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A DEVELOPMENT PROCESS OF NO-BURNING IN AGRICULTURAL SOCIETY: A SUCCESS OF PEOPLE'S PARTICIPATION IN PHAYAO, THAILAND

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Abstract

It was strongly confirmed that the burning of biomass caused pollution and was harmful to the environment. This research aimed to develop an efficient process of people's participation to reduce burning agricultural waste in the society of Phayao, Thailand. It was also to study the impact of people's participation in integrated farming to reduce smog. The research areas were 3 different types where more hotspots were reported. The data was collected by interviewing, questioning, and group discussions through 393 participants from three villages. Descriptive statistics were used for the analysis of data. An application of appropriate cropping system patterns in integrated farming was also used for field research to replace the actual planting of field corn and upland rice. The development method started with people concurrence and cultivating the purposed crops such as sweet corn, chilly, and beans associated with major crops for one year.

It was found that there were good yields in all 3 areas. The productive efficiency of each crop assessment presented 77% of farmers cultivated both upland rice and specialty corns. In terms of creating community participation principles and social responsibility concepts, the sample groups emphasized participation in preventing and solving smog and forest fires as a whole at a high level ($\bar{x}$=4.17). The result revealed people's positive attitude in decision making and participation in research activities at the highest level. However, the sample groups agreed at a moderate level to avoid burning agricultural materials ($\bar{x}$=3.40). It was recommended that community leaders should increase their roles of communicating information to the community, especially the campaign of community philosophy to jointly solve the problems.

Keywords

People's Participation, Smog, Haze, Integrated Farming

1. Introduction

The effects of forest fires and smog posed huge damage to people and animals in many countries. In January 2020, an area of more than 25.5 million acres was burnt across all Australian states and territories. It was reported that at least 33 people were found dead and around 3,000 homes in New South Wales were destroyed. Moreover, a third of all the koalas were put to death. The thick smoke could even reach New Zealand which was 1,000 miles away (Calma, 2020). Earlier in Southern California, there was a fire near Santa Clarita. The situation was out of control and moved quickly as seasonal winds gust across the state. The fire got through vineyards, across mountains, and setting homes ablaze (Wolters, 2019). Another case of burning was in London. It was affirmed that thick smog frequently blanketed around the city during the 19th and 20th centuries because of coal-burning to warm homes. One of the big events called London Great Smog in 1952 was believed to kill more than 10,000 people (BBC News, 2019). The hazard was recovered by the Clean Air Act in 1956, and the "smoke control areas" were imposed in towns and cities. However, to date, London is still known as the highest pollution city in Europe.

For Thailand, severe problems of pollution and smog from forest fires and burning in agricultural areas in the north has been dramatically increasing. The hazard occurred especially from December to April each year (The Thai Pollution Control Department, 2019). The pollution is harmful to the environment and makes an effect on the economy, the well-being of the society, as well as endangers public health. Dirty haze, dust, ash, soot floating in the atmosphere could result in annoyance, rash, allergies, affect the quality of the environment, and obscure the traffic visibility

both by land and air. The case has been expanding to the neighboring ASEAN countries such as Myanmar and Laos. To this extent, the ten ASEAN countries have signed the ASEAN Agreement on Trans-boundary Haze Pollution since 2002 (Tararatanasuwan, 2014). Moreover, Thailand has established a center of prevention and control pollution problems from the haze among the 9 Northern provinces. They are ChiangMai, ChiangRai, MaeHongson, Lampang, Lampoon, Prae, Nan, Tak, and Phayao. The center has conducted its activities along with the government five-year plan (2013-2019) to prevent and solve forest fires and smog pollution under the National Fire Safety Development Master Plan. Nevertheless, the disadvantage has occurred in a wide area in the last few years. During 2012 and 2014, the statistics data of locations with possible active fires (hotspots) from satellites found 18-31 heat points per year (Pollution Control Department, 2019). Observation revealed that the severity of smog-related to the topography of each area. It was also reported that, during 2015- 2019, a particulate matter of 2.5 microns (PM2.5) was found at 68 micrograms per cubic meter in northern cities (World Health Organization's allowed rate was 25 micrograms per cubic meter: Pollution Control Department, 2019). Each year, the number of bad days that the proportion of dust in the air exceeds the standard is more than 13 days. In 2016, the situation reached the second-highest level in the northern provinces, and medical care for haze diseases augmented to 39% on the days when PM.10 level exceeded the standard (Regional Environment Office 1-Chiang Mai, 2019; Pimonsree, 2018). It has been confirmed by the PCD that burning biomass caused pollution which was harmful to the environment (Pollution Control Department, 2017; Pimolsri, 2018). As a result, the government has announced a prohibited period not to burn any waste during 100 dangerous days (from January to April) every year. This could, more or less, help improve air quality and the haze situation in the northern region.

