

COMMUNITY-BASED WATER MANAGEMENT IN THAILAND TOWARD WILDLAND FIRE AND SMOKE HAZE ISSUE IN THE UPPER ASEAN

Pengelolaan Air Berbasis Masyarakat di Thailand dalam Mengatasi Masalah Kebakaran Lahan dan Kabut Asap di Kawasan ASEAN Bagian Utara

Veerachai Tanpipat^{*,1,2}, Royboon Rassameethes¹, Jittiporn Chantarojsiri¹,
Pakarat Danusatianpong¹, Sarawadee Phattharakijkulthorn¹, Royol Chitrdon¹, and
Sutat Weesakul¹

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ABSTRACT

Community-based Water Management (CBWM) in Thailand is fundamentally grounded in the Sufficiency Economy Philosophy (SEP), a concept introduced by King Rama IX in 1974. This approach highlights the importance of self-reliance, active community participation, and the development of locally adapted solutions to foster disaster resilience and promote environmental sustainability. Community-based Fire and Water Management (CBFWM) represents an integrated strategy designed to address environmental challenges, particularly wildland fires and smoke haze, which are prevalent in the Upper ASEAN region, specifically within the Lower Mekong River Basin. By combining water and fire management, this holistic approach not only strengthens community resilience to climate change but also enhances local livelihoods in a sustainable manner. Given that social issues often serve as the primary drivers of wildland fires, this approach provides strategies focused on building community capacity to independently maintain ecosystem sustainability while addressing economic and environmental challenges.

Keywords: Community-based, Sufficiency Economy Philosophy (SEP), holistic approach, Upper ASEAN.

ABSTRAK

Pengelolaan Air Berbasis Masyarakat (Community-based Water Management/CBWM) di Thailand didasarkan pada konsep Filosofi Ekonomi Kecukupan (Sufficiency Economy Philosophy/SEP) yang diperkenalkan oleh Raja Rama IX pada tahun 1974. Pendekatan ini menitikberatkan pada prinsip kemandirian, keterlibatan aktif masyarakat, dan pengembangan solusi yang disesuaikan dengan kondisi lokal untuk membangun ketahanan terhadap bencana serta mendorong keberlanjutan lingkungan. Pengelolaan Kebakaran dan Air Berbasis Masyarakat (Community-based Fire and Water Management/CBFWM) merupakan strategi terpadu yang dirancang untuk mengatasi berbagai permasalahan lingkungan, khususnya kebakaran lahan dan kabut asap, yang banyak terjadi di kawasan ASEAN bagian utara, terutama di wilayah Cekungan Sungai Mekong Bawah. Melalui integrasi antara pengelolaan air dan kebakaran, pendekatan ini menawarkan solusi holistik yang tidak hanya memperkuat ketahanan masyarakat terhadap perubahan iklim, tetapi juga meningkatkan mata pencaharian lokal secara berkelanjutan. Dengan mempertimbangkan bahwa permasalahan sosial sering kali menjadi penyebab utama kebakaran lahan, pendekatan ini memberikan strategi yang berfokus pada peningkatan kapasitas masyarakat untuk secara mandiri menjaga keberlanjutan ekosistem sekaligus mengatasi tantangan ekonomi dan lingkungan.

Kata kunci: Berbasis komunitas, Filosofi Ekonomi Kecukupan (SEP), pendekatan holistik, ASEAN bagian utara.

¹ Hydro-Informatics Institute, Ministry of Higher Education, Science, Research and Innovation

² Upper ASEAN Wildland Fire Special Research Unit, Forestry Research Center, Faculty of Forestry, Kasetsart University

*Corresponding author email address: veerachai@hii.or.th

INTRODUCTION

Resources Management (CWRM) is fundamentally rooted in the Sufficiency Economy Philosophy (SEP). This philosophy was initially articulated in the Kingdom of Thailand during a royal address by King Rama IX to the graduates of Kasetsart University on July 18, 1974. In this address, His Majesty elucidated the deep-seated knowledge, ethical principles, and virtues that underpin the SEP (Chaipattana 2022). He posited that effective management and preservation of water resources are essential for the ongoing development of the nation, particularly given that agriculture constitutes a vital aspect of life in Thailand.

