3.4

Fire around the Doi Chang Pa Pae community. Photo: Buncha Dupunu Muharr

Combining community management of fire and water in Thailand

Veerachai Tanpipat, Royboon Rassameethes, Kobsak Wanthongchai, Prayoonyong Nhuchaiya, and Jittisak Yodcum

"Effective fire management is integrally linked to improved water management following a holistic, ethical and truly participatory approach."

Introduction

Fire has long been used in Southeast Asia to clear land and to facilitate hunting and the harvesting of non-timber forest products. Fire is also still used in slash-and-burn farming, but less often as farmers adopt rotational systems and agroforestry. However, increasing economic and climate change pressures mean that many natural forests have been permanently converted to agriculture, or now frequently burn. Wildfires are a major cause of forest degradation and biodiversity loss.

Smoke haze from fires is also detrimental to human health and livelihoods. Biomass burning is the dominant source of outdoor air pollution, contributing to premature mortality in the Lower Mekong region (Lelieveld et al. 2015). Poor air quality from smoke haze has become a national issue. A Clean Air Act is currently being considered by the House of Representatives, but further awareness raising is clearly needed.

A community group clearing dead undergrowth that could ignite and cause a wildfire. Photo: Buncha Dupunu Muharr

Smoke haze has also become a transboundary issue, from northern Thailand to southern China and Taiwan (Lin et al. 2014), so international efforts are also required to solve the problem, including more intensive efforts to reduce the number of wildfires.

A no-burning policy was introduced in Thailand in 2013 to tackle the problem. No-burning periods — at different times between January and May — were set by the governors of 17 northern provinces (Panyakam and Pongsawat 2021). This had only a limited impact, however, as local communities continue to use fire. Furthermore, mixed deciduous and dry dipterocarp forests are fire-dependent ecosystems, and no-burning policies would have negative impacts on their structure (Goldammer and Wanthongchai 2008).

An ethical approach

For effective fire management, it is crucial to have sustainable livelihoods. Community development must include adaptation and improved disaster resilience by integrating community-based fire and water management. This requires a holistic approach such as the concept of the "land ethic" (Leopold 1949), and the "sufficiency economy" of Thailand's former King Rama IX Bhumibol Adulyadej (Mongsawad 2010).

In Thailand, most community development involves the "sufficiency economy" concept in some way, including good practices in water resource management. Essential to the concept are multifunctional agroforestry systems that provide a wide range of economic, sociocultural and environmental benefits throughout the year. In Thailand, this is known as "three forests and four benefits" — the three forests are edible, usable and profitable; and the four benefits are food, other resources, income and conservation.

Community-based management of fire and water need to develop together and to integrate both indigenous wisdom and scientific knowledge. Measures include integrating modern practices of prescribed burning and thinning with cultural burning, and use of traditional practices along with new technologies.

Integrated forest fire management

This involves communities in using fire in land-use systems in safe and environmentally benign ways that prevent or control excessive burning and unwanted wildfires. It brings together best practices regarding fire ecology, fire management and social issues. Its participatory approach means that local people are involved in problem solving and local fire processes, and are supported by government agencies and NGOs. The successful participation of local communities depends greatly on strong local leadership and education.

Community-based fire practices in Southeast Asia are still limited, however. To develop integrated forest fire management in a given area, communities must be involved in all processes and must have a good understanding of fire ecology in order to ensure that

fire management plans will be adopted and effectively implemented. Unless local people agree to and participate in a plan, it will be impossible to sustain. Farms and forests — and the food, timber and non-timber forest products they provide — are all susceptible to burning by local people as part of traditional practices. Burning activities must be discussed, and be supported by science-based information, in order for fire management plans to be adopted and sustained.

Community participation

King Rama IX's concept of "connect-understand-develop" guides sustainability efforts. It underlies the need to understand every dimension of a particular area, both physical and social. Using this holistic approach, the first and most important task is to establish trust with local people before any process begins. That requires sincere and open communication. Moreover, strong community leadership is also crucial, and leaders must be committed to the approach. This commitment, which is often missing from sustainability initiatives, is the main driving force for success.

Only after trust is established can activities begin, including the collection of field data, remote sensing images, digital topographic maps, and weather and climate data. A range of technologies and tools can be used to gather information on soil and water, and to determine water demand and supply. The three main issues to address are water security, food security and community economy. The use of public-private-people partnerships (PPPPs) can help integrate soil, water and forest management and agriculture. With better incomes and livelihoods within a community, there is less demand on forest resources, and fewer fires. PPPPs build capacity and facilitate community networks and help to expand implementation from the individual level to the community, sub-district and river-basin level (HAII 2016). As of December 2021, there were PPPPs in 1,816 villages throughout Thailand, with 60 core communities within 19 river basins.

