specific hazards**, considering **responses and capacity to recover** from the probability and consequences of these events




**HAZARD**

dangerous phenomenon that may result to negative impacts

**EXPOSURE**

people, property, systems, or other elements in places or settings that could potentially experience adverse effects .

**VULNERABILITY**

characteristics of the watershed, the circumstances of the community, and the systems within the watershed that render them susceptible and/or adaptive to the impacts .

# HYDEPP SATREPS

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

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.

Achieve highly accurate assessment of flood and drought risks by developing a hybrid assessment model with a DIAS-based big-data platform.

Evaluate benefits of pre-disaster investments by applying the hybrid assessment model to target local municipalities and make policy proposals for the sustainable economic development of local units

### Project Management Team

Dr. Fernando C. Sanchez, Jr.
Project Director, Philippines

Dr. Patricia Ann J. Sanchez
Project Manager, Philippines

Dr. Miho OHARA
Project Leader, Japan

## FRAMEWORK

**01 CLIMATE MODEL**

**02 HYDROLOGICAL MODEL**
WEB: ATMOSPHERE-LAND INTERACTION
RRI: SURFACE WATER FLOW

**03 AGRICULTURAL MODEL**
SIMRIW
SIMULATION MODEL FOR RICE-WEATHER RELATIONS

**04 ESTIMATION OF YIELD LOSS DUE TO FLOOD & DROUGHT**

**05 SOCIO-ECONOMIC MODEL**
PREDICTION OF FUTURE LOCAL DEVELOPMENT SCENARIO WITH/WITHOUT ADAPTATION MEASURES

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

## STUDY GROUPS

### 1 DATA COLLECTION AND SHARING

Data on natural and social environment will be collected and converted to a data form applicable to flood and drought risk assessment.

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

### 2 ASSESSMENT OF FLOOD AND DROUGHT RISK

Hydrological and agricultural models for flood and drought will be integrated and validated to the target areas

Dr. Rubenito LAMPAYAN
College of Engineering and Agro-Industrial Technology, UPLB

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

Dr. Mohamed RASMY Abdul Wahid
ICHARM

### 3 ASSESSMENT OF WATER-RELATED DISASTER

Visualizing water-related disaster resilience and benefits of pre-disaster investments in DRR are provided to support the consideration of appropriate structural and non-structural adaptation measures in target basins

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

Dr. Kentaro TAKI
University of Shiga Prefecture

Dr. Miho OHARA
Institute of Industrial Science, University of Tokyo

### 4 SUSTAINABLE LOCAL ECONOMIC DEVELOPMENT

Based on outcomes 1-3, policy recommendations for sustainable local economic development in urban and rural areas under climate change will be provided.

Dr. Ma. Angeles O. CATELO
College of Economics and Management, UPLB

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

Dr. Tomohiro TANAKA
Disaster Prevention Research Institute, Kyoto University

# ACTIVITIES

## COOPERATING ORGANIZATIONS

Department of Science & Technology
Department of Public Works & Highways
Laguna Lake Development Authority
Metropolitan Manila Development Authority

## TRAININGS

International and Local Short Courses
Data Management | River Flow Monitoring

International Long Courses:
Hydro-agricultural Modeling | Flood Hazard Mapping & Risk Assessment | Local Economic Growth Prediction Modeling

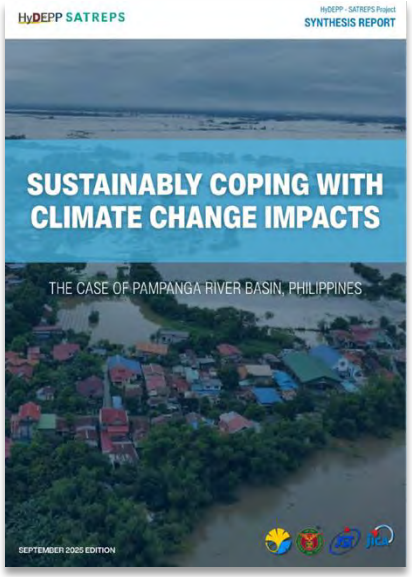
## INSTRUMENTATION

Agricultural Monitoring
Plant Canopy Analyzer | Chlorophyll Meter | Soil Moisture Sensor
Multispectral Drone
River Flow Monitoring
Microwave Doppler Non-contact Current Flow Velocity Meter
Sediment Bottom Sampler | Acoustic Doppler Current Profiler
Lake Monitoring
X-Y Velocimeter | Turbidity Sensor |
Water Quality Multiparameter Meter