The connection between SEP and Buddhism is evident, particularly given that a significant majority of Thais identify as Buddhists (Feigenblatt *et al.* 2021, Song 2020, Jitsuchon 2018, Wibulswasdi *et al.* 2009, Piboolsravut 2004). The holistic framework of SEP is initiated at the grassroots community level. This concept of community-based management (CBM) has been developed and integrated since the late 1970s (Whaley *et al.* 2020). Furthermore, it serves as a fundamental principle and practice of Agenda 21, which was established in 1992 to promote sustainable development (International Development Research Centre 1993, Khan *et al.* 2018). This approach fosters a resilient mindset and a "*monster mentality*," characterized by the courage to pursue the seemingly impossible in the face of disasters or crises. Ultimately, the goal is to achieve sustainable living in harmony with nature. Piboolsravut (2004) emphasized that the concept of Sufficiency comprises three essential elements: moderation, reasonableness, and the necessity for a self-immunity system. He identified two fundamental prerequisites for achieving Sufficiency: "*Knowledge and Morality*." In terms of knowledge, the Sufficiency Economy Framework demands comprehensive and meticulous planning, careful application of knowledge, and effective execution of those plans. Regarding moral and ethical standards, it requires individuals to embody honesty and integrity while leading their lives with perseverance, harmlessness, and generosity. Similarly, Wibulswasdi *et al.* (2009) illustrated that the SEP can be represented visually, highlighting the three interconnected core components (moderation, reasonableness, and self-immunity) alongside the essential conditions of knowledge, wisdom, and ethical virtues. The notion of moderation aligns with the middle path in Buddhist teachings; however, it can be tailored to accommodate individual circumstances, which may differ from the strict moral and ethical guidelines of Buddhism. This approach is fundamentally grassroots, necessitating community engagement and acceptance of its principles to cultivate a robust mindset that fosters optimal solutions tailored to local realities.

On December 4, 1997, during the Tom Yam Kung 1997 Economic Crisis, while addressing the nation, King Rama IX brought up SEP again that it would be the appropriate vehicle to get Thailand out of economic crisis. Later, the "*New Theory of Agriculture (NTA)*" emerged. (Piboolsravut 2004, Chaipattana 2022).

In an interview conducted in 2011, Princess Maha Chakri Sirindhorn discussed the topic "*Hua Hin ... the Origin of His Majesty's Initiatives*," recalling that the concept of Sufficiency Economy Philosophy (SEP) was first introduced in 1955, the year of her birth, at "*Klai Kangwon Palace*" in Hua Hin City. During His Majesty's frequent visits to nearby agricultural villages, he observed the challenges faced by the local populace, particularly the issue of water scarcity. In response, he commissioned the construction of small water containers for the villagers and subsequently established the Khao Tao Reservoir, marking the inception of his royal initiatives (Bangkok Post 2017). This initiative may well represent the origins of Community Water Resource Management (CWRM) in Thailand. As noted by McNabb (2017), "*We can get by without a lot of things, but we can't get by without water.*"

The vision, wisdom, and extensive knowledge of His Majesty, accumulated over more than fifty years of experience, have been instrumental in advancing the concept of "*sufficiency*" development through the SEP and the NTA. Consequently, the CWRM system was developed between 2005 and 2007. From 2008 to 2012, a community network was established to promote the sustainable use of water resources, leveraging a science, technology, and engineering (ST&E) approach within various geographical contexts. In the period from 2013 to 2017, sixty core communities were designated as prototypes for the CWRM initiative. Between 2018 and 2022, twenty-four of these core communities were selected to broaden their initiatives to the district and watershed levels, evolving into Natural Living Museums where a disaster early warning network was implemented and integrated with local and governmental entities. To facilitate the comprehensive expansion of the CWRM, the master plan has been incorporated into Thailand's National Development Plan #13 (2023 – 2027). The Utokapat Foundation and the Hydro-Informatics Institute (HII) are set to play pivotal roles as primary coordinators, educators, and facilitators in mentoring, instructing, and supporting the future objectives of CWRM expansion.

The Community Water Resource Management (CWRM) or Community-based Water Management (CBWM)

The Community Water Resources Management (CWRM) framework is grounded in the principles articulated by His Majesty King Rama IX, specifically the "*Connect-Understand-Develop*" philosophy, which aims to foster sustainability. Adherents to this framework must comprehensively grasp both the physical and social dimensions, aligning with the "*working with the grain*" principle that emphasizes a balance between pragmatism and ambition (Whaley *et al.* 2020). This methodology embodies a holistic perspective on sustainable development. Its operational procedures mirror those of the interdisciplinary Integrated Water Resource Management (IWRM) paradigm (Grigg 2016, Lenton *et al.* 2009, McNabb 2017) and the Total Water Management (TWM) strategy (Grigg 2008, Young 2006, McNabb 2017). The IWRM concept was initially presented at the United Nations Water Conference held on March 14, 1977, in Mar