Phayao is one of the provinces in the north of Thailand where people have been suffered severe haze. At the beginning of each year, the province would experience smog and air quality is polluted by PM.10 as well as PM.2.5, especially around the University of Phayao. The University is surrounded by a range of mountains of Doi Phu Nang and Doi Loung National Parks. And the condition of smog annoys all inhabitants nearby, included 20,000 staff and the students. The area of Mae Ka and Mae Nareu in Muang district is considered as an area of many hotspots closed to the communities. In this area, the forest fires burning agricultural biomass occurred regularly in the dry season. This resulted from the fact that the actual method did not return better income than causing

great stuff of agricultural waste. Table 1 shows the number of Hotspots in the area of Muang District of Phayao from 2012 to 2019.

Table 1: *Number of Hotspots in the area of Muang District, Phayao (Pollution Control Department, 2019)*

Number of Hotspots during 2012 - 2019								
Province	2012	2013	2014	2015	2016	2017	2018	2019
Phayao	474	283	287	214	405	115	86	507

Number of days that PM. exceeded safe level (2019)		
Month	Day	
	$PM_{2.5}$	PM_{10}
January	-	-
February	11	-
March	24	9
April	53	4
Total	58	13

The situation indicated the problem of smog as a severe and continuous circumstance. As stated by Pimolsri (2018) that smog problems cannot only be solved by emission control measures in the city; biomass burning must also be reduced on a regional scale. For this reason, it is important to help stop burning and solve this urgent problem. Strong preventive and corrective measures are required. In this study, we applied Cohen & Uphoff theory of participation (Cohen and Uphoff, 1980). We defined participation as including people's involvement in decision-making processes about what would be done and how; their involvement in implementing programs and contributing various resources or cooperating in specific activities. This encompassed people's sharing in the benefits of development programs and their involvement in efforts to evaluate such programs too. We also proposed a new "cropping system" accompanied by major crops (rice and maize) that would develop the efficiency outcomes (Chanwijit. P. & Sinkangam, B., 2016).

