

## Upper ASEAN Wildland Fire Special Research Unit (WFSRU)



*At the heart of the image are bold black “hands,” symbolizing strength, unity, and human determination. As the most striking and memorable element, these hands gently yet powerfully embrace trees and green spaces, shielding them from the threat of raging flames depicted in red and layers of smoke in gray rising above.*

*This imagery reflects more than protection—it represents a collective human commitment. The outstretched hands embody an organization that stands at the frontline of safeguarding nature, offering vigilance, knowledge, and collaboration. Through continuous monitoring, research, and coordinated action, the unit works to prevent wildfires and smoke from invading forest ecosystems and harming wildlife.*

*Ultimately, the image conveys a message of hope and responsibility: that through human effort and unity, nature can be protected, preserved, and sustained for future generations.*

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**Background**

There are many forest fires, smoke and haze related researches and studies in Thailand and the Upper ASEAN region. A few forest fire management books have been written addressing the environmental and socioeconomic implications of fire use and wildfires in the region. A few studies on forest fire behavior and fuel have been elaborated at the Faculty of Forestry, Kasetsart University, the Forest Fire Control Division and others in Thailand. However, there is no database on forest fire, open burning, smoke and haze related studies database in the Upper ASEAN region. Thus, it is not entirely known if these studies are covering the areas/ecosystems typically affected by fire use or wildfires and how much field data exist. It is difficult to manage the existing studies and the underlying datasets are often difficult to locate or missing. At this time, no one knows in detail what gaps in fire, smoke and haze knowledge must be filled. Furthermore, decision makers are not aware of the knowledge and information about the role of fire and fire emissions (smoke and haze) that are needed in order to support informed, effective and efficient fire and smoke management.

Fire behavior and its effects for tropical pine forest, deciduous forest, and peat forest have been reviewed and studied (Wanthongchai and Goldammer, 2008; Wanthonchai et al., 2008; Wiriya, 2009; Wanthonchai et al., 2011; Wanthonchai et al., 2013; Wanthonchai et al., 2014; Chairak et al., 2016). There are a few attempts trying to create fire risk maps of Thailand, but there is none cover the upper ASEAN with varieties of information using satellite remote sensing data from Earth Observation Systems (EOS), Geographic Information System (GIS) and weather forecast knowledge such as active fire detection, burn areas mapping, fire weather index (Tanpipat, 2000; Tanpipat, 2002; Tanpipat et al., 2003; Tanpipat et al., 2004; Tanpipat et al., 2005; Nuchaiya, 2006; Tanpipat, 2008; Tanpipat et al., 2009; Tanpipat, 2010; Tanpipat, 2011a and 2011b; Poschong, 2010; Chien et al., 2011; Dontri, 2011; Sirimongkolertkun et al., 2013; Rucker et al., 2017a and 2017b; Manomaipiboon et al., 2017). The adjustment and calibration of Canadian Fire Danger Rating System has been done to be more suitable to upper ASEAN (Manomaipiboon et al., 2017a and 2017b; Tanpipat, 2017). The nature combustion process is highly complex: heat release, oxygen availability, fuel composition, topography, and weather all interact to affect fire and smoke behavior. In the upper ASEAN countries, human influence on timing, location, and size of fires cannot be ignored. This makes accurate risk mapping a different, and more complex, problem compared with less

populated areas. True knowledge of vegetation types / fuels, topography, and weather is needed to be understood in order to be able to predict and manage fire, smoke and haze; humans are the most important ignition source. The assessment of high-accuracy fire risk maps thus is important to consider the human component.

This is why principles of Integrated Fire Management (IFM) include the involvement of people and their abilities to apply fire in land-use systems safely and environmentally benign and to be able to prevent and control excessive burnings and unwanted wildfires. It attempts to bring together the best knowledge about 3 aspects of fires: ecology, management, and social. People participation means people get involved in all problem-solving and local development planning processes in fire management with their own responsibilities along with support by government agencies and non-government organizations. The successful of participation of local communities depends greatly on a strong local leadership and education level (Sirimongkolertkun et al., 2015). Other information on fire ecology is also important since people can judge whether they will adopt fire plans. The application of participatory or community-based practices in countries of Southeast Asia, however, is still very limited.