Participation is key to developing community-based fire management (FAO 2011), which includes open burning and fire protection (Wanthongchai et al. 2021). Community rules and regulations must be agreed to and accepted, so that everyone in a village will abide by them. This article discusses examples from four communities in northern Thailand (Figure 1): the Ban Huay Hin Lad Nai community; the Lao River Basin Community Network (Wieng Pa Pao District, Chiang Rai Province); the Ban Huay Pla Lod community (Mae Sod District, Tak Province); and the Ban Doi Chang Pa Pae community (Ban Hong District, Lumphun Province).

Ban Huay Hin Lad Nai community

This Karen community in Khun Chae National Park agreed to land-use zoning to manage their forests and other resources. This led to sustainable farming and to efficient and effective management of forest fires. Initial support came from the Royal Project in 1982, following Amnesty Order #66/23 in 1980. Later, many organizations

Figure 1: Locations of the four communities

Light green: Ban Huay Hin Lad Nai community and the Lao River Basin Community Network, Wiengpapao District, Chiang Rai Province; Red: the Ban Huai Pla Lod community, Mae Sod District, Tak Province; and Blue: the Ban Doi Chang Pa Pae community, Ban Hong District, Lumphun Province. Source: Google Earth

and institutions provided funding and support, thanks in part to the work of a strong local conservation leader, Preecha Siri, who received the UN Forest Hero Award in 2012.

To manage forest fires and smoke haze, the community adopted integrated forest fire management, supported by government authorities, researchers and NGOs. Integrating local knowledge and wisdom with scientific technologies and innovation helped people develop an effective fire management plan. The community established a committee to debate policies and make decisions on activities related to forest areas and resource use. For example, community members who wanted to cut down trees to build a house would need permission from the committee. The community also changed from shifting cultivation to rotational farming, where villagers divided planting plots into sub-plots in annual rotations, leaving some areas for natural regeneration and recovery. All plots are mapped and recorded in a database to prove that farmland areas are not expanding.

Through partnerships, participatory processes, acceptance and cooperation, the community has developed and taken ownership of specific action plans. This allows for sustainable agriculture practices while conserving natural resources and preventing forest fires. Moreover, the community has established a fund, with money earned from selling forest products such as bamboo shoots and honey, to manage forest fires.

The fund is used to buy tools and equipment for the construction of firebreaks, to pay for fire patrols during the peak wildfire period (between January and April), and to buy food for firefighters.

A key strength of the community, and one that has contributed to the success of forest fire management, is the incorporation of local knowledge into the conservation of natural resources. This includes knowledge of sustainable agriculture, indigenous vegetation, the importance of biodiversity, and ancient traditions that have been passed from generation to generation. The community members are also open to learning about new technologies, and have adopted a mobile phone app that alerts them to nearby forest fires using satellite data from NASA's Fire Information for Resource Management System (FIRMS).

The community developed a map and database of their natural resources, classified according to forest type and land-use type, and detailing firebreak locations, ecotourism locations and other areas. The community participates in training and capacity-development activities organized by the government and civil society organizations, and plays an active part in knowledge and experience exchange networks that enable them to remain up to date on the current situation.

Lao River Basin Community Network

This was established in 2005. The network is supported by the Utokapat Foundation and the Hydro-Informatics

Past (on the left) and present (on the right) condition of Ban Huay Pla Lod community. Photos: Hydro-Informatics Institute (HII)

Institute (HII) to apply science and technology to managing water, forests and natural resources. Communities receive funding and support as long as they fully participate and learn by doing. It operates under a programme that reduces the risk of forestry-based disasters and builds resilient livelihoods.

This has led to four main outcomes:

1. establishing the network, which now manages water, forests and natural resources in an area covering 256 km² and, including 41 communities in four sub-districts;
2. construction of 2,528 check dams that provide water to 14 communities, 881 households and 2,740 people;
3. a programme that promotes the production of organic tea, coffee, herbs and vegetables, adding to household income; and
4. the la-on-hug-nam-lao youth group, which applies science and technology to collect data, report on the water situation and maintain a disaster monitoring system.

A community fund sustains all activities, including the youth group, without any financial support from government agencies.