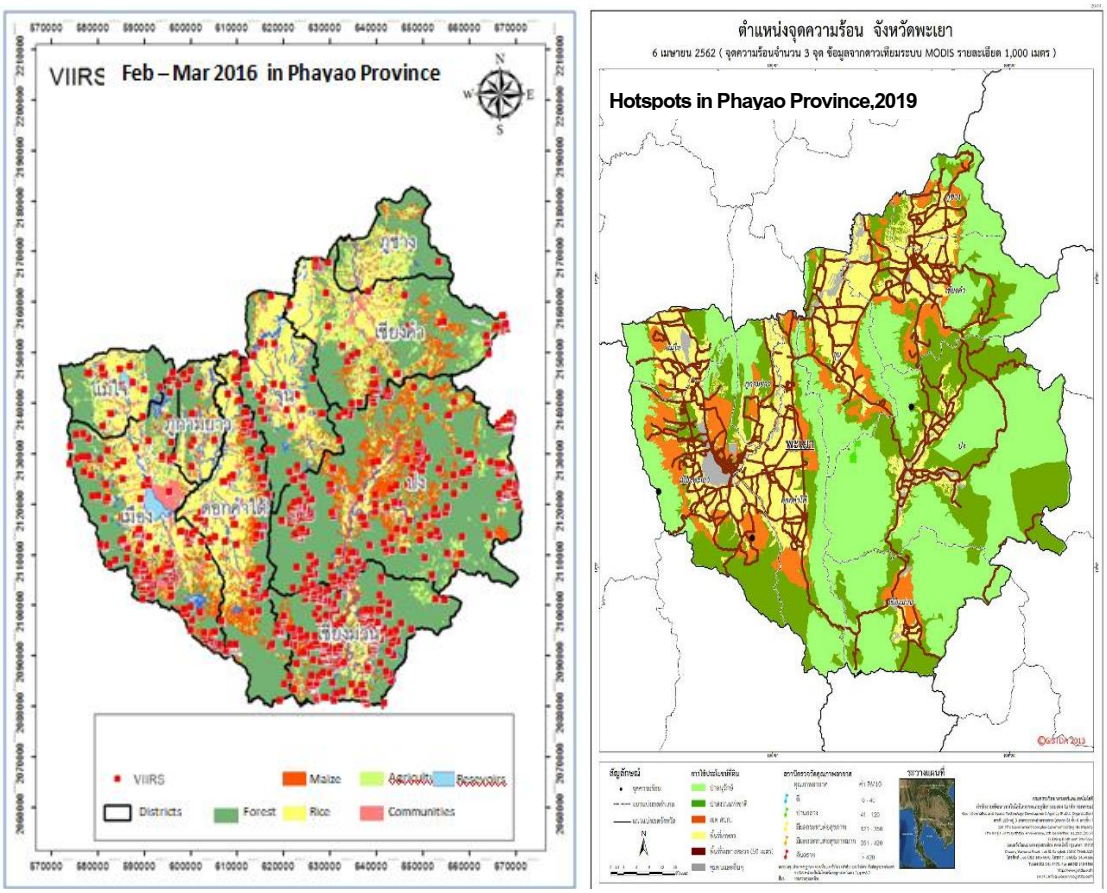

Figure 1: *Severity of Burning Areas in Phayao, 2016 vs 2019 (Pollution Control Department, 2019)*

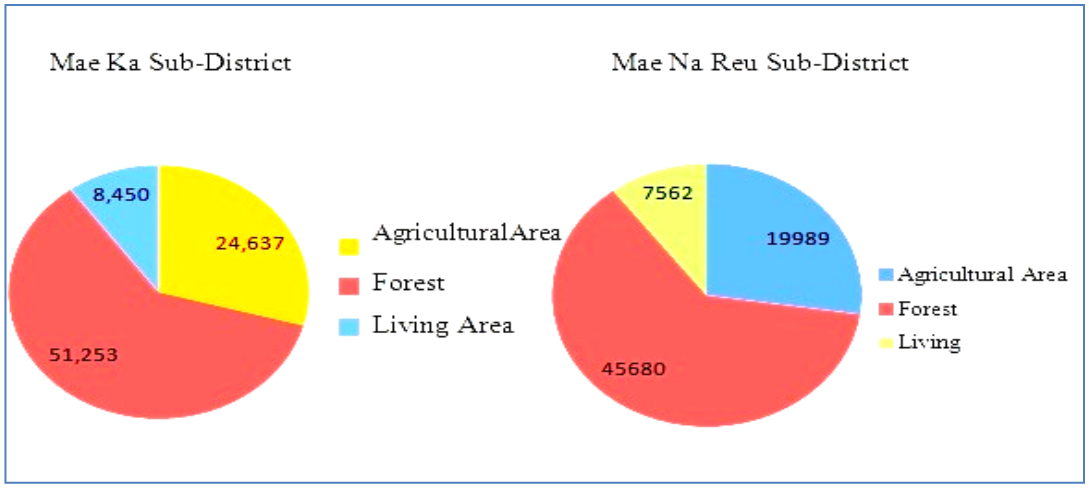

Figure 2: *Land used in Mae Ka and Mae Nareu, Muang District, Phayao (MaeKa Subdistrict Municipaity, 2019)*

The Severity of burning areas in Phayao province is shown in Figure 1. It states how people did not pay attention to the environment. Therefore, it is important to avoid people not burning the agricultural waste in their farms nearby the community as well as trespass their cropping in the forest. The area of study is shown in Figure 2.