Apart of fire being the major force for the accelerating degradation and destruction of natural forests and other sensitive ecosystems, smog and haze from excessive application of fire in land-use change impact humans' health and security. The smog pollution and haze issue indeed has a transboundary and international dimension. Smog and haze can travel across borders. Therefore, cooperative international efforts are critical to tackle this problem. The latest severe example of regional smoke pollution was the year 2015 when smoke from fire use for converting natural peatland ecosystems to plantation in South Sumatra released smoke that blanketed the Upper ASEAN region (Yokelson et al., 2016). The smoke and haze (fire emissions) become an annual problem in northern Thailand and upper ASEAN often affecting even countries like Taiwan and lower mainland China (Phairuang, 2006; Rayanakorn, 2010; Wang et al., 2012; Chantara et al., 2012; Pongpiachan et al., 2014; Lin et al., 2014; Field et al., 2015; Houseman et al., 2015; Yadav et al., 2017; Goldammer et al., 2017). There is not enough smoke and haze behavior research in the upper ASEAN region (Tanpipat et al., 2010; Tanpipat, 2015a and 2015b; Tanpipat 2016).

With the application of existing scientific and technical knowledge it is possible to reduce the occurrence of excessive application of fire in land use and land-use change and to reduce the occurrence of wildfires, thus reducing severe environmental damages and people affected, including the loss of lives. This is why an active Science-Policy Interface must be created to bring the state of knowledge and fire science and fire management to the decision- and policy making levels.

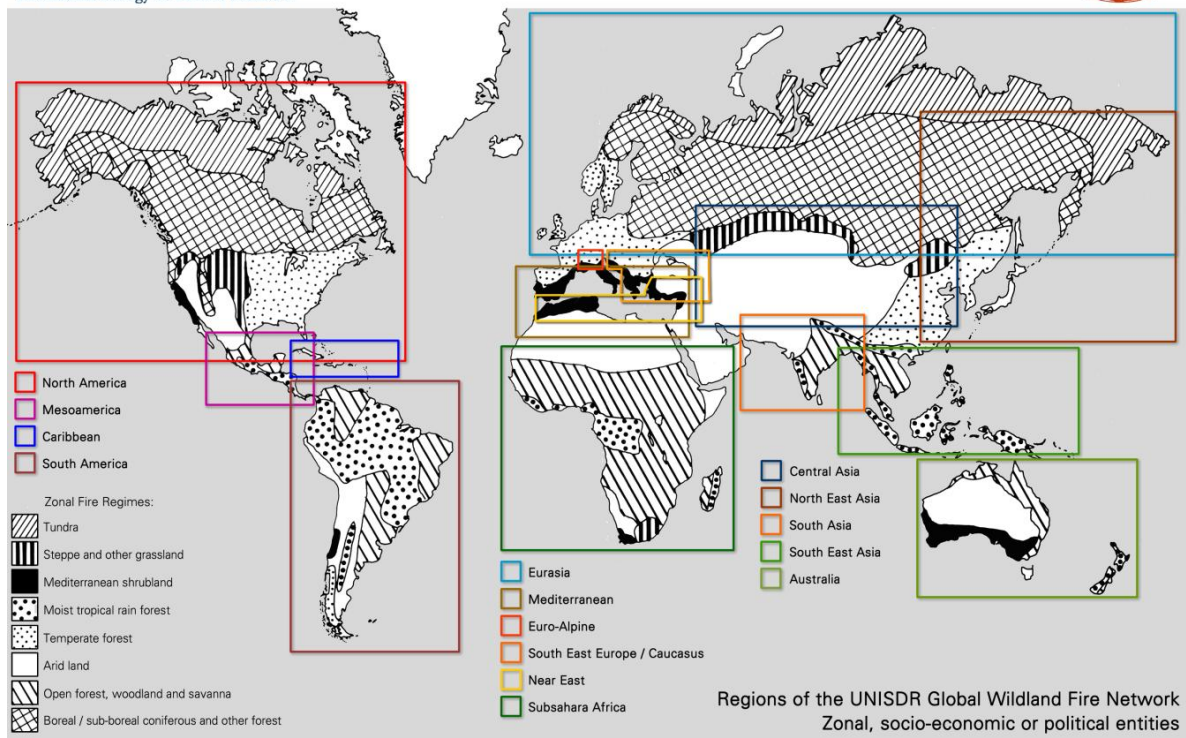
### **Rationale for the establishment of a Wildland Fire Special Research Unit within the Forestry Research Center**

