



ความรุนแรงของปัญหาหมอกควันในจังหวัดพะเยา, ประเทศไทย

The Severity of Smog Crisis in Phayao Province, Thailand

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Received : 7 April 2022

Revised : 13 May 2022

Accepted : 18 August 2022

บทคัดย่อ

ปัญหาหมอกควันในจังหวัดพะเยาซึ่งเป็นผลจากการพัฒนาเมือง มีการเผาเป็นบริเวณกว้างและรุนแรงมากขึ้นเพื่อเตรียมพื้นที่สำหรับการเพาะปลูกและการหาของป่า ปัญหานี้ก่อให้เกิดผลกระทบต่อสุขภาพของประชาชน (ทั้งสุขภาพทางกายและจิตใจ) สิ่งแวดล้อมและสังคม ซึ่งสอดคล้องกับผลการตรวจวัดคุณภาพอากาศในบรรยากาศที่ตรวจวัดได้เป็นเวลาต่อเนื่องและหลายปี โดยเฉพาะอย่างยิ่งฝุ่นละอองขนาดเล็กไม่เกิน 2.5 ไมครอน (PM 2.5) ซึ่งเป็นฝุ่นและควันที่เกิดจากการเผาไหม้ป่าออกมา ดังนั้นมาตรการต่าง ๆ ถูกกำหนดขึ้นเพื่อป้องกันและแก้ไขปัญหา แต่เป็นที่น่าเสียดาย มีอุปสรรคหลายประการที่ส่งผลให้การบริหารจัดการปัญหาไม่มีประสิทธิภาพ อาทิ การขาดงบประมาณสนับสนุน การขาดความรู้และการมีส่วนร่วม เป็นต้น บทความนี้จึงอยากชี้ให้เห็นถึงภาพรวมของประเด็นสำคัญต่าง ๆ ที่เกี่ยวข้องกับปัญหาหมอกควันในจังหวัดพะเยา โดยหวังว่าบทความนี้จะประโยชน์ต่อผู้ที่เกี่ยวข้องในการรับมือกับปัญหา

คำสำคัญ : หมอกควัน ; ฝุ่นละอองขนาดเล็กไม่เกิน 2.5 ไมครอน ; มลพิษทางอากาศ ; การเผาไหม้ป่า



Abstract

The smog crisis in Phayao province is the result of city development. Burning has been widely used as a method for preparing crop areas and finding wild products. This problem has substantial adverse effects on many people's health (both physical and mental health), environments, and social effects. According to the ambient air monitoring results, it has been continuing and extending for many years. Especially, fine particulate matter 2.5 (PM 2.5) refers to blowing dust and smog from the burning process. Therefore, many mitigation measures were settled to prevent and correct this problem. Unfortunately, many obstacles resulted in this ineffective management, such as lack of support budget, knowledge, people participation, etc. This article would point out the overall significant topics concerning the smog crisis in Phayao province, hoping that this will be advantageous to all stakeholders for dealing with it.

Keywords : smog ; PM 2.5 ; air pollution ; burning



Introduction

Clean air is a basic need for human survival. In Phayao province, Thailand, the lack of clean air happened for several months in a year due to the smog crisis. When the smog crisis appeared as part of the community development process such as the land preparations for planting and finding products in the wild. This has strongly intensified the health effect (both physical health and mental health), the environmental effect, and other effects throughout the five years. Also, Phayao province is not an important commercial city but only a natural small town. Therefore, it was not received concentrated attention and focus. Consequently, there was the continuous increase in the smog violations every year. There are plenty of reports presenting its impact in Phayao province. As the monitoring report 2017 of Phayao Provincial Public Health Officer reported that Pong District had the high incidence of the four major disease groups: inflammatory eye disease, cardiovascular disease, respiratory disease, and dermatitis up to 8,592 cases per year (Incidence rate of 16,919 per 100,000 people). The situation and correction report of the smog problem in the year 2019 indicated that it has significant negative effects to raise the risk of the four major disease groups by approximately 1,744 cases within a week (Jaitang & Wangrang, 2019). Additionally, the smog affected the quality of life of many local people. For instance, it increased the cost of living (personal protection equipment, medical care expenses), caused negative emotions, and reduced the ability to enjoy dairy life such as outdoor sports and activities (Matz *et al.*, 2020).

