Community Fire Education in Northern Thailand

Submitted on:
March 15, 2021

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An Interactive Qualifying Project (IQP) submitted to the faculty of Worcester Polytechnic Institute and an Interactive Social Science Project (ISSP) Submitted to the Faculty of Science at

Chulalongkorn University in partial fulfilment of the requirements for the Bachelor Degree of Science

Abstract

This research has the goal of raising awareness of wildfires in Mae Ping National Park and providing education on the impacts of common unsafe agricultural practices to the community of Ban Kor. This project involved creating educational animations for children of the Ban Kor Judsan school, developing easy access to near-real-time fire tracking software, and rebuilding the defunct weaving business of Kor Thung Home as a supplemental form of income in Ban Kor. The team recommended action items to the school to continue student involvement in wildfire-prevention and marketing strategies to the local weaving center of Ban Kor.

Executive Summary

Wildfires cause damage to the environment and the health of people living near the fires. Mae Ping National Park in Northern Thailand has been experiencing this destruction from man-made fires for several years, creating an excess of air pollution and contributing to the $PM_{2.5}$ levels in Thailand. The village of Ban Kor is located within Mae Ping National Park and was the area of focus for our project. These wildfires are caused by the use of agricultural burning practices for collecting mushrooms, which is a major source of income for the people of Ban Kor. The villagers have little recognition of the negative health and environmental impacts they create as they burn. The park rangers are concerned about a fire's potential to spread with greater fuel sources that cause uncontrollable fires, especially during burning season, which leads to the damage of an ecosystem that does not have enough time to regenerate with such frequent burnings. Through interviews with locals, guidance from our sponsor, and collaboration with the school faculty of Ban Kor Judsan, our team was able to increase the community's awareness of the issue and provide resources for the villagers to take responsibility for the fires.

Methodology

To meet our project goal, we developed the following research objectives:

1. *Educate the community of Ban Kor on the problems stemming from the wildfires in Mae Ping National Park and surrounding the village.*
2. *Provide the community of Ban Kor with tools and easy-to-use resources for automated tracking of wildfires, weather, and air quality data.*
3. *Prepare the Ban Kor community to make positive change with distinct plans and action items to grow their economy in a sustainable manner and institute activities and behaviors that promote overall fire-safe practices.*

Our main focus in the community was on the school children of Ban Kor Judsan. These children are the future of the community and are the best way to build a foundation for a sustainable, fire conscious community. Our first step was to conduct extensive research on the geography of Mae Ping National Park, wildfire science, the environmental and health impacts of wildfires, agricultural burning practices, alternative (and environmentally friendly) sources of income, how to institute societal changes, fire tracking data systems, and understand the current work of our sponsor, Dr. Jain Charnnarong. From the information we gathered, our team created an educational video to show to the students of Ban Kor Judsan, the local school. It was shown to students in grades four through nine. We also put together a questionnaire based on the information from the educational video that we used as a pre-test and post-test for the video. We created these evaluation questionnaires to gauge the students baseline knowledge of the pertinent information about the issues in their community and to quantify how much they learned from watching the video. We hoped this informational video would raise awareness of the problem of

wildfires amongst the youngest group of stakeholders in Ban Kor and instill a desire to take action within them. The second part of this first objective involved creating a detailed plan for the creation of a Fire Prevention Club at Ban Kor Judsan. The club would involve a range of hands on activities relating to the tracking and mitigating of wildfires near their community. There was not an immediate interest from the teachers to organize the club and gather student interest. We provided the school with a partial plan with many examples of activities the club could do. We hoped that the school faculty and students would be motivated enough to follow through with the club when provided with that club outline and the educational video.

Our team worked with another IQP/ISSP team to create accessible software for fire tracking information. This technology automatically sends out alerts to the community, relating to fire hazards, air quality, and weather updates. We created this technology on an existing platform that the majority of the community has access to and already uses, the LINE Official Application. This software makes tracking the wildfires and staying updated on the local environmental impacts available to the community, which contributes to our team's overall goal of helping the community become more aware of these impacts of the wildfires.

Since the main cause of wildfires in Mae Ping National Park is due to locals' strategies for mushroom collecting our next step was to focus on promoting an alternative source of income that would have less harmful environmental impacts on the national park. We decided to focus on helping the Ban Kor weaving center, Kor Thung Home, expand their business in Thailand. We conducted interviews with the elders involved in the weaving business to gain perspective on the situation and narrow down how we could design solutions to meet their needs. We also met with the managers of several markets outside of Ban Kor to get a sense of how we could expand their market. If their business grows it will provide the community with a substitute to the income they make from mushroom foraging. It will create a healthier environment for not only the forests, but for the citizens of Ban Kor.

Results and Analysis

Through research and observations of the community, we determined resources that would benefit the locals by informing them on the risks of fire and raising their awareness of the widespread fires occurring around them:

1. **Analyzing the Efficacy of the Informational Video in the Ban Kor Judsan School**

The Ban Kor Judsan students of grades four through nine gathered after a morning assembly to watch our educational video. Before they began watching they completed our pre-test so we could determine their base level of knowledge. After they watched the video they answered the same questions for the post-test. We recorded each students' test score and then averaged out all of the individual scores in each grade. The results from our evaluations were very eye-opening. We found that most students had firm understanding about the negative health and environmental impacts of $PM_{2.5}$. However, we found that when it came to current levels of

$PM_{2.5}$ we found that their scores improved considerably between tests. In general, we can conclude that the educational video increased the students' awareness of the regional wildfires and their hazards.

2. **Opportunities for Establishing Fire Prevention Initiatives for the Children of Ban Kor**

Our research concluded that there are a multiplicity of activities that could engage children in fire prevention. From our conversations with teachers at Ban Kor Judsan, we concluded that there was not enough interest to seek approval from the Ban Kor School Board and organize a club to implement these extracurricular activities. However, our research showed that these suggested activities could have a positive impact on the students ability to understand the dangers of wildfires and discover their own fire prevention capabilities. With this in mind, we chose to develop a guide for future students to potentially implement a club within the school for children interested in fire prevention. The activities in this guide were determined to be the most effective at engaging students' interest and enabling them to make an impact towards ending the bushfire crisis in Ban Kor.

3. **Analysis of the LINE Official Application and Fire-Tracking Software**

The goal of developing the LINE application was to make information about fire hazards more accessible to the wider community. Our hope was that this increased accessibility would bring increased awareness within the community as well. In the end our application essentially consisted of two parts. The first being an automated chat bot hosted on LINE, which provides the user with daily updates on air quality upon request. Additionally, our application links to the second part of our product, which is a companion website. The website contains our fire tracking timeline, a map displaying wind speeds and temperature and our informational video. Using our application, community members will not have to rely on Dr. Jain to communicate fire hazards. Considering the accessibility of the application, we hoped it will bring ease and security to the community of Ban Kor and help them feel more in control of the prevailing wildfire issues.

4. **Information Gained on Marketing Ban Kor Weaving Products**

From our research and conversations with the heads of the Kor Thung Home weaving facility, we were able to gather information on their potential for success through expanding their market size and business strategies. Currently there is lack of support from the community as well as financial resources to expand their business. The lack of income has prevented them from being able to purchase a weaving machine, specifically a cotton gin. They have to send their crop of cotton to a facility where this process can be done efficiently. This process wastes a lot of time and limits their production capacity. The elders have shared with us that they are interested in increasing their customer base not only to generate more revenue but to prove to the community that their business is successful.

Many tourists that pass through Ban Kor on the weekends and drive right past the weaving facility. We wanted to create some kind of tourist attraction to increase tourists' interest in the craft where visitors would have the chance to design and craft their own weaving products as a gift or souvenir. Additionally, there are many multi-brand stores around Thailand that could promote Kor Thung Home's weaving products and introduce them to the customer base.

Recommendations and Conclusions

Based on our findings we have come up with the following recommendations in order to continue the important dialogue about the risks of wildfires:

1. **Conclusions from School Evaluation and Next Steps for Educational Video**

Upon broadcasting our video to Ban Kor students and analysing their test results, we determined that spreading the video with other schools and on multiple platforms is the most appropriate step forward. Making the video available to as many people as possible will increase the overall awareness of the wildfire problem in the area. In turn this may lead to increased awareness and even a change in attitude towards wildfires. The principal of Ban Kor Judsan shared that he would like to send the video to other schools in the district. Other considerations would include sharing the video on other social media platforms like Facebook or Twitter. Besides these platforms being extremely popular which increases visibility chances, these platforms make sharing content very easy as well.

2. **Recommendations for Fire-Awareness Activities for the School Children of Ban Kor**

We planned to create a twenty-week structured outline for a fire club at Ban Kor Judsan, though unfortunately the timing was not feasible to complete the entire outline. Instead, our team devised a general outline of a plan. We will pass on this outline to the principal and teachers at Ban Kor Judsan so they can further organize the logistics of the club. Early execution of the program should include lessons on wildfires including topics such as fire science, the role of wildfires in nature, and an overview of the wildfire problems in their very own community. The students who join the club should also receive training on how to utilize tools such as NASA FIRMS, CUSense, and Windy so that they are able to effectively utilize the LINE Application created as a joint effort by our team and the IQP/ISSP Team 1. Other hands-on activities for the students could include acting as a watch team for signs of fire in the area and alerting community members of the students' observations.

3. **Conclusions on the LINE Application and Next Steps for Instituting within the Community**

With development of the application and website completed, the next steps should consist of advertising the existence of the technology. We recommend promoting the application within the school so that children may become comfortable using and interpreting information early on.

Our recommendation is that the product slowly phases into open source mapping APIs like Leaflet, thus ensuring continued scalability and longevity.