In Lower Mekong, fire, smoke and haze have long posed a significant problem, and efforts to really understand, manage and control them have been insufficient. Unfortunately, there is not existing place where knowledge and findings have been compiled and redistributed. Furthermore, there is also no unifying group motivating the science toward a deeper understanding of wildland fire, smoke and haze in order to manage the problems more efficiently.

Until now there was no existing focus or dedicated research center or unit that dealt directly with wildland fires, smoke and haze occurring in the vegetation types, geographic conditions and under weather patterns and related human behaviors of mainland Southeast Asia (Lower Mekong Basin). The ecosystems and the purpose of fire use in Mainland Southeast Asia differ from those in Insular Southeast Asia, which is dominated by fire use to convert equatorial tropical rain forest and peatlands. It is deciduous forest that is the dominant vegetation type up here. Moreover, for example, there are many mislead information and misunderstanding of the wildfires, smoke and haze issues because lacking scientific based research efforts and studies such as forest fire, smoke and haze behaviors which are very important elements to thoroughly understand in order to control and manage fire, smoke and haze situation efficiently; therefore, **the establishment of an Upper ASEAN Wildland Fire Special Research Unit (WFSRU) within the Forestry Research Center**, Faculty of Forestry, Kasetsart University, Thailand, which was founded in 1987, was essential and needed. The WFSRU was inaugurated in October 2017 and will act in the Upper ASEAN Region to provide fire, smoke and haze scientific and management knowledge to interested parties.

The WFSRU will closely cooperate with the Regional Fire Management Resource Center – South East Asia (RFMRC-SEA, <https://rfmrc-sea.org/>) which was established at Bogor Agricultural University, Indonesia, in July 2017. The WFSRU and RFMRC-SEA will act under the umbrella of Global Wildland Fire Network of UN International Strategy for Disaster ReDuction (UNISDR, <http://gfmcc.org/globalnetworks/globalnet.html>, Figure 1) and its Secretariat, the Global Fire Monitoring Center (GFMC, <http://gfmcc.org/>).

The WFSRU will follow up and continue with previous collaborations such as Fire Information for Resource Management System (FIRMS, <https://firms.modaps.eosdis.nasa.gov/>), NASA-LANCE-Earthdata-Rapid Response Team (<https://earthdata.nasa.gov/earth-observation-data/near-real-time/rapid-response>), Global Fire Monitoring Center (GFMC), the Copernicus Atmosphere Monitoring Service (CAMS)-Global Fire Assimilation System-The European Centre for Medium-Range Weather Forecasts (ECMWF, <http://atmosphere.copernicus.eu/about-cams>), ACT Emergency Services Agency, NOAA National Centers for Environmental Information (NCEI, <https://www.ncei.noaa.gov/>), Regional Education and Training Center (RETC, <http://retc.afocosec.org/>)-Asia Forest Fire Training and Landmark Program (AFoCO, <http://www.afocosec.org/afoco/pc/en/>), Canadian Forest Service, Royal Forest Department, National Park Wildlife and Plant Conservation Department (<http://www.dnp.go.th/forestfire/>), ZEBRIS GbR (<https://firemaps.net/>), Seven SouthEast Asian Studies (7-SEAS)-U.S. Naval Research Laboratory-Marine Meteorology Division-U.S. Navy ([https://www.nrlmry.navy.mil/aerosol\\_web/7seas/7seas.html](https://www.nrlmry.navy.mil/aerosol_web/7seas/7seas.html)), National Astronomical Research Institute of Thailand (NARIT), Hydro and Agro Informatics Institute (HAIL), Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC, <https://www.recoftc.org/>), Lao PDR Department of Forestry (<http://www.maf.gov.la/>), Myanmar Forest Department (<http://www.forestdepartment.gov.mm/eng/>), Japan Aerospace Exploration Agency (JAXA, <http://global.jaxa.jp/>), Academia Sinica Grid Computing Centre (ASGC)-Taiwan GRID (<http://www.twgrid.org/en/>), Asia Pacific Advanced Network (APAN) Disaster Mitigation Working Group (DMWG, <https://apan.net/>) and Disaster Mitigation Competence Centre Plus (DMCC+, <https://wiki.egi.eu/wiki/DMCC%2B>).