This work aims to summarize and depict the overall vital topic (the causes, the severity, the impacts, and the mitigation measures) concerning the smog problem in Phayao province. The authors expect that this article will be advantageous to readers. Furthermore, it can contribute to raising the awareness of the smog crisis in Phayao that this project was one voice to speak out

PHAYAO BACKGROUND

Phayao is a province in the upper northern of Thailand with an area of 6,335 square kilometers which is far from the capital city (Bangkok) approximately 735 kilometers. It is located between latitude 18 degrees 44 minutes north and 19 degrees 44 minutes north, longitude 99 degrees 40 minutes east, and 100 degrees 40 minutes east. About 47% of the total area of Phayao is mountains and high mountains, while 35% and 18% of the total area are intermontane and plains, respectively. Phayao province consists of nine districts namely, Murang Phayao, Dok Khamtai, Phu Kamyao, Chun, Mae Chai, Pong Chiang Muan, Chiang Kham, and Phu Sang. The major use of land is agriculture, accounting for roughly 52% (3,287 km²) (Figure 1). Approximately 38% (2,403 km²) is used for crops and only 10% (645 km²) for other purposes. There was a total of 170,211 families in the

year 2010 with approximately 487 thousand populations. Rice is the most produced crop followed by maize, cassava, shallot, garlic, ginger, rubber, lychee, and longan (Library and Learning Center, 2022).

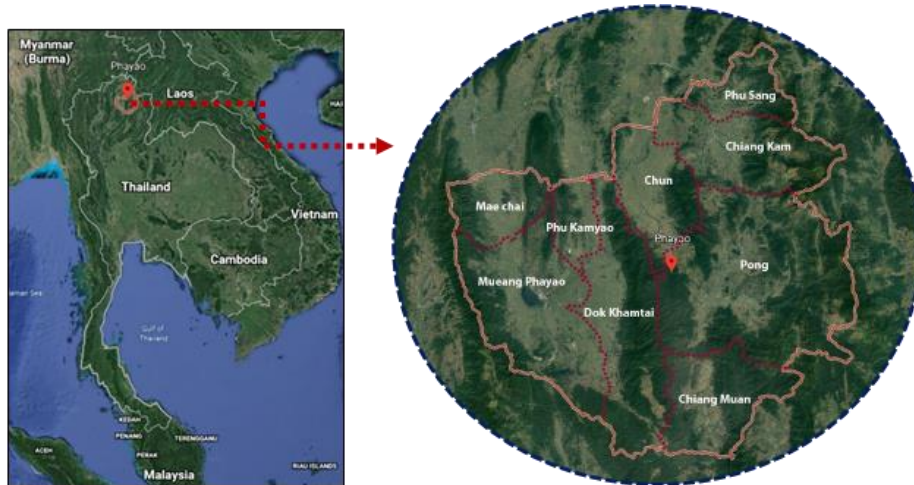


Figure 1 Location of Phayao province and the nine districts in Phayao

AIR POLLUTION MONITORING

The smog affects the quality of life of the local people by increasing the cost of living and the adverse emotions as well as decreasing the opportunities to enjoy daily life, outdoor sports, and activities. Further, making the normal lifestyle changes that are so difficult to carry out. In Phayao province, one air monitoring station was installed in the central point of the city as shown in Figure 2 (Pollution Control Department, 2010). To give the real-time data that makes them can respond to a problem quickly and effectively. Noteworthy, most parameters stayed within Thailand's National Ambient Air Quality Standards (NAAQS) (Pollution Control Department, 2022) of Thailand except PM 10 and PM 2.5 as shown in Figure 3 (Pollution Control Department, 2022). Typically, the emissions of sulfur dioxide (SO₂) and nitrogen dioxide (NO₂) were significantly increased depending on the relative sulfur and nitrogen content in the used fuel (United States Environmental Protection Agency, 1999; Zhou *et al.*, 2019). The results of lower NO₂ and SO₂ in ambient may be related to less nitrogen and sulfur content in agricultural wastes and biomass. While carbon monoxide (CO) is generated from incomplete combustion (Oluwoye *et al.*, 2020). The CO levels were very low because this is open burning that provided adequate oxygen for making complete combustion. Ozone (O₃) is a secondary pollutant, that is formed by a photochemical reaction between NO₂, volatile organic carbon (VOC), and ultraviolet light (Ling *et al.*, 2014). The low level of NO₂ has led to the decrease of O₃ too. It is noteworthy that PM 10 exceeds the standard in some points. Meanwhile PM 2.5

over the standard as many times during the critical period (between November and April). At the worst time, PM 2.5 was twofold higher than the standard. The long-time exposure to PM 2.5 is more harmful than PM 10 because it can enter the deep lung part as alveoli (Xing *et al.*, 2015). According to the PM 2.5 results, all prevention measures are proven to be ineffective throughout the three years that are always over the standard.



Figure 2 Ambient air monitoring station at Phayao

THE SIGNIFICANT IMPACTS OF THE SMOG PROBLEM

Smog is a complicated combination of gases and particles created by the combustion of various biomass. The significant impacts of the smog problem in Phayao province were summarized below.