4. Summary of Key Findings About Needs for Expanding the Ban Kor Weaving Center

Based on our conversations with the elders of the weaving center in Ban Kor, we found that they lacked three primary resources which have hindered them from growing their business and annual profits. The first of these was the availability of water resources during the dry season. The second is substantial and effective marketing, particularly in the category of attracting already-present tourists in the region. Lastly, is a larger industrial cotton gin, which will allow them to produce the workable material in their own facility. Keeping in mind that this machinery will require financial assistance and resources they do not have, we have developed the following recommendation of a business plan to assist the weaving center in improving their marketing capabilities to increase their customer base and annual profits.

To kick-start their business growth, we recommend that Kor Thung Home work with ECOTOPIA in the Siam Discovery Mall in Bangkok to create an exhibition promoting their business and bring awareness to the city and tourists about the wildfires in their region. We recommend that Kor Thung Home open direct communication with ECOTOPIA to establish the exact plan and details of this exhibition. Kor Thung Home's partnership with ECOTOPIA will be their first crucial step towards expanding their customer base. In the long-term, we recommend that the business utilize the tourism industry in the Lamphun Province to their advantage by building up infrastructure near the weaving center and marketing their facility as a tourist attraction.

Acknowledgements

This project and resulting report would not have been possible without the continued support and collaboration from many individuals from Worcester Polytechnic Institute, Chulalongkorn University and beyond. We would first like to recognize Dr. Jain Charnnarong and the Club of Recipients of Ananda Mahidol Foundation for sponsoring this project and providing us with this amazing opportunity. We would particularly like to thank Dr. Charnnarong for his devoted efforts to improving the wildfire problem in the Ban Kor community, and for welcoming us to assist him in devising solutions to this multifaceted problem.

We would also like to express gratitude to the following people:

Teachers and Faculty of Ban Kor Judsan: For welcoming us on our journey to Ban Kor, and distributing and gathering valuable information from the students so that we may learn from them through understanding their perspectives.

Kanlayanee Katekaew, head of the Ban Kor Weaving Center: For supplying us with valuable information on the current state of the weaving facility and providing insight on potential improvements.

Amporn Phutham and Sand Vongthongmark, managers at ECOTOPIA: For their insight on marketing and brand development

Mae Ping National Park Rangers: For giving us a first-hand perspective on the impacts that fire has had on the national forest and providing insight to their fire prevention strategies.

Professors Svetlana Nikitina, Brigitte Servatius, Numpon Insin, Supawan Tantayanon and Siripastr Jayanta: For challenging and guiding us throughout the entire project. We would not have been able to complete this project without their advice and support.

Table of Contents

List of Figures

List of Tables

Authorship Table

Chapter and Section	Author	Editor
Abstract	Evy	All
Executive Summary	Julia, Hezekiah	All
1. Introduction	All	All
2. Background and Literature Review	Alex	All
2.1 Geography of Ban Kor and Mae Ping National Park	Alex, Josho	All
2.2 Mushroom Cultivation and its Connection to the Causes of the Wildfires	Alex, Evy	All
2.3 Painting a Picture of the Community of Ban Kor	Alex	All
2.3.1 School Children and their Interactions with the Ban Kor Community	Alex, Josho	All
2.3.2 Agriculturalists and the Practice of Mushroom Cultivation	Alex, Evy	All
2.3.3 The Potential of the Kor Thung Weaving Center in Ban Kor	Alex, Tong, Leng, Evy	All
2.4 Change Management Literature Review	Alex	All
2.4.1 Instituting Societal Change with The Elephant, The Rider, and The Path	Alex	All
2.5 Sponsorship Mission and Previous Work in the Ban Kor Community	Alex	All
2.5.1 Manual Fire Tracking and Alerts with LINE and NASA FIRMS	Alex, Julia	All
2.6 Conclusion	Alex	All
3. Methodology	All	All
3.1 Objective 1	Evy	All
3.1.1 Create an Informational Video to Increase	Evy	All

the Community Awareness		
3.1.2 Establish Fire Prevention Activities for School Children at Ban Kor Judsan	Evy, Alex	All
3.2 Objective 2	Evy	All
3.2.1 Utilize the LINE Official Application to Create Accessible Software for Fire-Tracking Information	Hezekiah	All
3.3 Objective 3	Alex	All
3.3.1 Determine the Needs of Kor Thung Home Through Interviews	Alex, Evy	All
3.3.2 Developing Marketing Approaches in Bangkok Through Interviews	Evy	All
Chapter 4: Results and Analysis	Evy	All
4.1 Analyzing the Efficacy of the Informational Video in the Ban Kor Judsan School	Julia	All
4.2 Opportunities for Establishing Fire Prevention Initiatives for the Children of Ban Kor	Evy	All
4.3 Analysis of the LINE Official Application and Fire-Tracking Software Final Product	Hezekiah	All
4.4 Information Gained on Marketing Ban Kor Weaving Products	Evy, Tong	All
Chapter 5: Recommendations and Conclusions	-	-
5.1 Conclusions from School Evaluation and Next Steps for Educational Video	Hezekiah	All
5.2 Recommendations for Fire-Awareness Activities for the School Children of Ban Kor	Evy, Julia	All
5.3 Conclusions on the LINE Application and Next Steps for Instituting within the Community	Hezekiah, Julia	All

5.4 Summary of Key Findings About Needs for Expanding the Ban Kor Weaving Center	Alex	All
5.4.1 Recommendations of Marketing Strategies to Increase Customer Base at the Ban Kor Weaving Center	Alex, Tong, Leng	All
5.5 Project Conclusion	Alex	All

Chapter 1: Introduction

Wildfires have long been a notorious problem for humans and nature, causing destruction of ecosystems and threatening the health and safety of many different species (Asher, 2016). Humans have used fire to seek various agricultural benefits, and natural fires proved to avail land regeneration by clearing and fertilizing land for new growth (Forest Encyclopedia). Farmers and other agriculturalists have refined these practices to promote healthy crops or to simply clear land for foraging. These practices supported the income of many individuals and fire greatly impacted their ability to expand potential earnings from selling crops.

Many methods of burning have been used in rural, developing communities that lack the financial resources for modern machinery that would replace these traditional practices. While these individuals may not view fire as a bad thing for the earth, frequent and uncontrollable wildfires can cause wide-spread, long-lasting damage to the environment (Asher, 2016). With unpredictable changes to the climate and overuse of land, controlled burns have presented a greater risk of developing into bushfires. Unfortunate events such as these have been occurring more often in areas known for agriculture, such as Northern Thailand.

Our area of interest, Mae Ping National Park, is full of vast tropical forests and multiple villages including Ban Kor, which was our community of interest concerning this problem. There are many locals within the Ban Kor community that participate in agricultural burning practices, and the park rangers in Mae Ping National Park have little to no control over their actions. The most popular cause of wildfires in this area is from fires that were ignited to assist in mushroom collection. Despite the obvious increase of wildfires in this area, the locals had little recognition of their contributions to this problem and the impacts of their actions. Meanwhile, park rangers are more concerned with the urgency of burning potential wildfire fuel that could cause further danger during the burning season and therefore condone some controlled burning. Neither group has full control over their actions and this has led to many uncontrolled wildfires in the region.

Our sponsor, Dr. Jain Charnnarong with the Club Recipients of the Ananda Mahidol Foundation, has already taken action in the community to combat this problem, but the community is still unwilling to change their attitude towards their practices. He has taken on the responsibility of notifying the community of wildfires in their area by checking fire-tracking software multiple times a day and sending updates through messaging technology. The sponsor's hope for the local people is to ensure their own protection and health along with the protection of the surrounding forest ecosystems. He recommended three missions that would truly benefit the community including: making the locals aware of the problem, getting them to change their attitude, and finally take action to alter their contributions.

Our team's project goal was to develop a sustainable foundation for fire prevention in the community of Ban Kor through raising awareness of the wildfires and increasing locals'

knowledge on the impacts of uncontrolled wildfires, therefore altering their perspective towards this issue. We accomplished this goal through meeting the following objectives:

1. *Educate the community of Ban Kor on the problems stemming from the wildfires in Mae Ping National Park and surrounding the village.*
2. *Provide the community of Ban Kor with tools and easy-to-use resources for automated tracking of wildfires, weather, and air quality data.*
3. *Prepare the Ban Kor community to make positive change with distinct plans and action items to grow their economy in a sustainable manner and institute activities and behaviors that promote overall fire-safe practices.*

These objectives accompany one another by establishing a foundation of understanding of the community's actions with implications, and providing Ban Kor with resources and action plans to re-claim responsibility over their health and surrounding environment.

Chapter 2: Background and Literature Review

The wildfire problem in Ban Kor and Mae Ping National Park is a very dynamic one with many continuously moving parts, contributors, possible solutions, and stakeholders in the entire situation. This chapter will explore the physical causes of the wildfires and their effects on the community, economic structures that fuel the negative actions causing the fires, and the stakeholders along with their relationships to one another. Additionally, it will summarize our research on structures of change management that we could utilize in our own development of a solution that would implement sustainable change in Ban Kor. Finally the chapter will detail the sponsored plan that has already been set in motion and how we could build a solution that fits into the mold created by this plan.

2.1 Geography of Ban Kor and Mae Ping National Park

The Ban Kor community is located in Mae Ping National Park, in the northern region of Thailand, where wildfires typically occur in surrounding forests several times each year. Mae Ping National Park was declared as a national park in 1980 as the thirty-second Thai National Park with an area of 626,875 rai or 1,003 square km and expands through the Doi Tao District in Chiang Mai, Li District in Lamphun, and the Sam Ngao District in Tak. Figure 1 depicts the geographical positioning of the Kor Sub-District, where Ban Kor is located, in relation to Mae Ping National Park.