Ban Huay Pla Lod community

In 1974, King Rama IX visited the community and urged them to restore forests using the "three forests and four benefits" concept. The people began to plant coffee instead of opium poppies. In 1981, the community became a part of Taksin Maharat National Park; this caused conflicts due to the loss of land-use rights. In 2008, Utokapat Foundation, under the Royal Patronage of H.M. the King as well as HII, started working with the community. It introduced upstream forest rehabilitation and community water resource management, and applied science and technology to manage water, forests and natural resources more effectively. This has led to massive reforestation and improved land management during the past 14 years.

The community conducted a participatory field survey to map water resources (Figure 2) and plan for the management of soil, water and forests. A forest restoration process was also initiated to recover and increase water resources for consumption, agriculture and power supply, and 400 check dams were built to increase soil moisture. People also planted coffee and vegetables, which provided income, as well as trees for shade. They improved water management through integrating science, technology and engineering to better understand their water supply and demand.

HII helped community members design a crop rotation calendar (Figure 3) to meet water and market demands and generate higher incomes throughout the year. The community also developed a sustainable land-use management plan, after zoning by land cover (Figure 4). This was possible using geoinformatics technology and by achieving agreement from all community members through many meetings, discussions and voting processes.

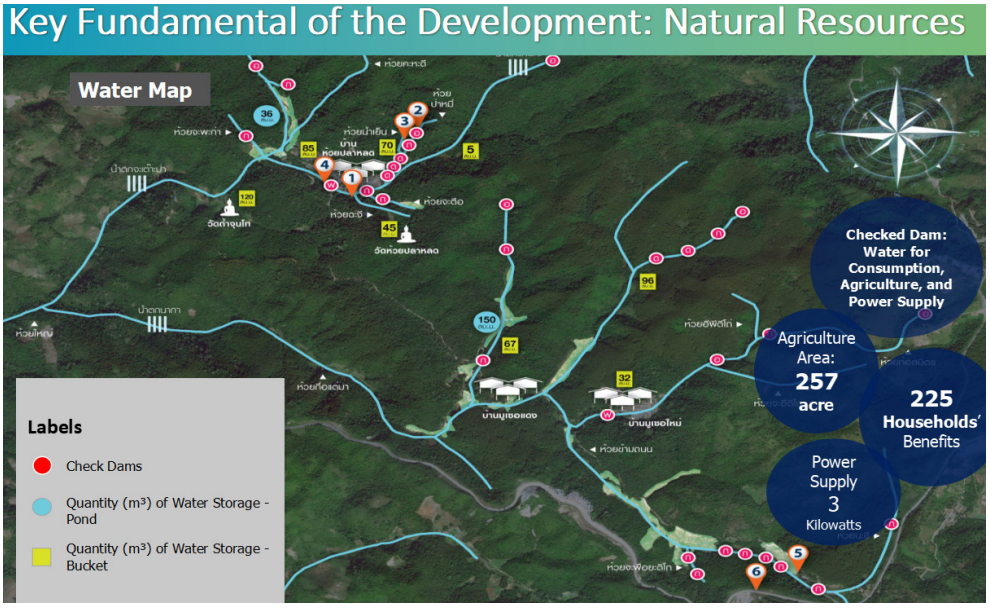

Figure 2: Water resources map prepared by the Ban Huay Pla Lod community. Source: Hydro-Informatics Institute (HII)