## ACADEMIC OUTPUTS

International Publications
International Conference Presentations
Policy Briefs
MSc & PhD Students

# EVIDENCE SYNTHESIS PRODUCTS





# SUMMARY FINDINGS

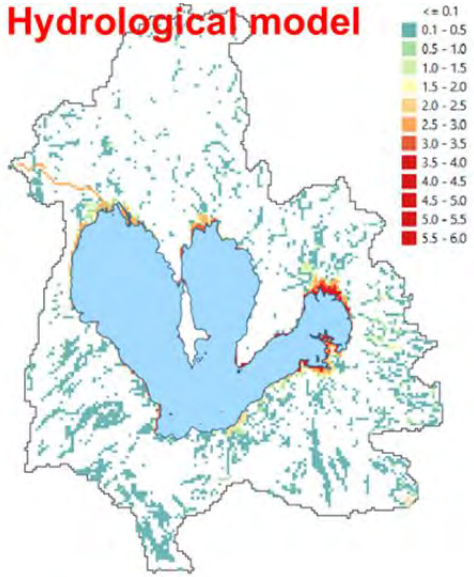
***Hybrid Assessment in Pasig-Marikina River & Laguna Lake Basin***

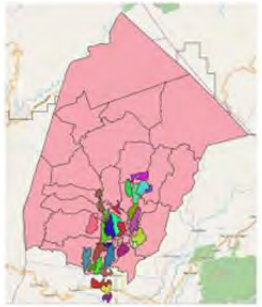
## Pasig-Marikina Laguna

**Climate Model**

| GCM | PAST (1979-2003) | RCP 8.5 (2075-2100) |
|---|---|---|
| MRI-AGCM 3.2S | completed | completed |