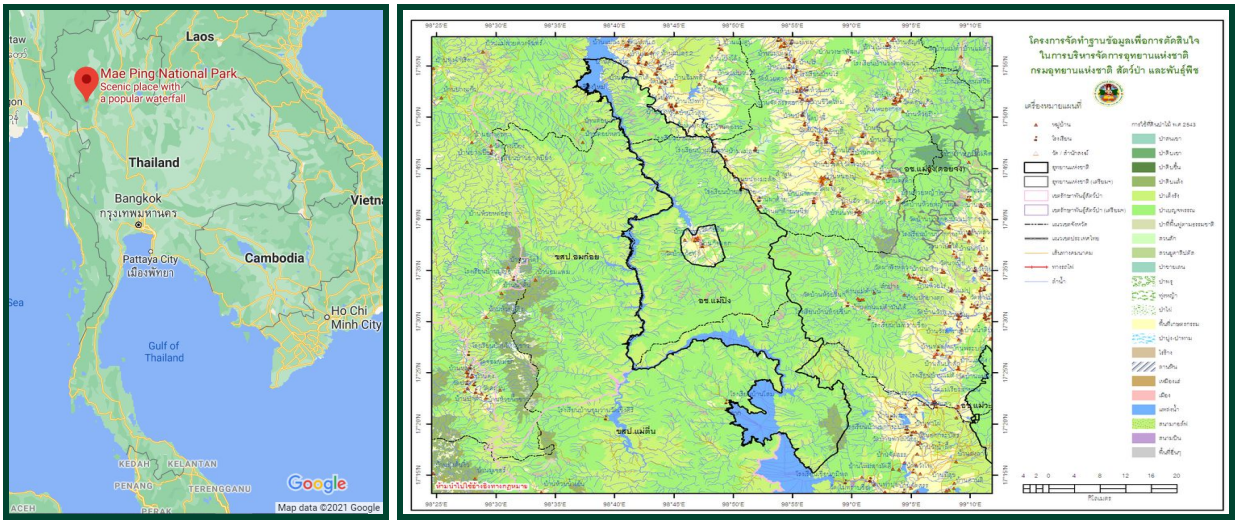

Figure 1: Kor Sub-District Placement in Mae Ping National Park (Google Maps, 2021)

Mae Ping National Park has a primarily mountainous landscape. The mountain range runs from the north side, in the area of Doi Tao district, to the south side, around the northern part of Bhumibol Dam. Ban Kor is a community that finds itself in a flat region surrounded by the mountain range. This mountainous area around Ban Kor is a popular location for wildfires, therefore the community members have been victims of wildfires spreading from Mae Ping for at

least the past four years, based on data we collected from the Mae Ping Forest Fire Control Station during a preliminary visit in December of 2020.

2.2 Mushroom Cultivation and its Connection to the Causes of the Wildfires

From conversation with our sponsor, Dr. Jain Charnnarong, we learned that in Northern Thailand and many other parts of the world, local villagers lack the irrigation systems and precipitation during the dry season that enables them to promote successful agriculture and therefore must resort to scouring forests for products like mushrooms to sustain themselves and their families (J. Charnnarong, personal communication, February 9, 2021). The ideal habitat for mushroom growth are dark and moist environments (Peace Corps). Despite this, fire has been used in the process of mushroom collecting for decades. The purpose of using fire in this process is to reset everything on the ground level by clearing forest overgrowth that has hidden the mushrooms and created a perfect environment for the fungi to grow. Once the vegetation has cleared, the mushrooms are exposed and easier to collect (J. Charnnarong, personal communication, February 9, 2021). While this simplifies the foraging process, it does not sustain the land for regrowth. We have learned from our sponsor and Mae Ping National Park rangers that the use of fire for mushroom collecting does not truly benefit the environment or the locals' chance of long-term cultivation. The heat from fire dries out the soil, and the remaining ashes absorb water, preventing it from reaching the soil where mushrooms thrive. Over time, Ban Kor locals discovered that they had to dig deeper into the soil to find mushrooms (J. Charnnarong, personal communication, February 16, 2021). Additionally, there are mycorrhizae (or symbiotic relationships) between the mushrooms and the surrounding trees of the forest. These symbiotic relationships involve the trees and plants obtaining phosphate and other minerals through the fungus, while the fungus receives necessary sugars from the plant roots (*31.3B*, 2018). When the plants and trees are burned and killed, the mushrooms experience a nutrient depletion because they no longer receive the sugars they need from the forest plants, harming their well-being and ability to continue their growth. The results of these impacts on the environment are evident, yet the Ban Kor locals continued to believe that using fire to collect mushrooms is a sustainable and harmless practice.

Not only does the use of fire in mushroom foraging create dry conditions in the upper layers of the forest ground, harming the ease at which mushrooms can be collected, it is not always controlled and has proven to be one of the most significant sources of wildfires in Mae Ping National Park since 2017 as depicted in Table 1. These totals were sourced from the Mae Ping Forest Fire Control Station that we visited in December 2020 where rangers track the fires throughout the park.

Year	2017	2018	2019	2020
Farm Burning	-	-	2 fires	2 fires
Collecting Forest Product	96 fires	66 fires	95 fires	132 fires
Animal Farming	-	1 fire	-	-
Tourism	-	-	1 fire	-
Unknown	-	-	1 fire	1 fire
Total Damaged Area (rai)	1,701	1,897	2,201	4,185

Table 1: Number of Fire Occurrences in Mae Ping National Park Attributed to Various Causes

This relationship between the causes of wildfire occurrences in Mae Ping National Park and the Ban Kor locals' dependency on mushroom foraging for profit during the dry seasons was very important to recognize when determining a solution for the community.

2.3 Painting a Picture of the Community of Ban Kor

This section will explore the roles that all stakeholders played in contributing to the wildfire problem and their relationships to one another. The dynamic interactions between these stakeholders have been critical for our team to understand in order to anticipate how any solutions directed towards a single group will influence others.

2.3.1 School Children and their Interactions with the Ban Kor Community

The school children of Ban Kor were a great area of focus for us because they are the most open-minded and impressionable subset of the community. Similarly, they are the future of the community, so instilling motivation within them to fight the wildfire problem plaguing their village was imperative to ensure the sustainability of a solution. We developed an understanding of the structure of their education system during a preliminary trip to Ban Kor in December 2020.

The Ban Kor Judsan school consists of 22 teachers and 255 students of which 47 are kindergarteners, 77 are primary students, and 32 are secondary students. The Thai education system contains four levels of education. The first level is primary which consists of grades one through three. The second level includes grades four through six. The third level is secondary which contains grades seven through nine, and finally the fourth level is grades ten through twelve. Ban Kor Judsan school contains only the first three levels of the education system,

meaning that students graduate after they have completed grade nine. After graduation, the student has the option to attend a secondary school and complete the fourth level. In Ban Kor, the children typically do not want to go to a secondary school due to the distance between their home and the school as well as the financial commitment. Therefore, many children end up attending a technical school locally.

The students are already wise and open to new technologies. The Ban Kor Judsan school provides opportunities for volunteer activities to their students which helps them to cultivate kindness in their childhood years. The students at Ban Kor Judsan are high-potential children who can adapt to new technology and use it effectively. From a quick, informal survey of the students of Ban Kor Judsan, we found that approximately 80% of the students at the school had a smartphone with a social media application, showing us that a technological solution was not out of the picture for our team.

2.3.2 Agriculturalists and the Practice of Mushroom Cultivation

The primary career path in Ban Kor is in agriculture, based on the remote, rural location of the village. We learned from our sponsor that, in recent years, the community has been facing increasingly difficult dry seasons which prevented them from being able to produce and sell their crops during this time. As previously discussed, this caused them to turn to foraging for mushrooms in the forest and near the park. The economic reliance on agriculture and mushroom foraging indicates that instructing the community members to stop foraging for mushrooms is not sustainable and would not be heard since it is simply not feasible to implement.

A key dynamic of this group of stakeholders is that they are the family members of the school children who already foster attitudes of positive change and community well-being. Therefore, any necessary communication of important educational topics and concepts to the agriculturalists can be done naturally through the school children. For example, when school children are taught something interesting in class one day, they naturally discuss it with their parents and family members that evening at home. This dynamic was a forefront in our ideas for producing a sustainable solution to the wildfire problem.

2.3.3 The Potential of the Kor Thung Weaving Center in Ban Kor

The third group of stakeholders in Ban Kor is a much smaller subset of the agriculturalists and general community members. In Ban Kor, there is a small, run-down weaving facility run by two elders of the community, shown in Figure 2.

Figure 2: Elders of the Ban Kor Community at the Kor Thung Weaving Facility

From our preliminary trip to Ban Kor, we learned that the craft of cotton weaving is not currently popular in the Ban Kor community, despite the fact that it has been a staple of the Ban Kor community and Thai culture and carries extensive cultural significance. One of the reasons why cotton weaving is not a chosen career path is because of the small size of the market for woven products in the region. However, there is significant potential to increase this regional market. From basic understanding of Thai culture in the city of Bangkok, we know that the market here for organic, cotton-woven products is very vast. Knowing there exists a substantial market for these types of products in Thailand showed the opportunity for growth and expansion of the Ban Kor weaving center's business, Kor Thung Home. Kor Thung Home's current business model includes onsite and online selling of their product. Their Facebook page showed that they sell their products primarily in kiosk stores during special events such as the OTOP City Festival 2020, Chiang Mai Design Week 2020, and the Thai Organic Festival. When selling products online, the only way to order weaving products from them is to contact them directly via Facebook Messenger, the messaging application known as LINE, or a phone call.