Del Plata, Argentina (Filippo *et al.* 2021) and was subsequently incorporated into Agenda 21, also referred to as the "Dublin Principles," which outline four fundamental guidelines for the management of freshwater resources in 1992 (Kadi 2014). As a community-centric approach, the foundational step involves cultivating "Trust" and securing "Concept Buy-in" from local stakeholders prior to initiating any processes. Transparent and sincere communication, coupled with an appreciation of diverse viewpoints within the community, is crucial for ensuring comprehensive local engagement (Kaptijn 2018). Numerous efforts have proven unsuccessful when this crucial initial step was overlooked. Subsequently, a dedicated community leader or a prominent local figure who is fully invested in the methodology will serve as a catalyst for change and a facilitator of connections. Utilizing a science and technology-based approach, the processes of data collection and analysis will be carried out. This includes the collection of field data and the acquisition of secondary information, such as remote sensing imagery, aerial photographs, digital topographic maps, weather and climate data, as well as geo-informatics, hydro-informatics, and geospatial information. These data sets provide insights into the current dynamics of water, the status of water demand and supply—often referred to as 'water balance'—and the changes in land use and land cover within specific geographical landscapes over extended periods.

The concept of "citizen science" has been integrated into the community to enhance understanding of the landscape. This integration has led to the development of appropriate water engineering solutions aimed at supporting and improving water management practices. As with any community-driven initiatives, it is essential to establish rules that govern the community's interactions. In Japan, while the government oversees the majority of water management, local residents possess the authority to engage with water management agents, thereby preserving their traditional practices and cultural connections to water (Takeuchi *et al.* 2010). For effective land-use planning, it is crucial that these community rules receive consensus from all members. A notable illustration of equitable and impartial utilization of water resources can be observed among indigenous populations in the Himalayan regions of Pakistan, who have successfully managed their water resources for several centuries without significant conflict (Ahmad *et al.* 2020; Zulfiqara *et al.* 2021).

The focus encompasses four primary areas: water security through effective water resource management, food security, community economic development, and the establishment of Public-Private-People-Partnerships (PPPP) (HAIL, 2016). The integration of the "New Theory of Agriculture (NTA)," which incorporates adaptive agroforestry practices across three forest types and emphasizes four ecosystem benefits (as outlined by Chaipattana in 2022), along with fundamental accounting principles, is aimed at fostering sustainable income and enhancing livelihoods within the framework of Community Water Resource Management (CWRM). Achieving community stability, balance, and sustainability necessitates the conservation and preservation of natural resources while coexisting harmoniously with nature, reflecting the community's unique cultural identity (Lenton

et al. 2009). The phased development of CWRM, inspired by His Majesty's "Burst from Within" initiative, emphasizes self-reliance and the principle of "helping people to help themselves," advocating for a comprehensive approach. It is crucial to embrace His Majesty's perspective that "there is no one size fits all" and the "Connect-Understand-Develop" principle prior to initiating any community-specific development efforts; this process is inherently challenging, requiring patience and time. The CWRM initiative is a long-term endeavor that demands a transformative mindset, along with visionary and courageous leadership and commitment at all levels (Wibulswasdi *et al.* 2009; Koppen *et al.*, 2007; Grigg 2016; Chaipattana 2022).

The effectiveness of implementing a community-based approach in Thailand is contingent upon various factors. These include not only the tangible elements such as thorough fact-finding, comprehension of existing conditions, comprehensive local engagement, strategic planning, and efficient systems, but also the intangible social dimensions of equity, trust, and community cohesion. Furthermore, the amalgamation of contemporary and traditional indigenous knowledge plays a crucial role in safeguarding ancient wisdom while integrating it into modern practices. This approach enables communities to protect and uphold their cultural heritage and traditions, all the while generating financial gains that enhance their livelihoods, ensure the sustainability of water resources, and promote harmonious coexistence with the natural environment.

The parallels between Aldo Leopold's "Land Ethic" and the "Sufficiency Economy Philosophy" warrant discussion. Leopold, an eminent American land conservationist often referred to as the "Father of the American Land Ethic" (January 11, 1887 – April 21, 1948), played a pivotal role in shaping contemporary American environmental ethics and advocating for wilderness conservation. His principles regarding the preservation of nature and wildlife significantly influenced the environmental movement, characterized by both egocentric and holistic perspectives on land use. To achieve a harmonious existence with nature, it is essential to "learn to read the land" (Wikipedia 2022a; Callicott and Frodeman 2009; Warren 2005). In Thailand, a similar ethos was embodied by the late King Rama IX Bhumibol Adulyadej (December 5, 1927 – October 13, 2016), who established the Sufficiency Economy Philosophy (SEP) as a framework for land ethics. This philosophy is integral to various community-based development initiatives (Chaipattana 2022; Wikipedia 2022b). His Majesty was recognized as the "Father of Water Resources Management" or the "King of the Waters" in Thailand (Blake 2015). In acknowledgement of his lifelong commitment to sustainable soil management, the United Nations honoured him by designating his birthday, December 5, as the "World Soil Day" starting in 2013 (United Nations 2022; Royal Thai Embassy Singapore 2022). In addition to his contributions to land ethics in the United States, Leopold's remarkable efforts in soil conservation to combat erosion were noteworthy (Keeney 2022). King Bhumibol Adulyadej's approach to land management through the Sufficiency Economy Philosophy emphasizes self-reliance and sustainability. The

amalgamation of Western and Eastern philosophies could enhance equity, stability, and sustainability within community-based holistic frameworks.