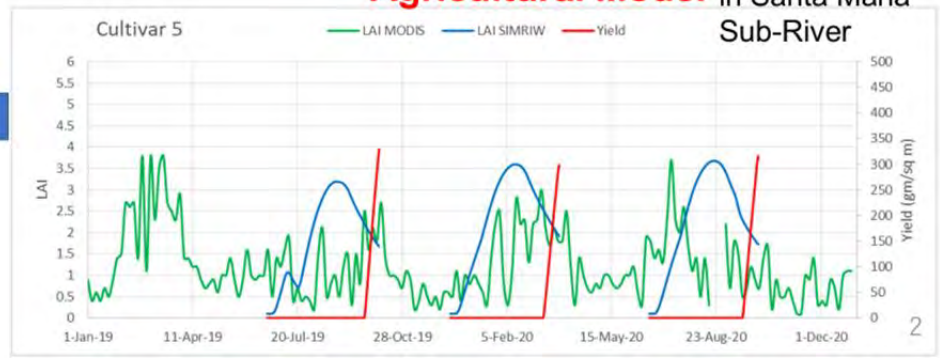
**Hydrological model**



**Agricultural Model**

Detailed Study in Santa Maria Sub-River




**Resilience Assessment**

**Socio-economic model**

Multi-agent simulation model

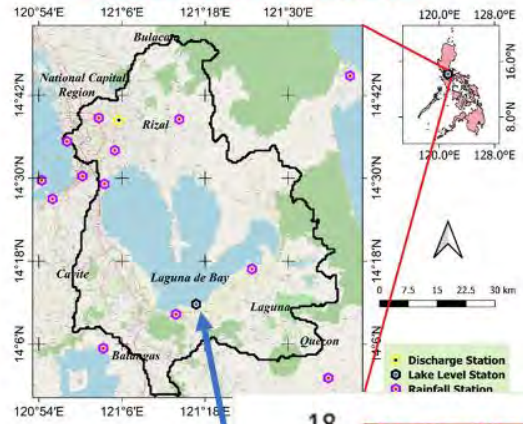
On-going by UPLB members

# SUMMARY FINDINGS

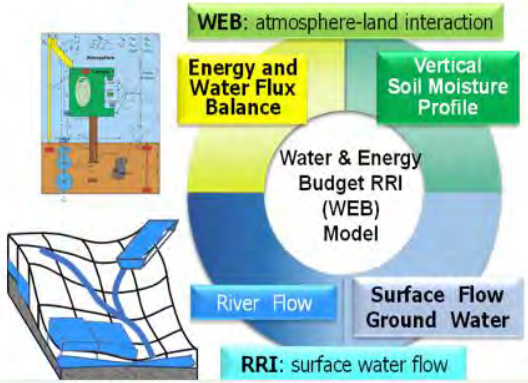
***Comparison of Laguna Lake level in past (1973-2003) & future (2075-2100) under RCP 8.5***

By Dr. Ballaran et al.