The existence of a market for Ban Kor's woven products in Thailand pinpointed the elders of the weaving center as key stakeholders to be included in addressing the wildfire problem in Ban Kor since growth of their business could eventually substitute for the income generated by mushroom foraging.

2.4 Change Management Literature Review

Looking at the wildfire problem with the broadest scope, it is evident that the community's overall attitude towards fire use in the forest needed to be changed so they no longer turn to its use anytime they need to forage for mushrooms or want to perform an activity where they believe fire needs to be involved. Changing the mindset of an entire community in a rural, remote area of a country on the direct opposite side of the world is seemingly an impossible task when viewed as the one solution. However, this solution exactly mirrors the

concept of change management. How could we manage a group of people in a way that promotes the institution of vital changes, and how can we make these changes sustainable?

2.4.1 Instituting Societal Change with The Elephant, The Rider, and The Path

Chip and Dan Heath outline exactly how to create lasting change on an individual, organizational, and societal level in their book, *Switch: How to Change Things When Change is Hard*. The Heath brothers break down the human brain's processing of change into three psychological concepts: The Elephant, The Rider, and The Path (Heath & Heath, 2010). They describe that the Elephant represents our emotional side. It is the source of our motivation, but it is also the impulsive and instinctive side that seeks instant gratification: it has no sense of rationality. That is where the Rider comes in. The Rider, they tell, is our rational side. It sits atop the Elephant and guides our actions and steers our motivations towards productivity. However, when the Rider and the Elephant disagree (when our emotions and our logical reasoning disagree), the Rider loses to the much larger and stronger Elephant. Sometimes, though, the Elephant and the Rider agree on where they want to go, and it becomes the Rider's job to determine how to get there. However, if the Path on how to get from point A to point B is not clear, the Rider can only do so much to figure out how to get there and will inevitably fail if it spends too much time trying as it will become fatigued and give up with no progress (Heath & Heath, 2010).

This analogy of the human brain's processing of change played a crucial role in determining our three objectives to meet our goal of instituting lasting change in Ban Kor. Point A is the current state of Ban Kor, where Mae Ping is riddled with wildfires caused by the community members' own actions to make a living. The village needs to get to point B, where they are no longer utilizing fire unnecessarily and can sustain themselves economically without these unsafe burning practices. Our first objective, to educate the community of Ban Kor on the problems stemming from the wildfires in Mae Ping National Park and surrounding the village, is how we will motivate their Elephants by showing the true extent of the damage and harm they are causing towards their environment and themselves. Our second objective, to provide the community of Ban Kor with tools and easy-to-use resources for automated tracking of wildfires, weather, and air quality data, will keep their Elephant connected to the problem as it evolves as well as provide their Riders some logic-based indication that the actions they have chosen are either helping or harming the situation. Finally, to prevent fatigue of the Rider as it tries to figure out how to change community behaviors, we determined our third objective to create the Path: Prepare the Ban Kor community to make positive change with distinct plans and action items to grow their economy in a sustainable manner and institute activities and behaviors that promote overall fire-safe practices.

All three project objectives work together to guide the Elephants and Riders of the community towards point B. Remove one of these components, and the community will struggle, reverting to their old habits when change becomes hard, or spin the wheels of their brains trying

to figure out how in the world they can stop the wildfires destroying the beautiful ecosystems around them.

2.5 Sponsorship Mission and Previous Work in the Ban Kor Community

Our sponsor, Dr. Jain Charnnarong, a member of the Club of Recipients of the Ananda Mahidol Foundation, has been working very closely with the community of Ban Kor to implement resources and strategies for mitigating the frequent wildfire occurrences in the surrounding park forest. He has developed what is known as the Ban Kor Sandbox, shown in Figure 3, as a strategy for implementing lasting and sustainable change within the community.

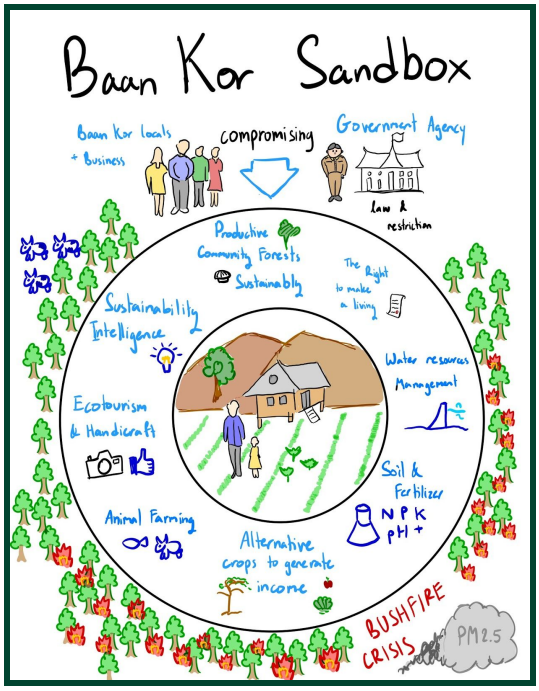

Figure 3: The Ban Kor Sandbox Developed by Dr. Jain Charnnarong

To summarize the concepts on the Sandbox, the Ban Kor locals and government agencies must first come to a compromise on how the government can provide necessary funding and resources to the community. The key resources of interest have been a community forest outside of Mae Ping National Park for their foraging uses and access to underground water in the dry season so that they may uphold their right to make a living year-round. Recently, this funding has been granted and the construction of many wells throughout the village has begun. This has been one of the greatest successes so far in Ban Kor that Dr. Jain has worked towards. The next steps illustrated on the Sandbox are the development of proper soils and fertilizers for the community to use so that they may begin growing alternative crops to generate income and soon develop animal farming in the village after. After this has been accomplished, the community can begin to develop an ecotourism base in the region, which is tourism directed towards exotic and often threatened environments to support environmental conservation efforts. Finally, in

order to ensure lasting change in the region, all community members must develop their knowledge of sustainability and how to support the environment around them in order to prevent further harmful practices like they developed with mushroom cultivation (J. Charnnarong, personal communication, February 28, 2021).

2.5.1 Manual Fire Tracking and Alerts with LINE and NASA FIRMS

In addition to the policy work that secured necessary water resources for Ban Kor, Dr. Jain has been tracking wildfires daily and mapping out their predicted courses in order to notify the community members of the damage caused as effects of their actions. The key tools that Dr. Jain utilizes to do this are the National Aeronautical Space Administration (NASA) Fire Information for Resource Management System (FIRMS) in combination with standard weather applications, and LINE - an application for instant communications. NASA FIRMS is an online Geographic Information System (GIS) that plots active fire data in locations around the world using satellite data. After retrieving data from the system twice daily, he uses data on wind speed and direction in conjunction with terrain features to predict the fire's movements. Additionally, he monitors $PM_{2.5}$ sensors in the area to determine the threat level of the fire to the health of the village. $PM_{2.5}$ is particulate matter with a diameter of less than 2.5 microns which is commonly used by commercial air quality monitoring systems that track its concentrations in the air. He then sends this information directly to Mae Ping National Park rangers and Ban Kor locals via the LINE application who can take necessary action on the fires. This process has proven to be an involved process for Dr. Jain to complete daily, but remains to be an important source of vital information for the Ban Kor community to remain informed on the wildfires in their area.

2.6 Conclusion

From the information provided by our sponsor, Dr. Jain, preliminary visits to Ban Kor, and literature reviews on societal change, it is apparent to us that the Ban Kor community's relationship with fire and its use in the natural world has been lacking guidance and fueled by misinformation, along with a lack of resources until now to promote alternative behaviors and support their economy in more fire-safe ways. Instituting change in Ban Kor will require thorough education and involvement of many subsets of the community to ensure sustainability of a solution.

Chapter 3: Methodology

In order to accomplish our goal of developing a sustainable foundation for fire prevention in the community of Ban Kor through raising awareness of the wildfires and increasing locals' knowledge on the impacts of uncontrolled wildfires, therefore altering their perspective towards this issue, we developed distinct methods for addressing the project objectives that follow:

1. *Educate the community of Ban Kor on the problems stemming from the wildfires in Mae Ping National Park and surrounding the village.*
2. *Provide the community of Ban Kor with tools and easy-to-use resources for automated tracking of wildfires, weather, and air quality data.*
3. *Prepare the Ban Kor community to make positive change with distinct plans and action items to grow their economy in a sustainable manner and institute activities and behaviors that promote overall fire-safe practices.*

This chapter will identify the methodology we selected to bring awareness of the wildfire situations in Mae Ping National Park to the community of Ban Kor and how we analyzed the efficacy of these particular tactics.

3.1 Objective 1

Educate the community of Ban Kor on the problems stemming from the wildfires in Mae Ping National Park and surrounding the village

Our intent for the first objective was to deliver immediate information to the Ban Kor community that would assist them in understanding the wildfire problem. To do this, we targeted different social groups that would absorb this information and comprehend the intended message. We believed that educating students through an animated video would be the most effective method to accomplish our project goal. Furthermore, we wanted to develop activities to involve them in fire prevention that will be discussed in this section.

3.1.1 Create an Informational Video to Increase the Community Awareness

In order to improve the community's awareness of the regional wildfires and their hazards, we have conducted research on the science behind wildfires and associated health effects as well as improved our own understanding of the community's current knowledge of the forest fires in Mae Ping National Park. We sought this information to deliver appropriate educational information to the Ban Kor community that will help them understand the wildfire threat posed on their village and the surrounding environment. By spreading this information quickly and efficiently, we met our goal of setting a foundation of increased fire prevention and awareness amongst the community regarding the wildfires in Mae Ping National Park.