As of November 2024, a recent report indicates that 1,837 villages are engaged in 60 core communities, which include 24 Natural Live Museums situated across 22 river basins in the Kingdom of Thailand. This initiative is spearheaded by the Hydro-Informatics Institute and the Utokapat Foundation. The concept of "*Community-based Water and Fire Management*," also referred to as "*Community-based Natural Resources Management*," represents an ambitious yet promising approach to disaster risk mitigation and management. It aims to foster the development of climate-resilient communities capable of adapting to increasingly severe weather patterns and the challenges posed by the climate crisis, thereby contributing to the broader goal of sustainability.

Good Practices

Two exemplary practices (Figure 1.) derived from the document titled "*HII. 2021. Application of Science and Technology for Community Water-Related Disaster Risk Reduction: Thailand Good Practices following His Majesty King Bhumibol Adulyadej the Great's Initiative towards Sustainable Development Application of Science and Technology*" are as follows.

The first good practice is the "*Forestry-based Disaster Risk Reduction Builds Resilient Livelihoods: Conserved-Forest Lao River Basin Community Network, Wiang Pa Pao District, Chiang Rai Province.*" In 1984, the initiation of tin mining concessions in the region coincided with a significant crisis affecting the upstream forest. The Mae Tho upstream forest, which serves as a vital source for the Lao River Basin, experienced increased erosion due to mining activities, resulting in muddy water conditions. Additionally, local villagers began to encroach upon the forest, transforming it into agricultural fields primarily for maize cultivation. This deforestation has heightened the likelihood of flash floods and landslides, as

well as increased sedimentation in water sources. Moreover, the prevalence of wildfires and drought during the dry season has directly impacted food production, exacerbating livelihood insecurity.

In 2005, some communities in the Mae Lao River Basin established a Forest Conservation Group. This initiative set the stage for the implementation of Community Water Resource Management (CWRM) by HII and the Utokapat Foundation, which aimed to help these communities address challenges like deforestation, flooding, drought, wildfires, and the need to improve agricultural practices for more sustainable livelihoods. Over time, the Forest Conservation Group transformed into the "*Conserved-Forest Lao River Basin Community Network*".

To initiate the process, it is essential for local communities to embrace a new holistic approach to sustainable development, followed by a comprehensive understanding of their water resource systems. This necessitates the introduction of scientific and technological methods, particularly geoinformatics, through extensive local participation in the mapping of natural resources, including water balance assessments. As a result, a water storage and detention system were established in the upstream forest area to retain water for agricultural use during the dry season, while simultaneously enhancing moisture retention and mitigating water runoff and soil erosion. Additionally, a Disaster Monitoring Network was set up to gather data and provide weekly updates on the water situation. The agroforestry model known as "*Three Forests, Four Benefits*" is progressively supplanting traditional mono-cropping practices with diverse multi-cropping systems. To enhance the market value of agroforestry products, community collaboration has been strengthened, leading to a transition from monoculture to integrated farming practices that incorporate a variety of crops, such as tea, coffee, and herbs, with maize cultivation limited to the foothills.

The Conserved-Forest Lao River Basin Community Network, through its committees and working groups