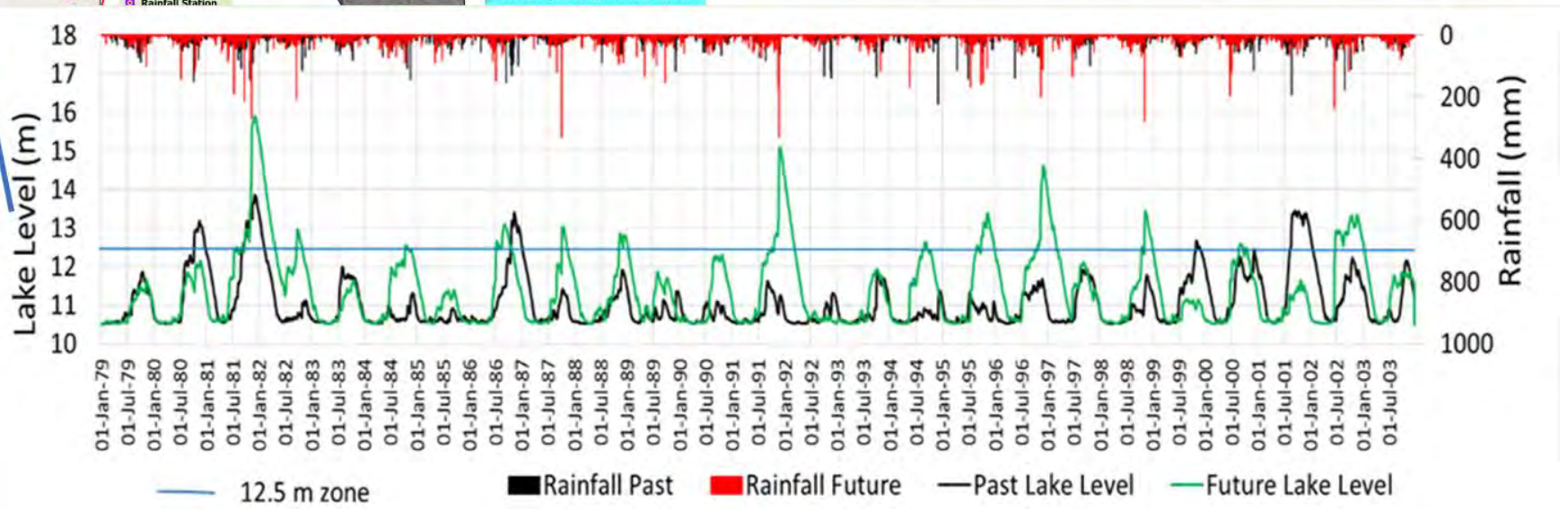
## Location of stations




## Hydrological model

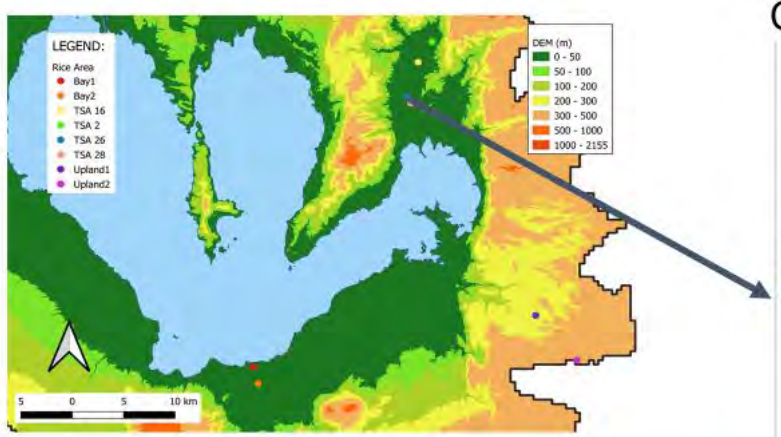



| Item | Past (1979-2003) | Future (2075-2100) |
|---|---|---|
| Maximum Daily Lake Level | 13.85m | 15.90m |
| Flood Frequency | 6 | 17 |
| Maximum Inundation Duration | 152 days<br>5 months | 213 days<br>7 months |