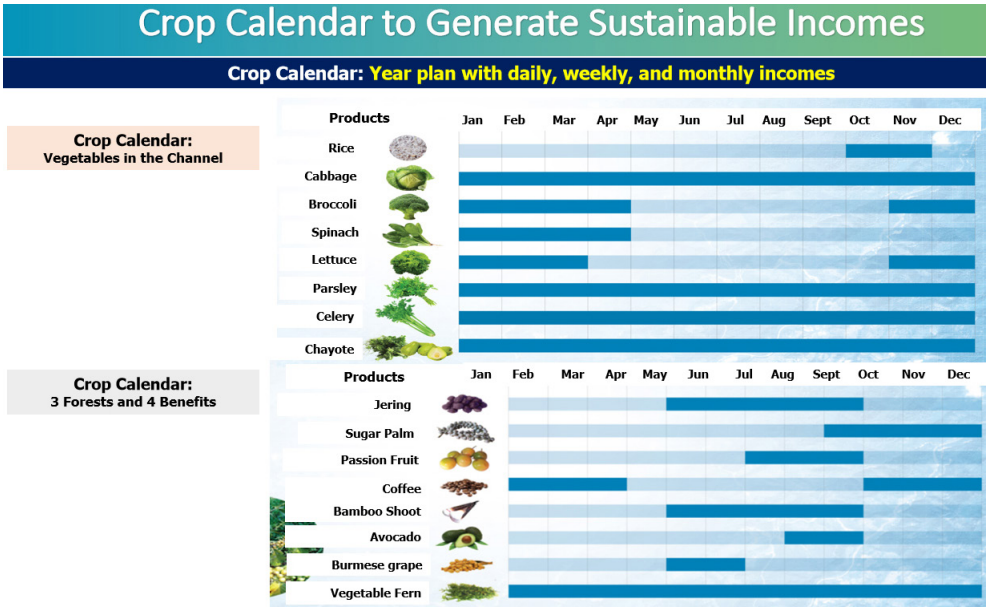

Figure 3: Ban Huay Pla Lod's crop rotation calendar. Source: Hydro-Informatics Institute (HII)

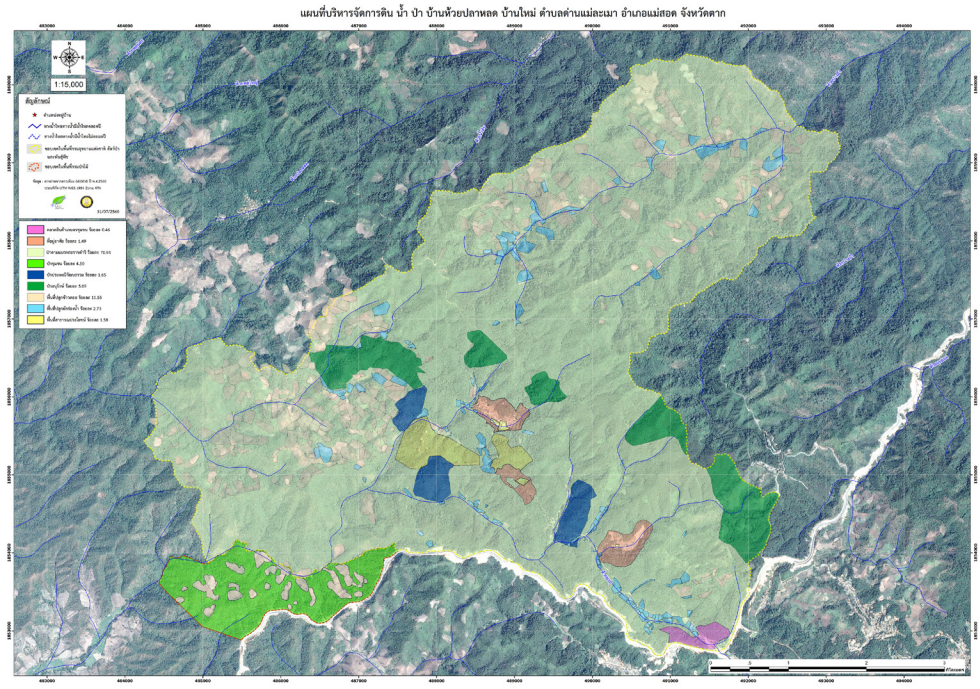

Figure 4: A land-use zoning map prepared by the Ban Huay Pla Lod community, with technical support from HII. Source: Hydro-Informatics Institute (HII)

Ban Doi Chang Pa Pae community

This is an indigenous community where rules and regulations have been agreed to and applied. In addition, the SEA-HAZEMON system monitors air quality; its low-cost sensors are installed in the mountains and monitored by local youth with permission from the village committee. This supports faster initial attack of fires through cooperation with the local fire control station. In addition, a rotatable thermal camera and high-resolution CCTV will also be set up. These measures show the community's adoption of innovative means to reduce fire risk by integrating indigenous wisdom with modern knowledge and technologies.

A simple and low-cost unit to monitor air quality, installed by the Ban Doi Chang Pa Pae community. Photo: Buncha Dupunu Muharr

Conclusions

Integrating community-based fire management and community water resource management provides a useful way to prevent the ignition and spread of forest fires in Thailand. This follows the Thai expression that "where is more water there will be less fire." More water also means more ways to generate income, which will improve community livelihoods and help sustain a community-based approach to fire and water management. Without sustained income sources, any community management initiative will fail when funding ends, as seen with payment for ecosystem services; for example, in Mae Sa Watershed (Wongsa 2015). With sufficient year-round water supply, local people have more cash crops and rotation periods to select from, and more flexibility to adjust to market needs. With higher income, they are also much less likely to go into the forest and start fires. In addition, increasing water in the landscape through the use of check dams creates a "wet belt" that acts as a firebreak.