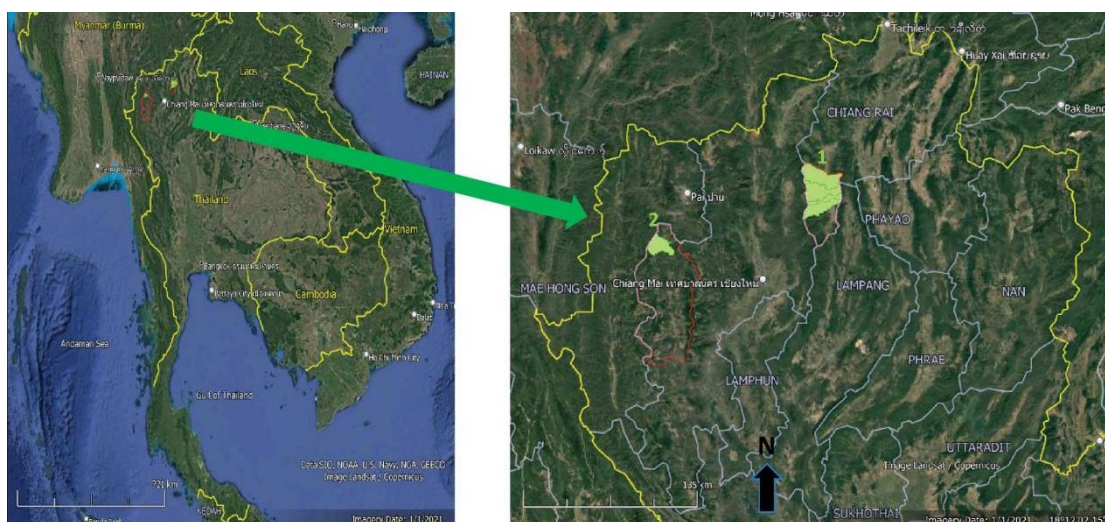


Figure 1. The two locations of the good practice of the Community Water Resource Management (CWRM) in northern Thailand 1 is *Lao River Basin Community Network* and 2 is *Mae La Oup River Basin Community Network*

made up of local community representatives, has facilitated collaborative efforts aimed at developing a comprehensive water management system, restoring upstream forests, and mitigating disaster risks. By 2022, the initiative had successfully constructed 3,332 check-dams, which supplied water to 3,027 households and benefited a total of 9,081 individuals across 50 villages and 6 sub-districts. Additionally, tree nursery and seedling programs were launched, focusing on 70% local tree species and 30% economically valuable plants. To combat the threat of wildfires, 200 kilometers of firebreaks were established (Figure 2.). Furthermore, a local youth organization, known as “*La-On-Hug-Nam-Lao*” or “*Youth Conserves Loa River Basin*,” was formed to leverage scientific and technological methods for field data collection, enabling the monitoring and reporting of water conditions as part of the Community Disaster Monitoring Network's early warning system.

The recognition of disaster risk reduction as a fundamental component of natural resource management is crucial. The Conserved-Forest Lao River Basin Community Network has acknowledged the necessity of addressing various natural hazards, including floods,

landslides, droughts, and wildfires. Consequently, they have incorporated disaster risk management into their strategies for forest conservation and water resource management. The development of water storage systems has been aligned with the natural topography and environmental conditions, effectively mitigating the risks associated with flash floods, droughts, and wildfires, while simultaneously enhancing the water supply to meet community needs. Reforestation efforts and the construction of check-dams have contributed to the improvement of watershed health. These check-dams serve to decelerate water flow, facilitating greater moisture absorption into the soil, which in turn enriches agricultural lands with essential nutrients. The reduction in water flow and the extension of flow duration also play a significant role in minimizing riverbank erosion. Additionally, check-dams function as firebreaks by increasing the moisture content in adjacent areas, thereby preventing the spread of fires and fostering robust local engagement in fire management efforts.

The community network has developed strategies to enhance the viability of agriculture, thereby reducing costs and increasing revenue. They received training on how to



Figure 2. The activities at the Lao River Basin Community Network Wiang Pa Pao District, Chiang Rai Province.

partition farmland for various purposes and progressively refine their production planning (Figure 2). Furthermore, reports on water conditions and warning notifications were incorporated into the planning of crop rotations, alongside the implementation of household accounting practices.

In 2007, the Conserved-Forest Lao River Basin Community Network commenced with 10 villages. By 2021, this network had grown to encompass 30 communities across five sub-districts: Mae Chedi Mai, Pa Ngew, San Sali, Wiang, and Ban Pong. This expansion covers an upstream forest area of 48.47 square kilometers and serves a population of 7,203 individuals. The enhancement of the water storage system has facilitated improved water supply from upstream weirs, integrating purification systems connected to water storage tanks for 24 communities. As a result, a total of 3,027 households now has reliable access to drinking water throughout the year.

The second good practice is the “*Strengthen Water Management Technology for Landslide and Sustain*

Agriculture: Mae La Oup River Basin Community Network, Galayani Vadhana District, Chiang Mai Province.” Due to the absence of a land title deed for “*Paka-Kyaw*,” the demarcation between their cultivated lands and protected zones remained ambiguous. The rise in population and migration patterns exacerbated the consumption of natural resources and led to increased encroachment upon forested areas. Additionally, the influx of capitalists into the region resulted in the employment of local laborers to clear forests for the establishment of monoculture crops, particularly maize. This degradation of forested land has intensified the water scarcity issues experienced by the community. Long-standing disputes over water resources have emerged, as individuals prioritize access for personal consumption, particularly for agricultural purposes. By 2009, the consequences of soil erosion and landslides, triggered by heavy rainfall, had escalated into significant natural disaster concerns affecting the community. Community Water Resource Management (CWRM) was subsequently implemented



Figure 3. The activities at the Mae La Oup River Basin Community Network, Galayani Vadhana District, Chiang Mai Province.