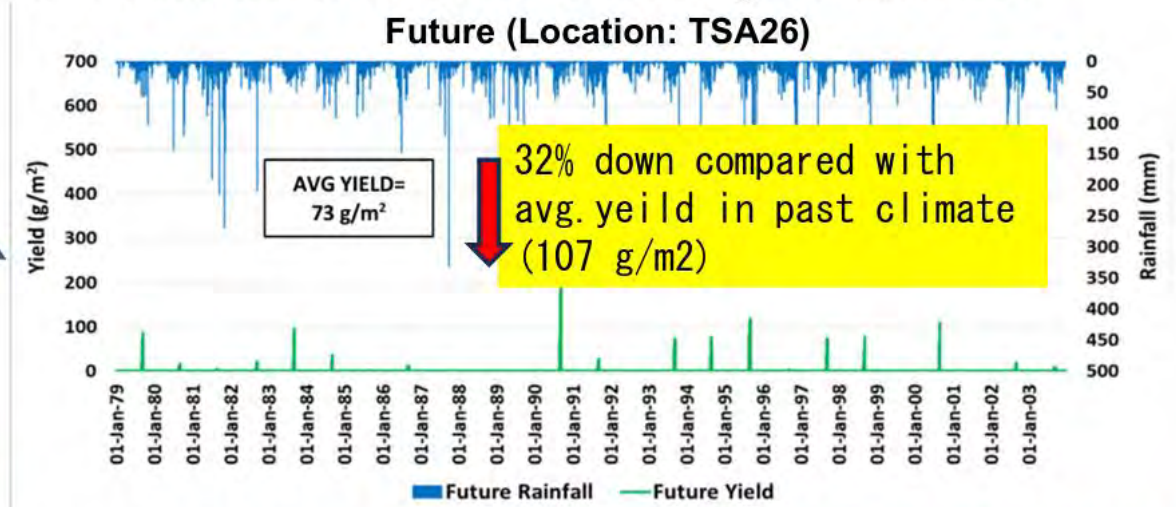


# SUMMARY FINDINGS

***Past (1973-2003) and future (2075-2100) rice yield under RCP 8.5***

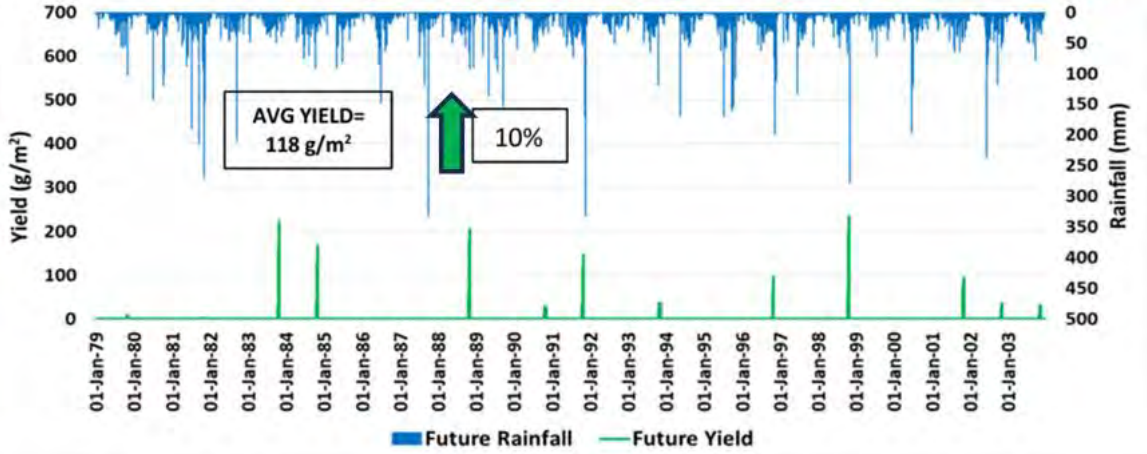



Case of Lowland in North-east area of Laguna Lake Basin




Selection of low-risk land and proper cropping calendar is necessary.

Future (Location: TSA26): **Change planting date with one month later**



# SUMMARY RECOMMENDATIONS

***Pasig-Marikina River & Laguna Lake Basin***

## 1. Hazard control (G2)

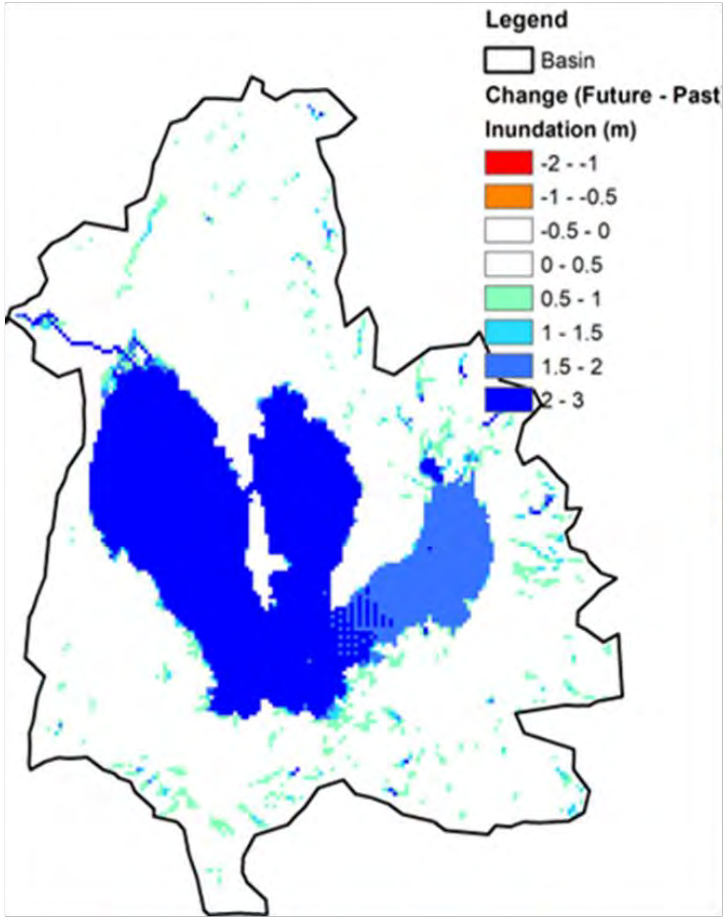
-Effective use of new spillway

-Increase of drainage capacity

-Increase of storage capacity of rainwater

## 3. Vulnerability Improvement

-Encourage elevated buildings in high-risk area(G3)




Difference (Future-Past)

## 2. Exposure reduction

-Risk-based land use management by selecting low-risk area(G3

## 4. Capacity Enhancement

-Collection of data(G1)

-Capacity for risk assessment (G3)

-Capacity for rapid damage estimation (G2)

-Adaptation such as changing cropping calendar, crop insurance (G4)