Our research gave us an understanding of how fires are started in the park as well as where and when they are occuring. We also learned how a bushfire's direction and intensity can be predicted by the wind and geographical knowledge and the associated health impacts related to pollutants released from smoke such as $PM_{2.5}$. With this information, we designed a storyboard to assist in developing the animation and ensured the graphics were appealing to the eye but also informative. In developing the storyboard, we followed the acronym AIDA (awareness, interest, desire, and action) to create an effective plot and convey our message. To increase desire, and specifically the Ban Kor locals' desire to take action, we encouraged the community to have a goal of good health by protecting one another from the dangers of wildfires and taking action to mitigate them. Awareness was accomplished through delivering bushfire information and explaining its impacts, including health and environmental concerns that spark interest in the locals.

The final product of this methodology was an informative video that we released to the students. The video was initially delivered to some students of Ban Kor with a pre- and post-evaluation to assist our team in analyzing the efficacy of the storyline in teaching school children about the wildfires in Mae Ping National Park. Both evaluations contained the same questions for effective comparison between the school children's knowledge on the video content before and after its viewing. These questions may be viewed in Appendix A. In order to analyze the efficacy of the video in teaching specific concepts, we grouped the questions into five conceptual categories so that we could make these same comparisons in a more precise manner and gauge gaps in the video's message. We hoped this informational video would raise awareness of the problem of wildfires amongst the youngest group of stakeholders in Ban Kor and instill a desire to take action within them.

3.1.2 Establish Fire Prevention Activities for School Children at Ban Kor Judsan

To further our work with the school children and provide them with opportunities to make a difference in Ban Kor, we planned to develop an outline of extracurricular club activities to deliver to the Ban Kor Judsan school. In mid-February, a virtual meeting was held with the science teacher of the school to further discuss the possibility of establishing an extracurricular program that would involve the school children of Ban Kor in the overall community efforts to track and mitigate fires in both Mae Ping National Park and other valuable nearby forests. Through these conversations, school faculty outlined the deliverables our team would need to produce in order to institute the extracurricular organization for the fall semester of 2021: a twenty-week plan and curriculum for the activities, responsibilities, and learning points for the club members.

While the information we received from the school faculty was useful, we did not receive enough interest from teachers to solidify who would run the club and organize a group of students after the completion of this project. Our team performed research on effective and engaging activities that could be done by the students, but this was not enough to seek approval

from the Ban Kor School Board. However, providing guidance and opportunities for the school children to take action in their community after viewing the educational video was a priority for our team.

The overall expectation of these extracurricular activities for the school children of Ban Kor is that they will connect the future generations of the community to valuable information about wildfires near their community and that the program will be able to run for years to come. Another expectation is that the students who participate in the program will communicate their lessons to family members or school peers who are not involved in the program themselves, while providing an opportunity for the students who do participate to contribute to the prosperity and safety of their own community in a positive and informed manner.

3.2 Objective 2

Provide the community of Ban Kor with tools and easy-to-use resources for automated tracking of wildfires, weather, and air quality data.

The purpose of our second objective was to equip the Ban Kor locals with the appropriate tools to give them access to information that they previously received from Dr. Jain. We hoped that by giving them this responsibility, they would be able to better understand the bushfire problem and how their actions are contributing to it. We believed that the creation of a LINE Official account and supporting a web page would be the most efficient way to accomplish this and would create a sustainable foundation for fire prevention.

3.2.1 Utilize the LINE Official Application to Create Accessible Software for Fire-Tracking Information

Through our preliminary research and conversations with our sponsor, we determined that developing an effective means of communicating fire alerts and fire hazards to the community of Ban Kor would be vital to wildfire mitigation in the region. We believed that the best way to achieve this was to try and leverage technology such as LINE. LINE is a free instant communication application that can be downloaded onto one's smartphone. The application is widely popular across Thailand, with approximately 84% of Thai internet users having active LINE accounts in 2019 (Steve, 2020). We employed our skills to host an application of our own creation on the LINE app, with fire-tracking information and features. This application provided information such as wildfire locations, air quality information, wind speed, and general information about wildfires. We hoped that by making this information accessible through LINE, it would be evident to the Ban Kor locals how much of an impact their actions have on the environment and encourage them to think twice before igniting a fire.

Information about the location of wildfires was obtained through data made available by NASA FIRMS. It provides data on wildfires globally in a periodic fashion. From this data, we obtained information about wildfires all over Southeast-Asia. For example, for a detected

wildfire hotspot, we learned its latitude, longitude, date acquired, and time of day the fire occurred. Active fire data is updated in near-real-time, ensuring that information is always current and up to date. Additionally, information about air quality, wind speed and temperature was also deemed helpful for our users. Air quality data was obtained from a technology called CUSense. We gained access to local sensor stations and obtained information about temperature, humidity, and $PM_{2.5}$ concentrations. Users would be able to monitor air quality by province, helping them understand how local pollutants in the air may affect them adversely. To augment this, we also obtained wind speed data from another source titled Windy. Windy provides information about wind speed in different areas. Combining wind speed with the fire location enabled the community with information to predict how an active fire could spread over time.

The final step was to consolidate this information into LINE in a manner that is engaging, user-friendly, and easy to understand. This was extremely important because our target audience was primarily the school children of Ban Kor. One way to do this was to display the aforementioned data on a map. We created it so that users can view information all the way back to a week prior, and then subsequently scroll through each day observing how wildfires are spreading in conjunction with its effect on air quality. We intended to make data points coloured and labeled in an effort to minimize ambiguity. With this strategy, we could work towards enabling the community to understand and take action against the wildfire problem.

We recognized the limitations of undertaking such a task within the timeframe and scope of this project early on. The main limitation we faced was that of time constraints. We acknowledged the short timeframe of this project, which meant that we would not be able to add as many features as initially planned, or evaluate the effectiveness of our application. Furthermore, sources such as Windy require paid subscriptions in order to access additional information, like weather, which limits the amount of data available for us to utilize in our application. There are also limits to the amount of times data can be requested in a day, which, assuming the app undergoes heavy usage, would pose an issue. For example, Windy limits sensor requests to 500 a day (*Windy: Map Forecast API - Home*, n.d.). We hope that financial assistance from our sponsor would prevent this from becoming an issue after the conclusion of our project.

3.3 Objective 3

Prepare the Ban Kor community to make positive change with distinct plans and action items to grow their economy in a sustainable manner and institute activities and behaviors that promote overall fire-safe practices

The purpose of the third objective in achieving our project goal is to establish action items for the Ban Kor weaving center and outline a path by which they could grow their business in Thailand. By growing their business, they provide the whole community with a promising substitute to the income generated by mushroom foraging that Ban Kor villagers have relied

upon. Because of this, we set out to investigate the shortcomings of their business previously and the successes of the organic woven-commodity market in Bangkok in conjunction with the areas of opportunity directly in the Northern Thailand region for market expansion.

3.3.1 Determine the Needs of Kor Thung Home Through Interviews

The first portion of this method that we instituted for the purpose of exploring market opportunities was by interviewing the elders of Kor Thung Home to assess their perspective on the current state of their business and to learn what it is they believed they needed to establish and build a reputation in the region. The first of these interviews was conducted on December 21, 2020 during an in-person visit to Ban Kor, and the second on March 2, 2021 via LINE phone call with Ms. Kanlayanee Katekaew of Kor Thung Home. The following are the big-picture questions that we set out to answer through these conversations:

Why do they believe that the community does not have an interest or devote time and attention in the weaving business in their own community of Ban Kor?

What resources does the business and facility lack that prevents them from reaching a greater market?

What has prevented them from the necessary access to these resources until now?

With these resources, what is it that they would do that would build their business and their reputation within the Northern Thailand region?

These ideas were vital for us to understand first so that we could ensure our research initiatives centered around the successes in Bangkok markets would lead towards recommendations that catered directly to Kor Thung Home because of the primary role they would play in implementing these recommendations. Additionally, it was crucial for us to remain in-tune with the needs of the community so that we could build an important level of trust as an outsider group hoping to institute change in their daily lives.

We noted that this would only be possible if their workforce was expanded to make more products to sell. With that, their customer base was also in need of an expansion to increase chances of profit. Mae Ping National Park has many natural sightseeing opportunities and places to visit. By developing weaving centers into a complete local attraction with hotels and activity hubs, we can help Kor Thung Home become a greater tourist attraction and the main source of income for this community.

3.3.2 Developing Marketing Approaches in Bangkok Through Interviews

Once we understood the needs of Kor Thung Home, we explored the opportunities to introduce the brand into Bangkok's wider market by contacting several multi-brand stores who are passionate about eco-friendly products. These stores gather creative products from local

craftsmen in order to increase the opportunities for the Thai locals to represent their ideas and materials in a complete retail ecosystem. Some examples of organic multi-brand stores are ECOTOPIA (Siam Discovery Mall, Bangkok, Thailand), ICONCRAFT (Siam Discovery Mall and ICONSIAM, Bangkok, Thailand), ODS-Objects of Desire Store (Siam Discovery Mall, Bangkok, Thailand), and Phu Fa (total of 21 branches in Bangkok, Thailand). We had an initial meeting on March 5, 2021 with managers of ECOTOPIA to understand their business and marketing strategies. Another interview was held on March 8, 2021 where we discussed the potential for Kor Thung Home to market their products in Bangkok. With this strategy, we hoped to learn more about these unique markets and potentially promote the Kor Thung Home weaving products in these stores.