within the Mae La Oup River Basin Network Community. The community members received training in the application of scientific and technological methods to develop water and natural resource maps, conduct water balance analyses, and design and construct check-dams and water distribution systems (Figure 3.). They also formulated land use plans and obtained land use titles, which facilitated collaborative efforts in upstream reforestation. To address the issue of landslides, a canal street was constructed along the ridge area. Under normal conditions, this street serves as a regular thoroughfare; however, during the rainy season, it functions as a canal to manage flash floods and channel water into a network of small retention ponds, colloquially referred to as "*monkey cheeks*." Indigenous knowledge was utilized in the design of water storage dams and local irrigation systems (Figure 3.). Furthermore, local customs, including the River Goddess Worship Ceremony, known as "*Natee Khunnam*," and traditional rhymes, were revitalized to educate the community on environmental preservation. Enhanced water resource management practices led to a transition from monoculture to integrated agricultural practices, agroforestry, and crop rotation. As a result, household incomes increased through the promotion of organic farming and agroforestry initiatives.

Facilitating the integration of indigenous knowledge with contemporary technologies for contextually relevant solutions underscores the significance of traditional wisdom within the *Paka-Kyaw* community. The HII and Utokapat Foundation have prioritized the enhancement of local expertise by merging it with modern scientific approaches. To this end, training sessions (Figure 3.) were conducted for the *Paka-Kyaw* community, enabling them to create a land use land cover (LULC) map in their native language, leveraging their extensive traditional understanding of the region. Participants were introduced to accessible scientific tools and technologies in geoinformatics, including satellite imagery, Geographic Information Systems (GIS), and Global Positioning Systems (GPS). This initiative resulted in the development of a Land Use Land Cover map that delineates various boundaries, such as community areas, protected forests, usable forests, rehabilitating forests, water resources, crop rotation zones, and arable land. The community subsequently endorsed this map as a foundational document for issuing land use titles to local residents.

The Mae La Oup River Basin Network Community utilized their indigenous knowledge to construct check dams featuring a three-tiered filtration system, comprising primary, secondary, and tertiary levels, tailored to their specific topographical conditions. The primary and secondary tiers are designed to decelerate water flow and capture sediment, thereby facilitating reforestation efforts in upstream areas. In contrast, the tertiary tier enhances water retention for use during the dry season. By the year 2021, a total of 394 check dams had been established, ensuring a continuous flow of water for 20 brooks throughout the year.

Water supply management in elevated regions and rice terrace landscapes presents significant challenges. A locally developed irrigation system, grounded in indigenous knowledge and practices, emerged as an effective solution. Communities engaged in the excavation

of ditches and the construction of dams to capture and store water, which was subsequently allocated to the rice terraces, functioning as a reservoir before being redistributed for multiple uses, typically four to five times. This approach facilitated more efficient management of water flow from upstream to downstream areas. Furthermore, the revitalization of *Paka-Kyaw's* traditional practices for water resource management, including the *Natee Khunnam* (River Goddess Worship Ceremony) and the use of traditional rhymes, played a crucial role in the conservation of natural resources.

Enhancing land ownership is crucial for the sustainable management of natural resources. Involving the *Paka-Kyaw* community in the creation of land use and land cover maps has facilitated their understanding of the significance of safeguarding upstream forests and improving the management of various natural resources. With the community's endorsement of these maps, land use titles for 9,501 plots were allocated to the residents. This initiative was pivotal for the *Paka-Kyaw* community in establishing definitive boundaries for conservation areas. They successfully negotiated necessary actions, formulated regulations, and executed cooperative strategies aimed at restoring the upstream forest and managing water resources effectively.

The integration of water, forestry, fire, and agricultural management to achieve a balance between conservation and development is indeed feasible. Conflicts surrounding water resources, the degradation of forests, and other natural assets, combined with inadequate income amidst a growing population, have significantly strained social dynamics within the Mae La Oup River Basin Network Community. It became essential to illustrate how improved management of forest and water resources could sustain and enhance community food security, agricultural productivity, and overall livelihoods. Facilitating a process that brought community members together to understand their land rights and natural resources was crucial. *Paka-Kyaw* recognized the underlying causes of their challenges and collaborated with the community to identify what they considered equitable solutions for the management of land, forests, and water. With enhanced land tenure security, individuals learned to utilize their land more effectively for purposes such as afforestation, agriculture, and domestic needs. Supported by better water management practices, *Paka-Kyaw* transitioned agricultural production from monoculture to organic farming, thereby improving cash crop yields. This shift has resulted in increased food security, agricultural employment, and an improved quality of life for the community members. Consequently, *Paka-Kyaw* has seen a reduced inclination among residents to migrate in search of livelihood opportunities, moving away from traditional practices such as shifting agriculture or slash-and-burn techniques.