# SUMMARY FINDINGS

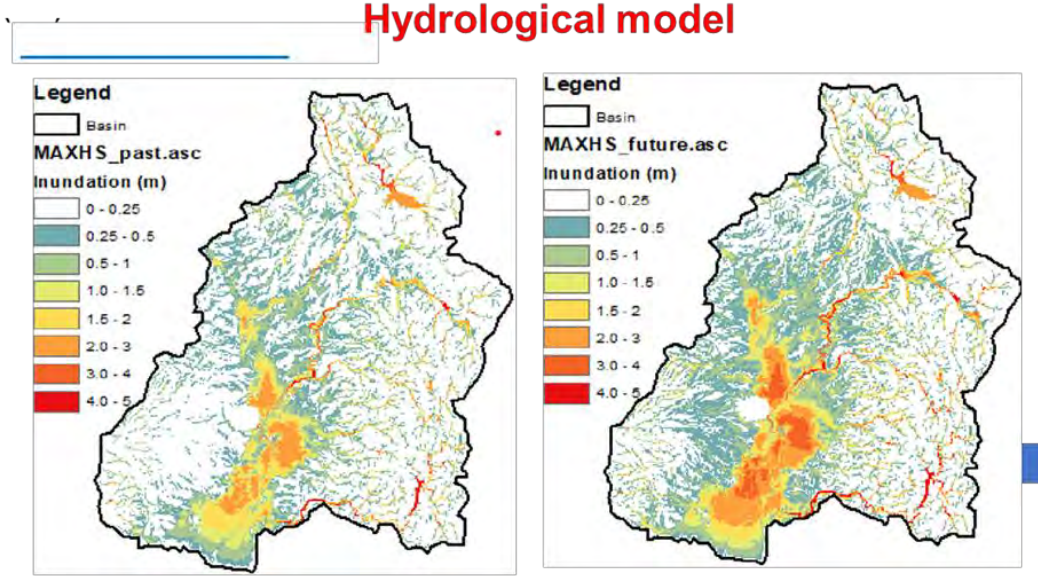
*Hybrid Assessment in Pampanga river Basin*

## Pampanga

### Climate Model

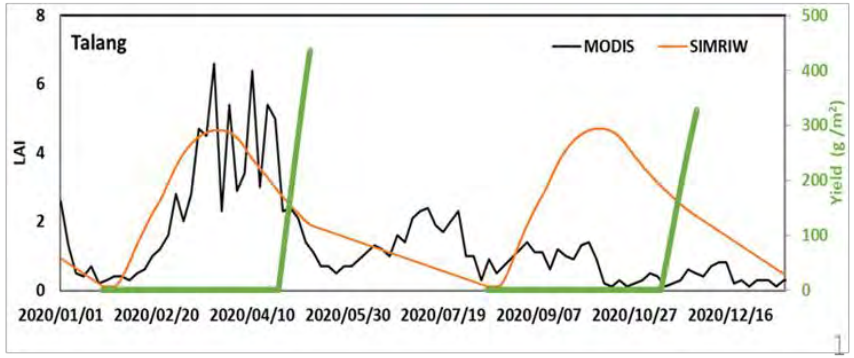
| GCM | PAST (1979-2003) | RCP 8.5 (2075-2100) |
|---|---|---|
| MRI-AGCM 3.2S | completed | completed |