2. Research Objectives

To be able to find a good solution to the problem of smog, it was considered to do the following research:

2.1 To develop an efficient process of people's participation to reduce burning agricultural waste in the society of specific areas in Phayao Province, Thailand

2.2 To study the impact of people's participation in integrated farming to reduce smog in the study areas.

3. Research Methodology

We have agreed upon in designing research activities as well as selected populations as the followings:

3.1 Population and Sampling

To develop an efficient process of community engagement in the selected areas, and to know the impact associated with the villagers' behavior, the population of three villages were selected. These were the burning areas of MaeKa and MaeNaReu, Muang District of Phayao province. The areas were crucial in connection with many "Hotspots" (depicted in the satellite map that represented the locations with possible active fires). We divided the study areas into three types: flat, slope, and mountainous.

The sample size was calculated by the reliable proportion using Taro Yamane formula at 393 participants to represent the entirety of the population (Yamae,1967). The research sampling method used was random sampling among farmers excepted 23 community leaders who were joined our group discussion and interviews for more particular questions.

3.2 Research Tools

This study used both qualitative and quantitative research designs to gather an in-depth understanding of people's responses to the problem of burning and how they would join our preventive project. The questionnaires were given out to respondents for the statistical

representation of the findings. For more advantages, we could also examine other phenomena through observations. The tools applied to this research were:

3.2.1. A close and open-ended questionnaire consists of three parts of basic information of the respondents, questions about people's attitudes, and knowledge on the disadvantage of burning biomass and smog. The third part was questioned about how they could participate in our research project and more opinions in line with smog and how to prevent it. This part followed Cohen and Uphoff's (1980) theory of participation. The questions also concerned how people could participate in designing the cropping system, how they could participate in planning, how they could monitor the project, and how they could evaluate the result.

3.2.2. A semi-structured in-depth interview included various questions to cover the research topic and to be able to easily categorize and analyze.

3.2.3. An observation and evaluation form was used after each activity of field research such as training or demonstrating.

3.3 Data Collection

The development of a community's participation in cropping systems started under a research framework in this manner:

Step 1: Group discussion among 23 selected community leaders from 3 mentioned areas of study to inform, explain, and plan our project details as well as to seek a consensus to stop burning biomass then plant purposing economic crops.

Step 2: A distribution of 370 pre-designed questionnaires to collect basic data and opinions of participants about burning as well as to make sure people's voluntary aspect and to seek concurrence to start cultivating the purposed crops in their proprieties.

Step 3: Focus groups were conducted for training about facts and the essence of the harm of biomass burning and the toxicity of smog. The training also included how to prevent burning and how to plant special substitute "Cropping System" in place of upland rice and field corn. After a process of learning by doing the groups should meet an agreement to cope with the problem and could be able to persuade others to join the team.

Step 4: Evaluation of results from field research that descriptive statistics were applied for the analysis of data using the computer program for quantitative data and study the characteristics and indications for qualitative data.

For the field research and application of appropriate cropping system patterns in integrated farming was used to replace actual planting of field corn and upland rice which did not return better income than causing great stuff of agricultural waste. It was expected that the "Cropping System" would be a method to optimize efficient cultivation. The development of the community's participation in cropping systems started with people concurrence and cultivating the purposed crops namely: sweet corn, chilly, beans, mulberry, and lemongrass associated with major crops during one year. The research areas were 3 different types: lowland, slope area, and forest (mountainous) area where more hot spots were found. Three experimental plots were designed, namely: 1) intercropping between rice and bean, 2) intercropping between maize, bean, and herbs, and 3) forest + economic crops.

4. Results

The study of a development process of no-burning in the agricultural society of Phayao province, to gain community participation, was done in three different farming areas. They were: lowland, and forest (mountainous) areas in MaeKa sub-district, and a sloped area in MaeNaReu sub-district. A population of 393 participants was gathered to conduct a focus group discussion and demonstration of our cropping system.

4.1. Concerning Field Research, we have created a planting model to be used as a potential cropping system that works well with economic crops on different characteristic farmings. It was found that there were good yields in all 3 areas. The productive efficiency of each crop assessment showed that 77% of farmers cultivated both upland rice and specialty corns. The study revealed a list of advantage:

4.1.1. Farmers participating in the project have gained knowledge and understood how to use the cropping system associated with the main crops, including 1) selection of varieties 2) land preparation 3) plant nutrient management and 4) pest management.