Another way that the Kor Thung Home weaving facility could promote their product and increase their market size is through an international marketplace. These businesses consist of global online markets that almost anyone can join to sell various handcrafted products. Many of these specialists share a passion for sustainable eco-friendly production and distribution. There is a large population of sellers and buyers that have this passion and interest for weaving products, and it would be beneficial for the elders at Kor Thung Home to expand their Facebook page to be able to sell through the Marketplace or consider joining an international market such as Etsy or Artfire.

All of this information was extremely useful in developing recommendations for Kor Thung Home in order to accomplish our goal. Through incentivising the weaving craft as a sustainable form of income, we hope that locals will not resort to mushroom foraging and instead adopt the heritage craft. This supports our goal of mitigating wildfires and preserving the forest of Mae Ping National Park.

Chapter 4: Results and Analysis

Our end goal for this project was to leave the Ban Kor community with a sustainable foundation for fire prevention. Through research and observations of the community, we determined what resources would benefit the locals by informing them on the risks of fire and raising their awareness of the widespread fires occurring around them. This chapter will discuss the findings from our research and deliverables that were completed to achieve this goal.

4.1 Analyzing the Efficacy of the Informational Video in the Ban Kor Judsan School

The Ban Kor Judsan students of grades four through nine gathered after a morning assembly to watch our educational video. Before they began watching they completed our pre-evaluation so we could determine their base level of knowledge on wildfires in their region. After they watched the video they answered the same questions for the post-evaluation. We recorded each student's test score and then averaged out all of the individual scores for each grade. The data shows that the students' level of knowledge about wildfires increased drastically after watching the video.

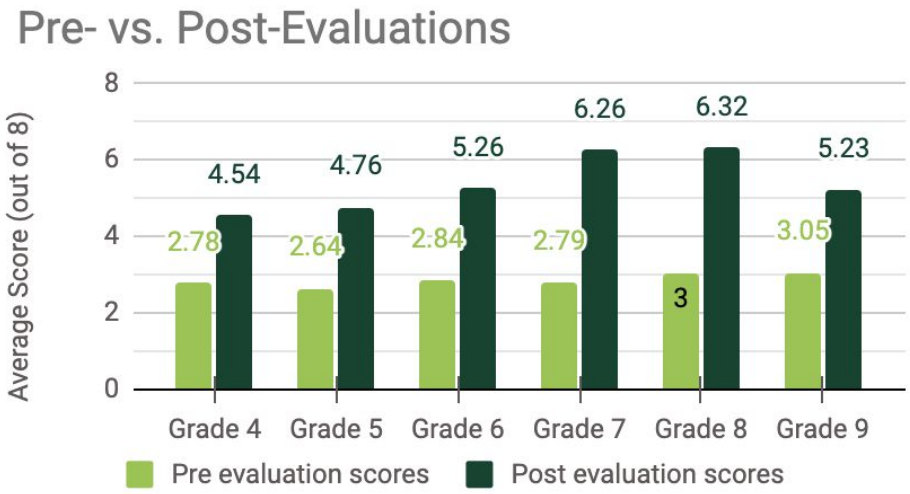

Figure 4: Comparison of Pre- and Post-Evaluation Scores

In Figure 4, you can see that the average post-evaluation scores almost doubled for most grades. This means that the students increased their evaluation scores and answered more correct answers after watching the video. There were eight questions on the video evaluation for both pre- and post-evaluations, so these scores are the average amount of questions the students got correct out of eight, separated by grade. Looking at Figure 4, it is evident that grades seven and eight got the highest average scores on the post-test. We are unsure why grade nine did worse than grades six, seven, and eight, because it breaks the trend of the post-test score increasing as grade increases.

Percent Improvement	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9
	63.31%	81.44%	85.21%	124.37%	110.67%	71.48%

Figure 5: Percent Improvement by Grade

Figure 5 indicates the percent improvement from the average pre-evaluation score per grade to the average post-evaluation score per grade. This data is a concrete result that indicates that our educational video led to the students' post-evaluation scores increasing. This allows us to infer that the educational video also increased the students' awareness of the wildfires near Ban Kor.

We can also take a look at the individual concepts that the students showed improvement on. We categorized the questions into the following concept categories: general fire science, identifying the status of the wildfire situation surrounding Ban Kor, current community mindset towards mushroom foraging, negative health and environmental impacts of $PM_{2.5}$, and current $PM_{2.5}$ levels in Thailand. We broke down the eight questions into these categories to get a better sense of which concepts the students were mastering and to see if certain areas needed to be expanded upon for future learning.

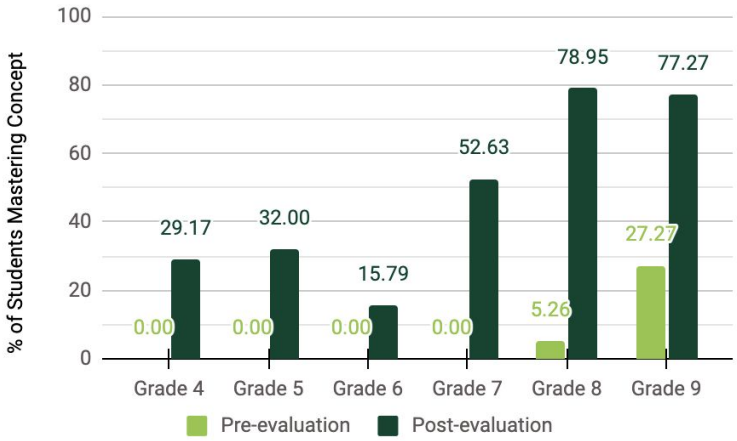

Figure 6: Student Mastery of General Fire Science

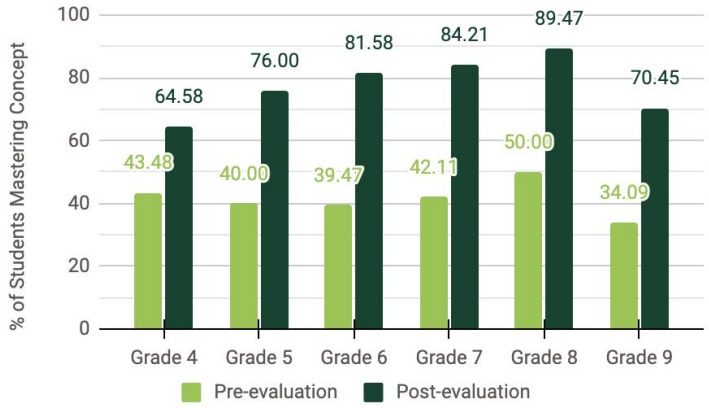

Figure 7: Student Mastery of the Status of the Wildfire Situation Surrounding Ban Kor

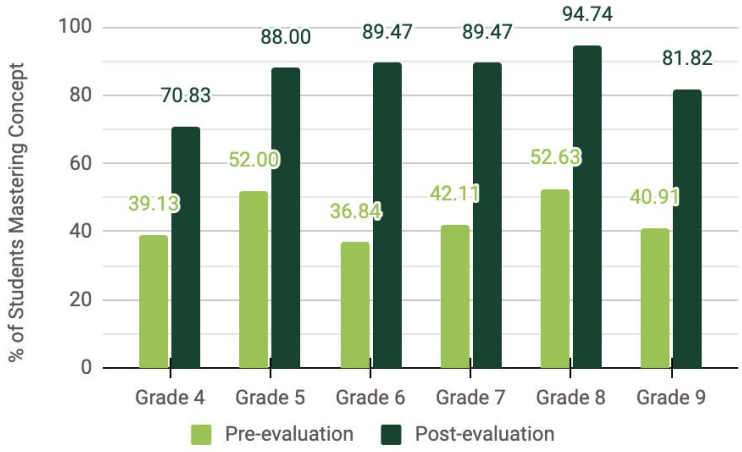

Figure 8: Student Mastery of the Community Mindset Towards Mushroom Foraging

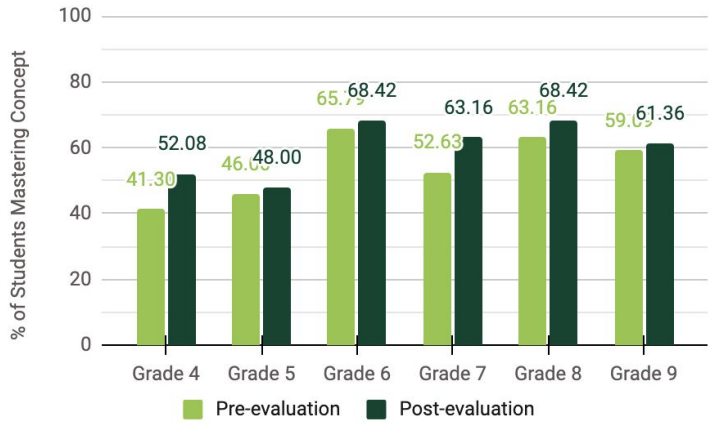

Figure 9: Student Mastery of the Negative Health and Environmental Impacts of $PM_{2.5}$

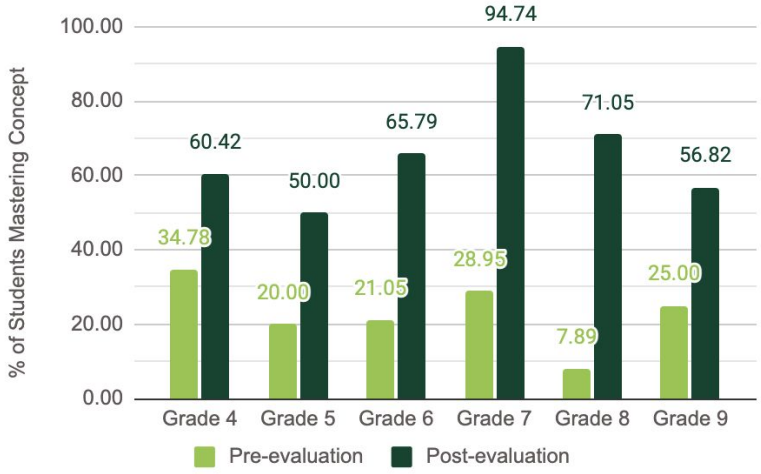

Figure 10: Student Mastery of the Current $PM_{2.5}$ Levels in Thailand

Looking at Figures 6 through 10, we can analyze how the students performed in each category. Figure 6 demonstrates that all grades greatly improved from their base level knowledge for the questions about fire science; grades seven, eight, and nine improved the most while grades four through six still seemed to struggle with these questions even after watching the educational video. This might be an indicator that these questions were too difficult for the younger students to understand. The data shows that most of the students did not know much about fire science before watching the educational video because the baseline scores were zero for the majority of grades. Only 27% of the students in grade nine were able to answer these questions correctly on the pre-test, which suggests that Ban Kor students were not educated on fire science before grade nine, if at all.

