Disaster Risk Reduction Using Applied Concept of Room for River for High-Water Channel in Agricultural Retention

Jittiporn Chantarojsiri[1†], Winai Chaowiwat[1], Sumaporn Puengpo[1], Royboon Rassameethes[1], Sutat Weesakul[1]

[1] Hydro – Informatics Institute (HII), 901 Ngam Wong Wan Road, Lat Yao, Chatuchak, Bangkok, Thailand
[†] Corresponding author (email: iaf@hii.or.th)

1. Introduction

The Rangsit community, located in the Nong Suea district, Pathum Thani province, Thailand, heavily relies on water sources from the lower Chao Phraya River and Pasak Jolasid Dam. The community serves as an ideal testing ground for the implementation of Nature-Based Solution (NBS), leveraging a unique blend of green-blue-grey infrastructure to mitigate its hydro-meteorological risks. Through comprehensive analysis and stakeholder engagement, the Hydro-Informatics Institute (HII), through meticulous analysis and active stakeholder engagement, collaborates closely with local villagers, authorities, and relevant agencies. Together, they have successfully harnessed NBS techniques to mitigate floods and droughts, thus enhancing the resilience of the Rangsit community and setting a precedent for best practices in area-based development.

Rangsit community initially arose from the excavation of the Rangsit irrigation canal network from 1890 to 1905, the community has evolved to become a vital hub for agricultural production and flood mitigation efforts. Over the past century, local inhabitants have taken it upon themselves to renovate and enhance the aging infrastructure, including agricultural ponds, canals, and waterways, thus fortifying the community against the ravages of flooding, as evidenced during the severe floods of 2011.

2. Approach

The Community Water Resources Management (CWRM) project, together with HII, integrates science, technology, and innovation (STI) to empower Rangsit's residents in safeguarding water-related disasters through NBS. The initiative fosters collaboration among stakeholders to analyze water balance and finally summarize that the area requires more retention capacity to prevent flood and drought problems.

Through the implementation of new management methods, particularly in oil palm cultivation areas, innovative tools such as mire suction boats are utilized alongside dredging of main and sub canals including furrows to enhance water and drainage systems. The strategic planting of oil palm trees along canal banks not only prevents erosion but also boosts palm oil yields, ensuring a more sustainable income for the community. These initiatives have significantly addressed flood and drought challenges, transforming the local community into a hub for increased agricultural productivity and community income.

Furthermore, hydro-meteorological risk assessment, focusing on flood and drought issues, is essential for effective disaster resilience planning. Adopting Climate Risk and Vulnerability Assessment (CRVA) processes, data collection from various sources informs risk assessment, enabling the identification of barriers and enablers for NBS implementation. Proactive measures by the community, such as shifting to integrated farming and fostering cross-sectoral collaboration, demonstrate resilience in the face of climate challenges and ensure swift implementation of sustainable management plans. For flood risk assessment, the flood hazard indicators were the climate related data and flooded information which are max 1-day rainfall (Rx1D), consecutive wet days (CWD), very heavy rainfall days (R35mm), frequency of flooding and drought events in the same area, and flood depth. While flood exposure indicators were length of road per repetitive flooded areas, total number of populations, agriculture area, urban area, and density of factories. Additional survey were conducted using questionnaire which related to water management and adaption in the studied area such as impact on the value of damage from floods, public participation in adaptation planning, obstruction of the river, preparing to cope with disasters by educating and training, an integration between government agencies responsible for the same or connected matters at the sub-district level, provincial level, and ministry level, availability of local warning alarm/local management, etc. For drought risk assessment, the drought hazard indicators were the climate related data and drought prone area information such as consecutive dry days

(CDD), dry spell length (DSL), annual contribution from wet days (PRCPTOT), severity of the drought, frequency of drought condition of rivers and streams, frequency of drought condition of water, and frequency of flooding and drought events in the same area. While drought exposure indicators were total number of populations, agriculture area, number of wells, and density of factories. Questionnaire related with water management and adaptation in the studied area were conducted which were average amount of water in water sources at the end of the rainy season, users of groundwater for consumption affected by drought, groundwater users in agricultural sector affected by drought, rivers for consumption affected by drought, amount of groundwater developed per amount of usable groundwater (%), annual available groundwater, public participation in adaptation planning, and preparation for dealing with knowledge transfer and practice, etc.

3. Result

3.1 Hydro-meteorological risk assessment

Flood hazard assessment results can be shown as max 1-day rainfall (Rx1d) and very heavy rainfall days (R35mm) will increase and cause more flood in the studied area in future period. While exposure assessment results can be shown in the agriculture area. The flood vulnerability assessment shows that the ability to cope with flooding is remaining low level, that can be implied this studied area should be pay more attention on enhancing the capacity building on flood fighting and water management adaptation.

Drought hazard assessment results can be shown as all extreme indices tend to decrease except consecutive dry days in SSP2.45, that can be implied the studied area will face less drought in future period. While exposure assessment results can be shown agriculture area will sensitive areas like as the flood exposure results. The drought vulnerability assessment is remaining low level.

Compared risk assessment results show that it will be more flood than drought in future period.

3.2 Management Plan

In anticipation of potential increased flooding, the community has developed comprehensive management strategies encompassing both normal and emergency scenarios. The management plan prioritizes proactive regular monitoring through the use of staff gauges, automated telemetry stations, and notifications to monitor water levels and weather conditions in the rainy season. Annual maintenance of infrastructure ensures operational efficiency, while farmer training sessions promote sustainable water usage and integrated farming practices. Emergency plan shows the importance of collaboration with local authorities and community leaders becomes eminent. Early warning systems for droughts, floods, and other disasters are established to facilitate timely response and mitigation efforts. Regular drills and simulations familiarize community members with emergency protocols, enhancing overall preparedness. Additionally, stockpiling essential supplies and equipment, such as sandbags, pumps, and emergency food and water provisions, enables swift and effective response measures during crises. This comprehensive emergency plan highlights the importance of proactive collaboration and preparation to mitigate the impact of unforeseen events.

The strategic plan emphasizes strengthening partnerships among the community, local government, and private sector to enhance water management practices through long-term infrastructure investments. The expansion of successful system to other areas is embedded in the plan. Advocacy for supportive policies and regulations that encourage community-based water management initiatives and stakeholder collaboration is also essential for effective implementation of sustainable water resource management strategies.

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