4.1.2. Farmers participating in the project have studied and assessed soil fertility, water retention, and topsoil erosion of land used in each system for growing different plants.

4.1.3. Farmers participating in the project have gained knowledge and understood about soil management especially 1) the proportion of soil and water used, 2) land used and crop yield in each cropping system.

4.1.4. Farmers and researchers were aware of the economic crops produced and plants to supplement all 3 systems

4.1.5. Farmers and researchers could obtain crop production information, comparative economic cost analysis, and comparison of the production of plants in the cropping system tested and operated to reduce production costs or increasing of revenue.

At the end of the process, the study groups were able to summarize the possibility of using "the Cropping System" to reduce biomass burning.

4.2 In Terms of Creating Community Participation Principles and Social Responsibility Concepts, we have gained a model of community participation in agro-society without burning in the prototype area of Mae Ka and Mae Na Reu sub-district in Phayao Province. It was found that the sample groups emphasized participation in preventing and solving smog and forest fires as a whole at a high level ($\bar{x}$=4.17). The result also revealed the opportunity in decision making and participation in research activities at the highest level; ($\bar{x}$=4.39 and 4.45 respectively). However, the sample groups agreed at a moderate level to avoid burning agricultural materials ($\bar{x}$ = 3.40).

5. Conclusion

This research has had two main objectives. The first one was to develop an efficient process of people's participation to reduce burning agricultural waste in the society of Mae Ka and Mae Na Reu sub-district in Phayao Province, Thailand. The second point was to study the impact of people's participation in integrated farming to reduce smog in the study areas. From the results, it might be said that we have succeeded in our main point of the study that a model of agro-society's participation in the study areas was established systematically.

To trace back to the concept of people's participation, the research was conducted in line with Cohen and Uphoff's (1980) Theory of Participation to adjust the attitude about the burning of agricultural materials and raising awareness of the dangers of smog including health care when inhaling the haze. This enabled the community to be self-reliant, have the opportunity to think, plan, and act with leaders to solve problems themselves. The key procedure was followed:

5.1. People could participate in decision-making and planning which means the sample groups of the project could initiate or discuss their problems and needs to the team. They could set the priorities of each problem together, and determine appropriate options for tasks or activities by

themselves. This is per a study of Giriwati, S. et al. (2019), in Sumberwangi hamlet, Indonesia that the form of empowerment is necessary for every step of planning.

5.2. The study groups could participate in the implementation of designed activities which means that they could propose or support various resources in terms of money, labor, materials, equipment, and participation in project management and coordination. Participation in the operation is an important condition that makes the project successful.

5.3. The study groups could participate in Benefits. This type of participation has two implications: It is either a joint benefit or a joint result of any kind from our development project. Benefits received include 1) Material benefits or income gained from selling the project products. 2) Social benefits that we assured all participants of receiving knowledge and understanding about smog and forest fires, integrated farming, and analysis of soil suitable for plants. 3) Personal benefits such as increased self-esteem or have a sense of their effectiveness.

5.4. Participating in evaluation means that all the participants would be part of project assessments.

Although our research project was done based on smog problem considering the specific topography of the study areas, plain, hilly and a forest; interestingly, as a result of the cropping activities; the yield performance of averaged upland rice was less than corns while the net profit of maize was greater. Chanwijit, P. and Sinkangam, B. (2016) insisted that the "Cropping System" would be a method to optimize efficient cultivation, lessen mono agriculture, and soil & water conservation. As an impact of community empowerment, we are very happy with the study's outcome. The selected cropping system proved to be a model for growing crops for conservation on the area efficiently. For this great profitable outcome, the community's participation in the project brought about people's satisfaction. Moreover, as stated by Muarifuddin, & Kriswanto, H. D., (2020), the social structure formed could show dependency relations and the impact of community empowerment formed could be developed to the creation of an entrepreneurial community. Notwithstanding, a moderate level attitude to avoid burning biomass revealed an uncomfortable sense. To this extent, the implementation of government policies might need to fix the problem. Besides, it was recommended that community leaders should increase their role of communication important information to people in the community, especially the campaign of community philosophy and local wisdom to jointly solve the problems. We also hope that more government funds would be allocated to help manage the situation sustainably.

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