Figure 7 plots the data relevant to the status of the wildfire situation surrounding Ban Kor. The students were asked about certain statistics about the wildfires occurring in Mae Ping National Park. Almost half the students from each grade got these questions correct on the pretest, which indicates that most were aware of these ongoing issues in the park. All students of each grade greatly improved on the post-test, mastering the concept of the local wildfire situation. The same analysis and results can be seen for the mastery of the students' knowledge of the current community mindset towards mushroom foraging, which is shown in Figure 8.

Most students knew very well about the negative health and environmental impacts of $PM_{2.5}$. This level of knowledge is displayed through similar good scores on both pre- and post-tests shown in Figure 9. There was not a significant improvement of scores from pre- to post-test; this could indicate that the video did not have a major effect on their knowledge of this concept. Students were also asked questions about the current levels of $PM_{2.5}$ in Thailand, but Figure 10 shows that students did not have as much baseline knowledge of this concept. After watching the video, their scores improved considerably, implying that the video contributed to their newfound knowledge on the matter.

Through the analysis of the average student scores from each grade and the individual questions, we can conclude that the educational video increased the community's awareness of the regional wildfires and their hazards. We hope that this newfound knowledge will help create a foundation for the Ban Kor community to become more involved in fire prevention.

4.2 Opportunities for Establishing Fire Prevention Initiatives for the Children of Ban Kor

Our research concluded that there are a multiplicity of activities that could engage children in fire prevention. From our conversations with teachers at Ban Kor Judsan, we concluded that there was not enough interest to seek approval from the Ban Kor School Board and organize a club to implement these extracurricular activities. However, our research showed that these suggested activities could have a positive impact on the students ability to understand the dangers of wildfires and discover their own fire prevention capabilities. Since the children of Ban Kor Judsan are expected to be the future leaders of this village surrounded by forest, we wanted to make sure they had a long-lasting understanding of the impacts of wildfires. At their young age, they do not have underlying concerns about expenses and gaining revenue that can impact the decision-making of adults such as their parents who are contributing to wildfires. For this reason, we wanted to reinforce the importance of sustainability while they are young in order to prevent the persuasion of using fire to benefit them in the future.

With this in mind, we chose to develop a guide for future students to potentially implement in the school, or as a resource for teachers if they feel inclined to start up a club with children interested in fire prevention. This guide can be found in Appendix C. From the results of our educational video, we expected that there is at least a small population of students that are intrigued by this topic and interested in playing a larger role in fire prevention. The activities in

this guide were determined to be the most effective at engaging students' interest and enabling them to make an impact towards ending the bushfire crisis in Ban Kor. By keeping track of and recording new fire hotspots, students can observe the gradual changes and hopefully a reduction of forest fire instances. Tracking this progress will motivate them to take action and encourage their families to avoid lighting the forest on fire. With the assistance of Dr. Jain, the students also have the potential to understand fire-tracking technology. They are the most adaptive to this kind of information as they have the understanding of and access to technology which enables them to estimate the spread of a wildfire. Their involvement in these extracurricular activities could also give them a sense of their leadership potential and responsibility. If older children learn these skills, they would be capable of teaching younger generations to ensure that this issue never arises in the future. These methods would guarantee long-term sustainability and safety for the people of Ban Kor and the ecosystem within Mae Ping National Park.

4.3 Analysis of the LINE Official Application and Fire-Tracking Software Final Product

As mentioned in Chapter 3, our goal of developing the LINE application was to make information about fire hazards more accessible to the wider community. Our hope was that this increased accessibility would bring increased awareness within the community as well. In the end our application essentially consisted of two parts. The first being an automated chat bot hosted on LINE, which provides the user with daily updates on air quality upon request. Additionally, our application links to the second part of our product, which is a companion website. The website contains our fire tracking timeline, a map displaying wind speeds and temperature and our informational video previously analysed in section 4.1. Since the app was released shortly before the end of our project, there was no quantitative way to measure the success of our product. For this reason, this section will focus on the product's functionality, as well as its successes and limitations.

Using our application, community members will not have to rely on Dr. Jain to communicate fire hazards. Users may interact with a menu to give them information about air quality including PM_{25}, PM_{10} and PM_{1} concentrations. Information is updated in a timely manner, to be specific a request for updated air quality data is made every hour. The menu also links to a companion website containing a fire hotspot timeline displaying the occurrence of fires within the last week in Thailand. Clickable fire icons are displayed on the map, indicating the fire's coordinates, the date and time it occurred, and whether it occurred during the day or the night. On the same webpage is another timeline map displaying wind direction and weather so that users may predict the future trajectory of a fire. Having this information available instantly means that in the future, community members can be more prepared when it comes to recognizing hazards. Additionally, easily accessible information may help towards fostering a sense of responsibility amongst the coming generations.

In development of the application, we did encounter some financial limitations. For example, it would be possible to handle increased user requests, and even display air quality data

on one map. However, to do this a paid subscription is required. Instead, we opted to combine open-source technologies as well as paid technologies to achieve our product.

Considering the accessibility and instructional information provided to help users navigate the app, as well as the fact that students will be taught how to use it, we hoped it will bring ease and security to the community of Ban Kor and help them feel more in control of the prevailing wildfire issues.

4.4 Information Gained on Marketing Ban Kor Weaving Products

From our research and conversations with the heads of the Kor Thung Home weaving facility, we were able to gather information on their potential for success through expanding their market size and business strategies. Firstly, we learned that Kanlayanee Katekaew already had this idea, but lacked support from the community and the financial resources to expand their business. The lack of income has prevented them from being able to purchase a weaving machine, specifically a cotton gin, that removes seeds from the natural cotton fabric so that it may be spun into thread or yarn that is used to make woven products. This means that they currently have to send their crop of cotton to a facility where this process can be done efficiently and sent back to them which wastes a lot of time and limits their production capacity. We also learned that cotton can be grown year-round with the addition of water resources as mentioned in Section 2.5 which increases their production capacity and in turn their profitability.

The elders also shared with us that they are interested in increasing their customer base not only to generate more revenue but to prove to the community that their business is successful. This would greatly benefit the community because the locals that currently use fire in their daily activities would see the success of the weaving industry. Their success would show these locals that this career path can be more profitable than foraging for mushrooms and reduce the need for using fire in the forest. This is the most exigent need to mitigate uncontrolled bushfires and develop a strong market to sell their products. We learned that there are many tourists that pass through Ban Kor on the weekends and drive right past the weaving facility, but the facility lacks the advertising and establishment to attract customers. This inability to gain income and overall lack of funding from other organizations has limited their success to be considered as a competitor by other companies. Kanlayanee Katekaew told us that these are their most prudent needs currently, while human resources could be increased once the business has proven its chance for success as she could then convince more locals to learn the weaving craft.

Through advertising and expansion of the weaving facility, the elders can increase their customer base and activity at the center. We wanted to create some kind of tourist attraction to increase tourists' interest in the craft where visitors would have the chance to design and craft their own weaving products as a gift or souvenir. With financial assistance, the addition of restrooms and a park stop with food and drinks could also promote foot traffic at the weaving facility and increase their chances for higher revenue year-round. While this may not be possible

to accomplish in the duration of our project, we wanted to provide Kor Thung Home with the necessary strategies and next steps to expand their business. To assist the elders of the Kor Thung Home in creating and hosting such an event, we designed an infographic on their potential customer journey, which can be found in Appendix D. We also thought it would be beneficial for them to add a rest stop to their facilities along with providing food and drinks for their visitors, but this was not possible for us to implement due to their lack of financial resources.

As mentioned in Section 3.4.2 there are many multi-brand stores around Thailand that could promote Kor Thung Home's weaving products and introduce them to the customer base. We reached out to leaders of ECOTOPIA to gain insight on how this could be accomplished, but they shared with us that this strategy may not be suitable for Kor Thung Home in the long run since their business is not as established as their competitors. However, they did suggest and support the creation of a CSR (Corporate Social Responsibility) event that would consist of an exhibition of their products in an ECOTOPIA store in Bangkok. This exhibition would increase their market size by attracting customers that are interested in handmade eco-friendly goods. Such customers could include someone with similar interests to the ideal customer persona that we outlined, which can be found in Appendix E. With inspiration from the sustainable mindsets at ECOTOPIA, we also designed an infographic describing the damage that mushroom collecting does to the environment and establishes the positive impact that the weaving craft could have to improve this problem. The statistics found in the figure in Appendix F reveal information that is put into a perspective that people can easily understand the impact that weaving has over mushroom foraging. By purchasing a weaving product instead of an equally priced amount of mushrooms, customers can prevent bushfires and the damage they cause to the forest.