Making integrated management work over the long term required structures and agreements that took time and patience to establish. These include measures for community forest conservation, land-use management, zoning, sustainable management practices, community regulations, penalties for breaking community rules, sustainable incomes, community markets, a community fund, and common rights. This article shows that communities can be supported to develop and maintain sustainable practices that reduce the risk of wildfires while improving water availability, air quality and income, and that with additional revenue streams, they can become self-sustaining.

References

FAO (Food and Agricultural Organization). 2011. *Community-based fire management: A review*. FAO Forestry Paper 166. Rome: FAO. https://www.fao.org/3/i2495e/i2495e.pdf.

Goldammer JG and Wanthongchai K. 2008. Fire management in South Asia's dry forests: Colonial approaches, current problems and perspectives. *In* Diloksumpun S and Puangchit L (eds.). *Tropical Forestry Change in a Changing World*. Volume 5: Dry Forest Ecology and Conservation. Kasetsart University, Bangkok, Thailand, 1–24. http://frc.forest.ku.ac.th/frcdatabase/bulletin/Document/4.Volume5-1-GOLDAMMER.pdf.

HAII (Hydro and Agro Informatics Institute). 2016. *Application of science and technology for community water-related disaster risk reduction: Thailand good practices following His Majesty the King's initiative towards sustainable development*. 2nd Edition. HAII and UNISDR Regional Office for Asia and the Pacific. https://www.utokapat.org/wp-content/uploads/2018/10/Application-of-Science-and-Technology-for-Community-Water-Related-Disaster-Risk-Reduction.pdf.

Lelieveld J, Evans JS, Fnais M, Giannadaki D and Pozzer A. 2015. The contribution of outdoor air pollution sources to premature mortality on a global scale. *Nature* 525(7569):367–371. https://doi.org/:10.1038/nature15371.

Leopold A. 1949. *A Sand County Almanac*. Oxford, UK: Oxford University Press. https://www.aldoleopold.org/about/aldo-leopold/sand-county-almanac/.

Lin NH, Sayer AM, Wang S-H, Loftus AM, Hsiao T-C, Sheu G-R, Hsu NC, Tsay S-C and Chantara S. 2014. Interactions between biomass-burning aerosols and clouds over Southeast Asia: Current status, challenges, and perspectives. *Environmental Pollution* 195:292–307. https://doi.org/10.1016/j.envpol.2014.06.036.

Mongsawad P. 2010. The philosophy of the sufficiency economy: A contribution to the theory of development. *Asia-Pacific Development Journal* 17(1):123–143. https://doi.org/10.18356/02bd5fb3-en.

Panyakam M and Pongsawat P. 2021. The evolution of wildfire and haze policies: A case study of wildfire and haze policies in Chiang Mai. *Governance* 14:407–446.

Wanthongchai K, Tanpipat V, Noochaiya P, Sirimonkonlertkun N, Macatangay R, Thammavongsa L, Oo TN, Bran SH and Solanki R. 2021. Integrated highland wildfire, smoke, and haze management in the Upper Indochina Region. *APN Science Bulletin* 11(1):133–143. https://doi.org/10.30852/sb.2021.1704.

Wongsa K. 2015. *Payment for ecosystem services in the Mae Sa Watershed*. Technical Assistance Report. USAID LEAF Thailand Office and Winrock International, Bangkok, Thailand.

Author affiliation

Veerachai Tanpipat, Expert and consultant, Hydro-Informatics Institute, Ministry of Higher Education, Science, Research and Innovation (MHESI), Bangkok, Thailand (veerachai@hii.or.th)

Royboon Rassameethes, Deputy director, Hydro-Informatics Institute, Ministry of Higher Education, Science, Research and Innovation (MHESI), Bangkok, Thailand (royboon@hii.or.th)

Kobsak Wanthongchai, Dean, Faculty of Forestry, Upper ASEAN Wildland Fire Special Research Unit, Forestry Research Center, Kasetsart University, Bangkok, Thailand (fforksw@ku.ac.th)

Prayoonyong Nhuchaiya, Chief of special fire training and suppression section, Department of National Parks, Wildlife and Plant Conservation, Ministry of Natural Resources and Environment, Bangkok, Thailand (g39pyn@gmail.com)

Jittisak Yodcum, Chief of fire science section, Royal Forest Department, Ministry of Natural Resources and Environment, Bangkok, Thailand (jitti.rfd@gmail.com)