At the conclusion of 2023, the Mae La Oup River Basin Network Community achieved significant growth, extending its initiatives to encompass a population of 8,648 individuals across an area of 465.05 square kilometers. This network has been broadened to include seven sub-districts: Jam Luang, Mae Daet, Wat Jan, Mae Najorn, Mae Suek, Ban Tab, and Tha Pha. Additionally, Working Groups focused on Land Management and Regulation have been established. A youth network, known as "*Ae-Pa-Wa*

Dou,” has been formed within eight communities, comprising 105 members. Furthermore, the successful model of Mae La Oup has been replicated in the Mae Jam River Basin.

Given the ongoing difficulties associated with wildland fires and smoke haze in the Upper ASEAN or Lower Mekong Region, which are closely connected to water management concerns, the circumstances can be outlined as follows.

Landscape Fire and Smoke Haze Problems of The Upper Southeast Asia Region

Fire has historically played a significant role in Southeast Asia (SEA) and globally. Member countries of The Association of Southeast Asian Nations (ASEAN) face challenges similar to those encountered in other regions worldwide. The underlying social and economic issues are undoubtedly primary contributors to these challenges. However, factors such as climate change, population growth, and economic pressures have altered local livelihoods, including traditional fire usage practices. Many forests are subjected to frequent burning for the extraction of non-timber forest products (NTFPs), which sometimes leads to conflicts between local communities and authorities. The transition from native forest cover to agricultural land through slash-and-burn techniques has been documented (Carvalho *et al.*, 1995; Kauffman *et al.*, 1995; van Wees *et al.*, 2022), often resulting in monoculture practices that contribute to various environmental problems, including the degradation of primary forests, deforestation, soil erosion, and air quality deterioration. While some communities have adopted rotation cropping and agroforestry, many still rely on traditional shifting cultivation methods. This situation has resulted in an increase in unplanned fires, exacerbating the issues of domestic and transboundary smoke haze pollution, which has raised significant public concern regarding air quality during fire seasons. In this context, the fire and smoke haze challenges are primarily anthropogenic, necessitating a comprehensive understanding of both fire and smoke science, as well as addressing the associated social issues, which are central to the problem.

Gaps in Landscape Fire Science, Smoke Science, Control, Management and Policies

Numerous studies and documents have examined wildland fire and smoke haze related to peat fires in Insular (or Lower) Southeast Asia. However, there has been a notable lack of focused research and intervention strategies addressing wildland fires, anthropogenic fires, and smoke haze in mainland Southeast Asia. The impacts of burning various vegetation types, the characteristics and behavior of smoke, the influence of geographic conditions, fire weather patterns, and associated human activities in Upper Southeast Asia (or Lower Mekong) remain poorly understood and require further investigation. The ecosystems and the purposes for which fire is utilized in the Lower Mekong region differ significantly from those in Lower Southeast Asia, where fire is predominantly

employed to clear logging and agricultural residues, often on peatlands. The knowledge acquired regarding the fire environment in Insular Southeast Asia since the 1990s has limited relevance to the Lower Mekong due to variations in land use, forest cover, climatic conditions, and topography, such as the prevalence of deciduous forests in Upper ASEAN. Furthermore, the application of information without a foundational understanding of its limitations can lead to misuse and misinterpretation of data concerning wildfires and smoke haze. The challenges stem from insufficient science-based research efforts and studies on wildland fire, open burning, and the characteristics and behaviors of smoke haze. A critical issue is the ineffective communication methods currently in use, which require urgent enhancement. Without accurately quantifying these essential elements for the Lower Mekong, it will be impossible to improve the effective control and management of fire and smoke haze. Understanding the behavior of fire and smoke haze is crucial for their management. Several key factors influence the rate at which fires spread and the behavior of smoke plumes, including fuel availability, fuel moisture content, fuel type, fuel structure, and prevailing fire weather conditions.

A comprehensive understanding of the complexities surrounding wildland fires, open burning, and smoke haze management in Upper ASEAN necessitates the application of appropriate and effective scientific tools and advanced technologies. Investigating fuel dynamics and fire behavior in deciduous forests, as well as open burning practices in highland agroforestry and agriculture, will yield insights into the characteristics of fire within these ecosystems. This knowledge is crucial for assessing the impact of fire ecology on biodiversity and ecosystem degradation in fire-sensitive environments, as well as the maintenance of fire-dependent ecosystems. In alignment with ongoing research efforts in wildland fire and emissions, there is a collective interest in gaining a deeper understanding of the behaviors, patterns, characteristics, relationships, influences, and effects of fire and its emissions in the Upper Southeast Asia region. A study focused on fire emission factors is essential. Additionally, establishing a reliable daily monitoring system for fire and smoke haze, along with a scientifically grounded prescribed burning framework, is of paramount importance. An early warning system that addresses transboundary issues within the region and extends to neighboring areas is also necessary, as existing systems may lack the resolution and frequency required for effective local fire and smoke haze management. Ultimately, the goal is to generate scientific findings that will facilitate a more efficient fire and smoke haze management system, benefiting all stakeholders and enhancing efforts to control and mitigate fire emissions in the Upper ASEAN region.