Environmental Impact

These produced particles and ozone from smog resulted in the air being cloudy occurred all day affected to sunlight rarely penetrate through clouds and visibility is so difficult. Moreover, it made serious significant changes and disturbances in the environmental ecologies of Phayao province. The ambient temperature increased continuously, and the season has more fluctuation than normal. These scenarios are initial signs of the larger impact (global warming, biodiversity loss, etc.).

Health Impact

There were many studies about smog consisting of several pollutants such as PM 10, PM 2.5, SO₂, NO₂, CO, O₃, etc. (Khodmanee & Amnuaylojaroen, 2021). The most serious health risk from smoking is from the fine particles (PM 10 and PM 2.5). These can penetrate deeply into the lung. They can cause the four major disease groups: inflammatory eye disease, cardiovascular disease, respiratory disease, and dermatitis. Anxiously, there

are not enough studies concerning the long-time health effects of the smog problem in Phayao province (Ontawong *et al.*, 2019).

Social Impact and Others

Certainly, it affected the normal life and the quality of life of local people that making their daily life very harder. Importantly, Phayao was encouraged to be a tourist city, this problem has massive effects on the city's image and tourist confidence. Also, it may lead to the domino economical effect,

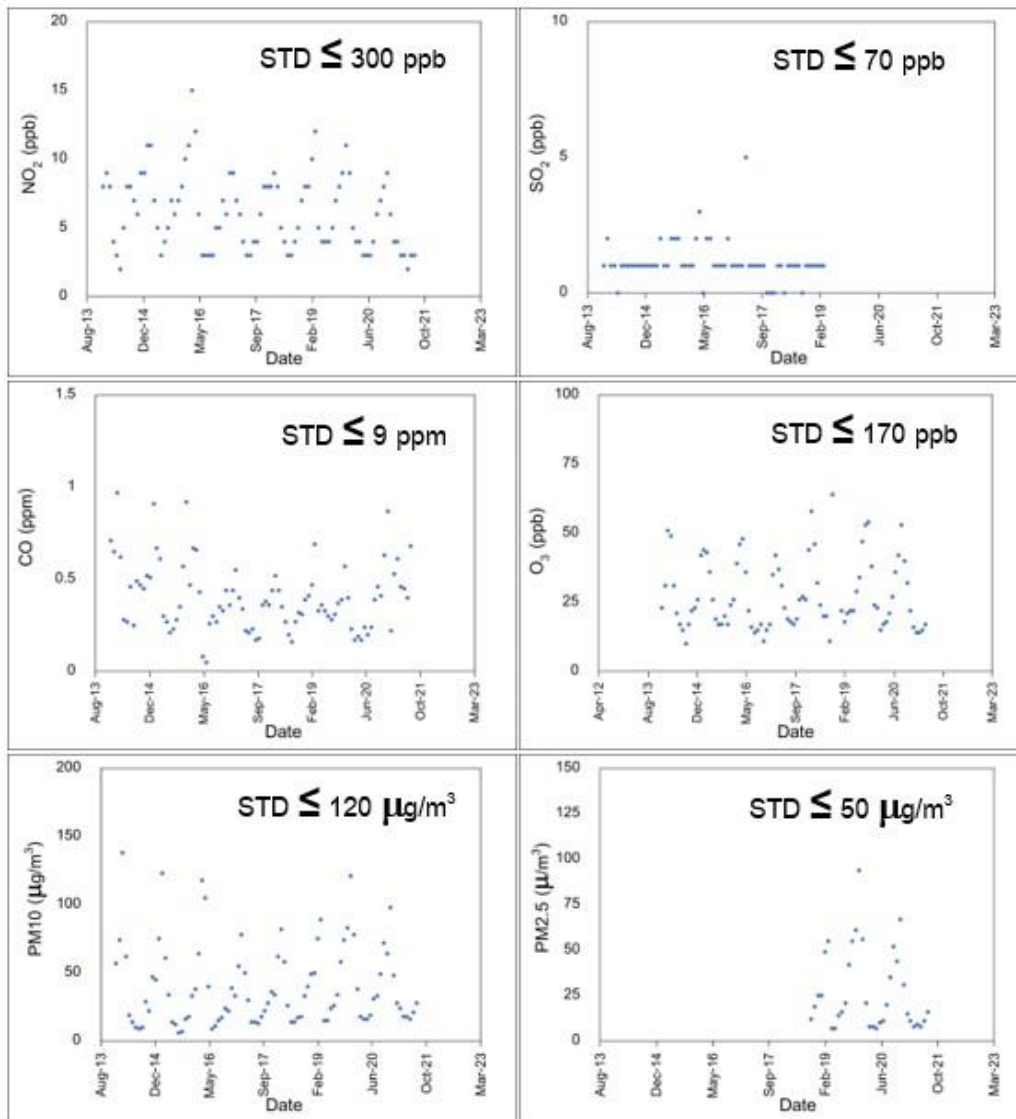


Figure 3 Ambient air quality monitoring results

Note : missing points as they were not detected, or the monitoring station was out of service., STD is Thailand's National Ambient Air Quality Standards