### Hydrological model

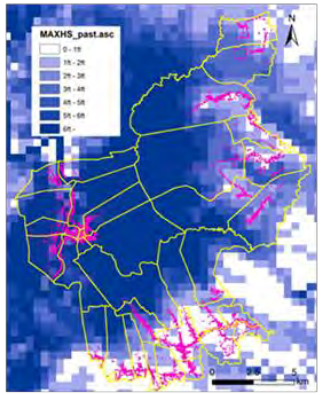



### Agricultural Model

Detailed Study in Candaba

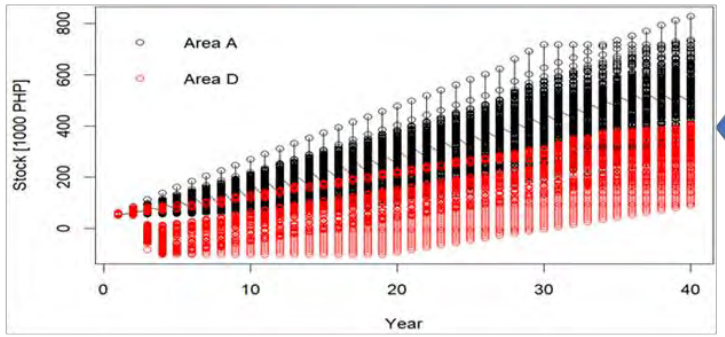



### Resilience Assessment



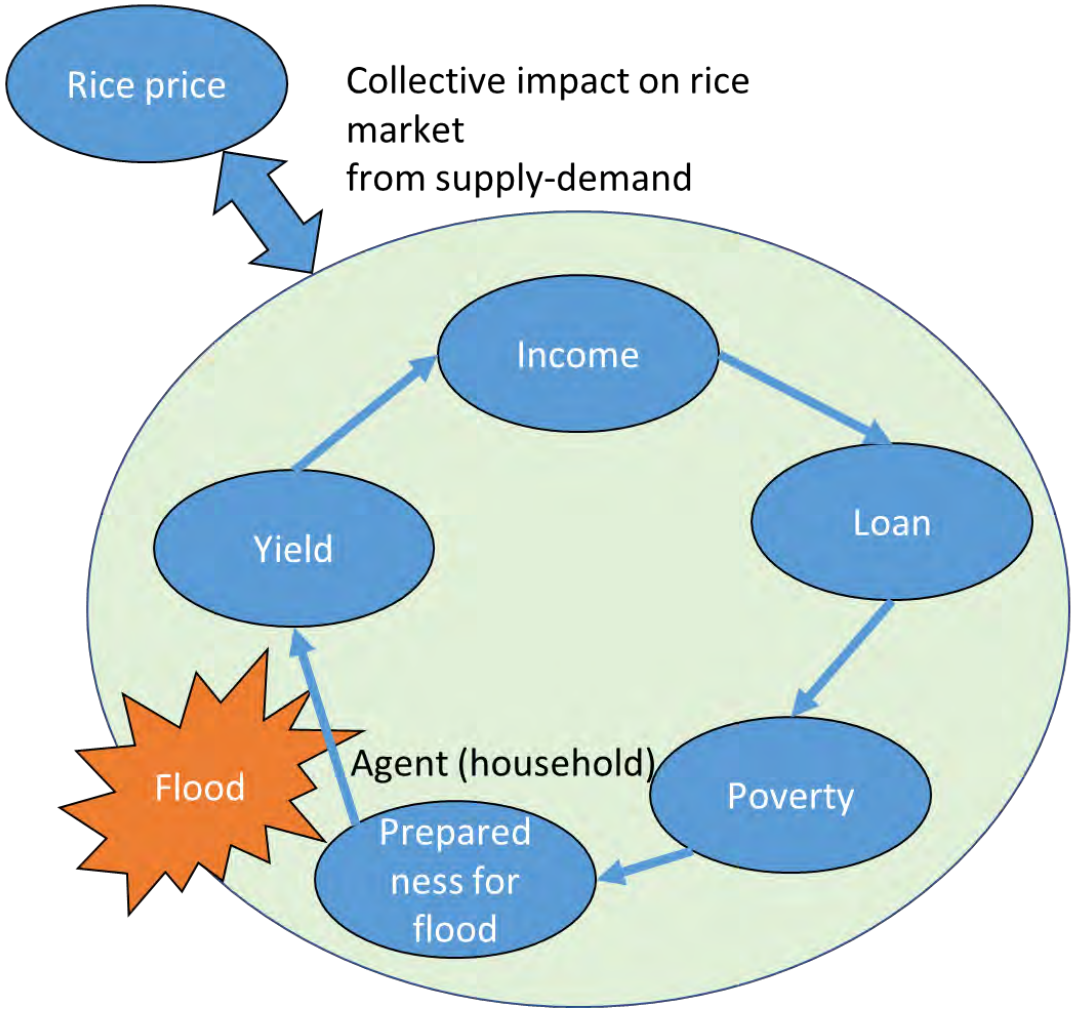

### Socio-economic model

Multi-agent simulation model

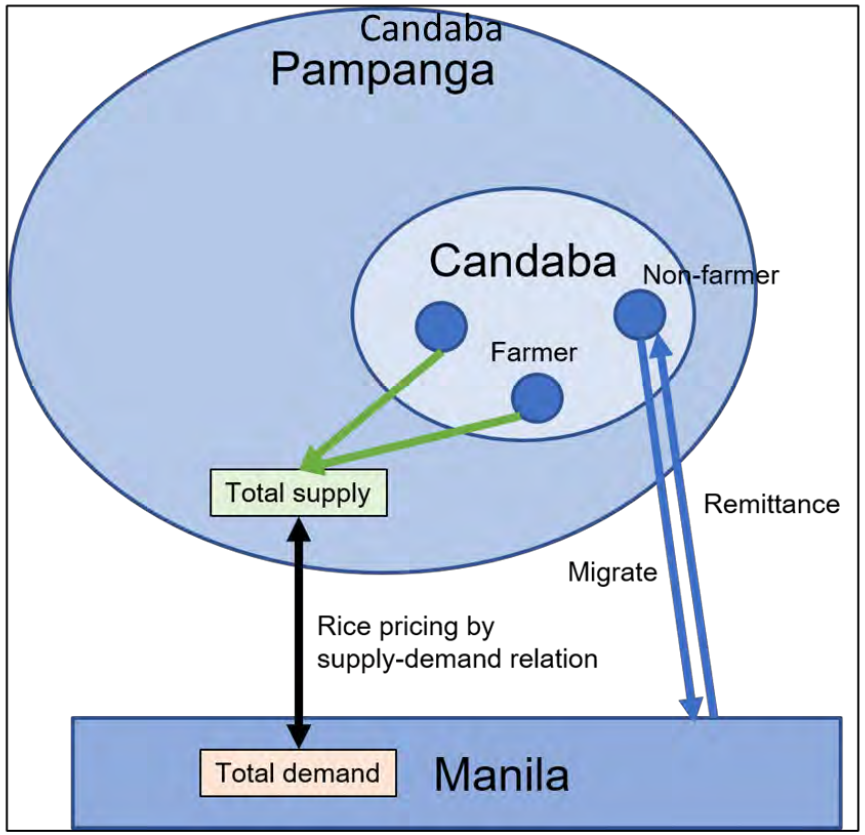


# SUMMARY FINDINGS

***Socio-economic model: Long –term flood impact at household-level scale***




Agent-Based Model
(ABM)
in a case study in
Candaba



# SUMMARY RECOMMEDNATIONS

***Pampanga river Basin***

1. Hazard control(G2)

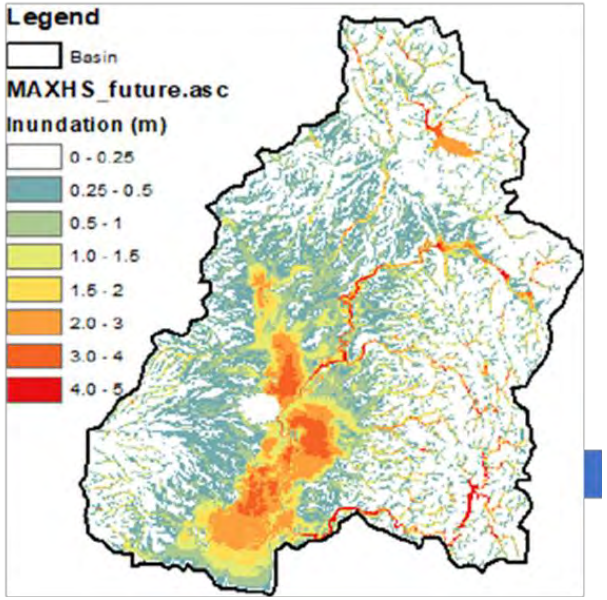
-Increase of drainage capacity

-Increase of storage capacity of rainwater

3. Vulnerability improvement

-Encourage elevated buildings in high-risk area (G3)

-Enhancing effective evacuation and emergency action with real-time flood monitoring (G1)




Difference (Future-Past)

2. Exposure reduction

-Risk-based land use management by selecting low-risk area (G3)

4. Capacity enhancement

-Collection of data(G1)

-Capacity for risk assessment (G3)

-Capacity for rapid damage estimation (G2)

-Adaptation such as changing cropping calendar, crop insurance (G4)

# THE FUTURE OF GLOBAL DISASTER RISK REDUCTION

*Thank you very much for listening to this presentation.*
*For any concerns, questions, or interest in this research topic,*
*Please do not hesitate to contact us through:*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STRENGTHENING THE RESILIENCE of MEGACITIES THROUGH SCIENCE, TECHNOLOGY & INNOVATION