Possible Solutions/Actions to Be Taken

The integration of scientific knowledge into policy-making is of paramount importance, as it ensures that political decisions are grounded in empirical evidence rather than emotional responses. Typically, high-ranking officials and politicians may overlook scientific insights; thus, an initial step involves synthesizing relevant findings

and disseminating them through established communication channels. Enhancing communication across all levels is also a critical issue that requires attention. Effective communication serves as a fundamental component, albeit one that poses significant challenges. Furthermore, fostering Public-Private-People Partnerships (PPPP) is vital for successful outcomes. Building resilient communities through grassroots initiatives represents a solid foundation, provided that such efforts are feasible. However, the unwavering support from higher authorities is often necessary to translate these initiatives into practical realities. Consequently, a balanced approach that harmonizes both grassroots (bottom-up) and authoritative (top-down) strategies is essential for maximizing mutual benefits. Challenges remain in knowledge sharing and securing adequate funding. Additionally, organizations such as the Hydro-Informatics Institute (HII) and the Upper ASEAN Wildland Fire Special Research Unit (WFSRU) at the Forestry Research Center of Kasetsart University serve as robust channels for disseminating information to the public, non-governmental organizations, and government agencies throughout Upper ASEAN and beyond.

To summarize, it is imperative to decrease greenhouse gas emissions and enhance carbon sinks. In the aftermath of the COVID-19 pandemic, sustainable development initiatives must persist, particularly in light of the economic downturn affecting numerous nations. A comprehensive understanding of current realities, coupled with resilience and adaptability, is essential for effectively addressing the repercussions of climate change. Capacity building through the exchange of knowledge and best practices serves as a fundamental component of this process. Additionally, instilling a culture of conservation and preservation in future generations is vital for fostering sustainable living. Ideally, this would pave the way for a transition towards environmentalism and, ultimately, deep ecology. The objective is to cultivate a sustainable and ecologically sound society. Furthermore, there is a pressing need to address the deficiencies in fire and smoke science. Effective communication across all levels is another critical issue that requires a holistic and innovative approach. It is crucial to recognize that we are not merely facing climate change; we are confronting a climate crisis. Disasters and extreme weather events are unavoidable. Our primary objectives must be to build sustainability, resilience, and adaptability to navigate future climate uncertainties and severe occurrences. While we may be in different circumstances, we are undeniably facing the same formidable challenges. Collective effort is essential. The enduring Earth Day slogan, "Think Globally, Act Locally," remains relevant today. Imagine the potential achievements when we unite in our efforts! The ASEAN motto, "Stronger Together," encapsulates the spirit we need. Finally, it is vital that we respond collectively with the ethos of "One for All, All for One".

CONCLUSION

Community-based Water Management (CBWM) or Community Water Resources Management (CWRM) has been in place and practiced in Thailand for a long time

and has proven to be highly effective in promoting sustainable development, improving livelihoods, and building disaster resilience at the community level. The progress in research, collaboration, and management related to wildland fire and smoke haze in Thailand and the Upper Southeast Asia (or the Lower Mekong Basin) is both promising and crucial. It is essential to thoroughly investigate, support, understand, and disseminate knowledge about *Fire Science* and *Smoke Science* in the region. Raising awareness of these issues should be a priority for national leaders through all available international channels. This initiative requires dedicated follow-up from representatives who are committed to driving change in their countries. Unfortunately, current representatives addressing fire and smoke haze have not effectively engaged with key stakeholders in their nations and local communities. Instead, they have tended to keep the knowledge gained from meetings, conferences, workshops, and working groups to themselves, highlighting the need for a significant change in behavior and mindset. Therefore, it is necessary to re-engineer existing working groups and committees. Mechanisms must be established to elevate recognized issues discussed in ASEAN meetings to the local level, where they are most pertinent. A substantial improvement in the bottom-up approach is essential. Furthermore, alternative and collaborative strategies for risk reduction, mitigation, adaptation, and resilience, including community education and outreach, are vital. Since social factors are the primary drivers of fires in this region, a community-based approach to fire, water, and natural resource management is crucial for sustainably improving the livelihoods of local populations. Sustainable development must start at the community level, and it is vital to create real, sustainable incomes to support this comprehensive and holistic management approach.

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