THE MAIN FACTORS AND CAUSES INFLUENCING THE SMOG SEVERITY

The smog problem in Phayao province is still considered as the significant issue that can conclude the vital causes as follow:

- Burning the rice field (Figure 4) and cop areas after harvesting to prepare the land for the next planting season (Junpen *et al.*, 2018).
- Burning the forest to make it easier to collect wild products such as mushrooms, *Melientha suavis Pierre*, etc. As well as, to accelerate their growth (Figure 5) (McLellan & Brown, 2022).
- The strength of the inversions often occurs strongly during the dry season (winter) between November and February (Sresawasd *et al.*, 2021). Which was an important influence on the severity of the smog problem.
- The topography of Phayao province is that most of the area is a high mountain. These make the smog more difficult to fly up and be diluted with the upper air, but it falls and covers the ground.



Figure 4 Burning the rice field after harvesting.



Figure 5 Burning forests.



THE MITIGATION MEASURES TO REDUCE AND CONTROL THE SMOG PROBLEM

From the violations of the smog crisis in nine provinces of the upper-northern region of Thailand, the government settled it as the national agenda since 2019 (Chairattanawan & Patthirasinsiri, 2020). Therefore, many measures were released to resolve and mitigate this problem (Provincial Office of Natural Resources and Environment Phayao, 2022), as follows:

- The provincial governor established the command center for the prevention and correction of the wildfire fine particle problem.
- There has issued an announcement that open burns were prohibited between February 1 and April 30 (90 days), as well as supportive legal measures, were issued to control it.
- The restriction on entering the conservation wildness areas was announced. The firefighter response teams, and rapid invention teams were settled to suppress and capture the lawbreaker.
- The governor had the campaign to reduce the open burning of agricultural residues. There was the encouragement to plow them back into the earth as a soil improver or organic fertilizer. However, most crop cultivation areas are not any plain areas. It is difficult to do according to the campaign. Moreover, this method needs to use a huge budget for management. But whether the return was so low was not worth the effort (Government House of Thailand, 2021).
- The local government will spray water to reduce the pollution caused by smog, especially, in the important and commercial areas by using around 30 trucks to spray the surrounding areas.
- The royal rain-making program was induced to reduce the smog in some areas by pouring the chemicals (such as sodium chloride, dry ice + urea, calcium chloride, and calcium oxide) into the ambient.
- There were efforts to develop the community communication system. For instance, a village headman will inform the burning period that can fire the residues and waste before raining through the community radio, social media, mobile voice, etc. However, they were often seen to delay in the communication because only minor burning occurred. These are caused by numerous obstacles such as insufficient and ineffective communication equipment, the inaccuracy of the weather forecast, the lack of people participants, etc.

THE VITAL BARRIERS TO SMOG PROBLEM SOLVING (Government House of Thailand, 2021)

- Lack of awareness about the smog problem and its impacts. Some people are accustomed to the forest firing to collect wild products, hunt wild animals, and prepare the clear area for the next year.



- Insufficient budgets to support and use for the key activities such as patrolling, monitoring, firefighting, etc. For instance, in the year 2020-2021, Phayao do not receive the central budget from the government for dealing with this problem that was normally distributed approximately 312,500 dollars per year.
- The absence of appropriate facilities and technologies resulted in ineffective management such as the proper firefighting equipment, vehicle, communication equipment, system, etc.
- The responsible forest area is very wide and too large. When comparing the number of competent officers per square kilometer that it is very little and inadequate. Thus, they cannot monitor, prevent, and control intensively.
- With the large fraction of crop cultivation area in Phayao province, the residues cannot be removed by the usual normal method. Because they are the high elevation geographic region consisting of many steep slopes.

Conclusions

The smog crisis in Phayao province, Thailand which intensified over the past five years. The monitoring information and its impact (health, environments, etc.) report provided obvious evidence. From the past management indicated that there are many significant barriers and obstacles to prevent and correct this problem such as lack of a comprehensive plan, budget, knowledge, technologies, manpower, communication system, people participation and engagement, etc. This work tried to summarize the severity of the smog crisis in Phayao province. Which are expected to benefit various readers. Especially people who are the key stakeholders such as the central government, local governments, etc.

Acknowledgements

The authors would like to acknowledgment Mr. Sirichai Suwanlamai for all your encouragement.

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