Source: Global Fire Monitoring Center (GFMC)

**Figure 1.** This world map shows the delineation of the Regional Wildland Fire Networks.

## Terms of Reference for the Unit

### 1. Particular Upper ASEAN Research Tasks

#### 1.1. Fundamental fire research

- Fire ecology: Characterization and functional role of fire in different ecosystems of Mainland Southeast Asia (the southern deciduous / semi-deciduous dipterocarp forest, mountain pine forests, wetland and peatland biomes, and agricultural lands); including relationship with climate change
- Fire behavior: Characterization of combustibles (fuels); modeling fire behavior in dependence of fire weather; fire hazard & wildfire risk assessments; including relationship with climate change
- Fire emissions: Vegetation fire emission characteristics/properties, emission factors, smoke dispersion/transport modelling, impact of fire emissions on the local, regional and global atmosphere and climate

#### 1.2. Advanced tools for fire early warning, monitoring and impact assessment

- Fire early warning: Improvement of existing fire danger rating systems for various ecosystem and landscape types in the region including relationship with climate change
- Early fire detection: Application of advanced ground-based methods for rapid fire detection (camera-based smoke sensing systems)
- Satellite fire detection, monitoring and impact assessment: Utilization of existing open access and commercial satellite-borne sensors for near-real time detection and monitoring of active fires and smoke emissions; area burned; ecosystem response including damages

### **1.3. The human dimension of vegetation fires**

- Socio-economics of fire: Reasons for fire application in land use and land-use change (forest and open land ecosystems, including agricultural and pasture lands); causes of wildfires; direct and indirect impacts of fires on society (rural, urban)
- Impact of fires on human health, security and private & public assets
- Community involvement and empowerment in fire management (prevention, preparedness, response, appropriate use of fire)

### **1.4. Fire management**

- Fire investigation and fire statistical databases: Development of capabilities allowing to understand the causes, extent and consequences of fire
- Fire management information systems and planning: Development of fire information systems based on advanced IT tools, fire management plans (preparedness and pre-suppression planning)
- Training: Provision of advanced training concepts and training services aimed at enhancing overall fire management capabilities of local, national and regional actors (fire prevention, preparedness, suppression and application of prescribed fire)

## **2. Cooperation with the Regional Fire Management Resource Center – South East Asia (RFMRC-SEA, <https://rfmrc-sea.org/>)**

The Regional Fire Management Resource Center-South East Asia (RFMRC-SEA), which was established at Bogor Agricultural University, Indonesia, in July 2017, is coordinator of the UNISDR Regional South East Asia Wildland Fire Network serving the fire science-policy interface for the pan-Southeast Asian/ASEAN region. At this level, WFSRU will cooperate

with and support the RFMRC-SEA, which is addressing fire management policies and cross-boundary cooperation in fire management on the following

- Creation of a science-policy interface to serve at national and regional levels: Provision of science and technology-based advisory services to policy makers and planning
- Support of the development of holistic fire management policies at landscape level and through inter-agency / cross-sectoral cooperation
- Provision of rationale for legislation and law enforcement
- Development of rationale and guidance: Creation of SOPs and guidelines aimed at enhancing interoperability of actors across national borders, conducting cross-boundary training
- Supporting the development of inter-agency (national) cross-boundary agreements (bilateral) agreements on cooperation in fire management

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