Aside from financial limitations, we discovered a larger obstacle that the Kor Thung weaving community must overcome is their ability to market their product and increase their market size. We calculated an estimated market size of Ban Kor tourists using data from the Ministry of Tourism and Sports. The estimated number of tourists that annually traveled through Lamphun was found to be 33,385 people (Ministry of Tourism and Sports, 2021). We took 5% of this number to conclude that the estimated serviceable market of Ban Kor tourists that would be interested in a homestay or purchasing weaving products as 1,669 people annually. This information gives the Ban Kor weaving specialists hope that they will be able to generate enough revenue to make the necessary improvements that they need to succeed. Once Kor Thung Home has established a large enough market within Thailand, they will have a better understanding of what it will take to sell their products in an international market.

Chapter 5: Recommendations and Conclusions

5.1 Conclusions from School Evaluation and Next Steps for Educational Video

Upon broadcasting our video to Ban Kor students and analysing their test results, we determined that spreading the video with other schools and on multiple platforms is the most appropriate step forward. Making the video available to as many people as possible will increase the overall awareness of the wildfire problem in the area. In turn this may lead to increased awareness and even a change in attitude towards the problem. This is especially true for children, as they were our target audience when creating the video.

In order to ensure our video is viewed by as many children as possible, the principal of Ban Kor Judsan suggested that we share the video with other schools in the district. Sharing this video with other schools in the area would ensure that other people in areas that experience similar wildfire issues may also obtain this information and seek out change. Furthermore, if resources like these are continuously shared between schools it could build the platform for continued dialogue and education about the wildfire problem.

Currently, the video is available for free on YouTube and can be accessed through the link in Appendix B. However, in order to achieve maximum possible outreach we should look into making it available on multiple platforms. Because LINE is so popular in the school and in Thailand, making the video available through our LINE application would be very useful. This is because it would reduce the amount of steps necessary for someone to access information about bushfires. If someone already has the LINE application, it would be as simple as tapping on a linked menu icon that would take them directly to the YouTube link. Other considerations would include sharing the video on other social media platforms like Facebook or Twitter. Besides these platforms being extremely popular which increases visibility chances, these platforms make sharing content very easy as well. For example, someone can share a part of the video they like on multiple platforms all at the same time. We hope that there is enough interest from students at Ban Kor Judsan and surrounding schools to share this information and develop an active perspective towards mitigating wildfires that will encourage them to take action against others that continue to use fire in the forest.

5.2 Recommendations for Fire-Awareness Activities for the School Children of Ban Kor

We planned to create a twenty-week structured outline for a fire club at Ban Kor Judsan, though unfortunately the timing was not feasible to complete the entire outline. Instead, our team devised a general outline of a plan, located in Appendix C, which may be refined by faculty of Ban Kor Judsan to ensure sustainability and effectiveness of the program. We will pass on this outline to the principal and teachers at Ban Kor Judsan so they can further organize the logistics of the club, like which faculty would advise the club, gauge interest from students, etc. Early execution of the program should include lessons on wildfires including topics such as fire science, the role of wildfires in nature, and an overview of the wildfire problems in their very own community. As a note, the overview of the problem in Ban Kor should be delivered in a

manner that invokes a desire to improve the situation and does not accuse community members of creating the problem. The students who join the club should also receive training on how to utilize tools such as NASA FIRMS, CUSense, and Windy so that they are able to effectively utilize the LINE Application created as a joint effort by our team and the IQP/ISSP Team 1.

After the students have completed lessons to understand the current status of wildfires in their community, the program should introduce a few hands-on, ongoing activities for the club members such as excursions to the nearby forests to clear brush and assist with fire-mitigation processes and techniques. Other hands-on activities for the students could include acting as a watch team for signs of fire in the area and alerting community members of the students' observations. These observations could include sights of smoke or the smell of a nearby fire which would be a very effective method for increasing awareness of a potentially dangerous and uncontrolled forest fire. These activities could also be incorporated into the school curriculum; they would benefit any science and geography classes the students take. It is our hope that the faculty of Ban Kor are motivated enough to organize this club to create a sustainable wildfire-free future for the community by involving their students in these activities.

5.3 Conclusions on the LINE Application and Next Steps for Instituting within the Community

With development of the application and website completed, the next steps should consist of advertising the existence of the technology. We recommend promoting the application within the school so that children may become comfortable using and interpreting information early on. Our recommendation is that the product slowly phases into open source mapping APIs like Leaflet, thus ensuring continued scalability and longevity. Furthermore, the app will be advertised on the Far Foon Facebook Page that our sponsor, Dr. Jain, created to update the community on the wildfires. We created an infographic, in Appendix G, that advertises the app and explains the different features, which will also be posted on the Facebook page and Ban Kor Judsan as well as being shared by Dr. Jain with the locals in the current fire-tracking LINE chat.

5.4 Summary of Key Findings About Needs for Expanding the Ban Kor Weaving Center

Based on our conversations with the elders of the weaving center in Ban Kor, we found that they lacked three primary resources which have hindered them from growing their business and annual profits. The first of these was water resources during the dry season which has prevented them from producing the foundational cotton crop year-round to produce their products. This resource has since been accounted for and they will soon have the vital year-round irrigation they need. The second of these resources is substantial and effective marketing, particularly in the category of attracting already-present tourists in the region. Our conversations with the Marketing and Merchandise Managers of ECOTOPIA presented some very feasible and easy-to-implement strategies and marketing opportunities for the Ban Kor weaving center which we will expand upon in our recommendations. Additionally, from these conversations, we

concluded that it would be best for Kor Thung Home to focus on the Thai market and dominating this region, therefore recommending that they do not expand into the international market at this current time. The third lacking resource that the weaving center needs to expand their production capacity is a larger, industrial cotton gin which will allow them to remove cotton seeds from the raw cotton and produce the workable material in their own facility without the need to outsource this vital production step. Knowing that this specific machinery will require financial assistance and resources they do not have, we have developed the following recommendation of a business plan to assist the weaving center in improving their marketing capabilities to increase their customer base and annual profits. In the long-term, we hope that growth of the Kor Thung Home business will help to build their reputation amongst the Ban Kor locals and prove that weaving can once again be a fruitful career path.

5.4.1 Recommendations of Marketing Strategies to Increase Customer Base at the Ban Kor Weaving Center

To kick-start their business growth, we recommend that Kor Thung Home work with ECOTOPIA in the Siam Discovery Mall in Bangkok to create an exhibition promoting their business and bring awareness to the city and tourists about the wildfires in their region while showing that support for their small business will directly and positively influence the wildfire problem. Appendix F displays an infographic we created that illustrates the conversion rate between the products a customer buys and the number of rai of Mae Ping National Park that the purchase will save. This will appeal directly to the customer persona depicted in Appendix E and elaborated upon in our findings. An exhibition like this will equally benefit ECOTOPIA by allowing them to uphold their CSR as they work with a small, ethical business to indirectly mitigate dangerous wildfires in a vulnerable community. Knowing that ECOTOPIA has expressed interest and willingness to work with Kor Thung Home to create an exhibition like this, we recommend that Kor Thung Home open direct communication with ECOTOPIA to establish the exact plan and details of this exhibition so that they can make this a reality and improve their presence in front of their target customer base.

Kor Thung Home's partnership with ECOTOPIA will be their first crucial step towards expanding their customer base. In the long-term, we recommend that the business utilize the tourism industry in the Lamphun Province to their advantage by building up infrastructure near the weaving center and marketing their facility as a tourist attraction. The infrastructure required to make the center an attractive stop for tourists include sanitary restrooms and a substantial food and drink stand to provide the basics that a tourist would need during their time in the village. It would also be beneficial for the weaving center to build relationships and partnerships with local homestays and lodging to help market their attraction. For the attraction itself, Kor Thung Home should prepare to educate visitors on the craft and its history, tutorials and instruction on how they weave their products from picking the cotton to the final product, and provide a do-it-yourself activity for the visitors that would result with them returning home with a final product they made themselves. Kor Thung Home and Ban Kor could profit from all aspects of

the complete visitor's journey, depicted in Appendix D, by profiting from the refreshments that visitors purchase, the entry fee they would pay to visit the weaving center, and any homestays in their village that tourists would spend the night in.

We recognize that the village and Kor Thung Home lack the financial resources to implement all the recommendations immediately, and that it will be a long-term process to rebuild the craft and career in Ban Kor. With financial assistance from CSR programs and fundraising potential from willing organizations, we hope that these recommendations may be achieved at an accelerated pace and that the desired benefits to the Ban Kor community may be realized within a much shorter time period.

5.5 Project Conclusion

The goal of the project was to develop a sustainable foundation for fire prevention in the community of Ban Kor through raising awareness of the wildfires and increasing locals' knowledge on the impacts of uncontrolled wildfires, therefore altering their perspective towards this issue. We employed a unique combination of methods ranging from interviews and conversations with stakeholders and experts, to developing software for easy access to near-real-time data on regional wildfires in order to address a social problem with technological advancements. Our research and deliverables led us to thorough recommendations for advancing the deliverables and offering the Ban Kor community some guidance on ways to continue positive progress on mitigating harmful wildfires in their region.

Appendices

Appendix A: Student Evaluation for Determining Efficacy of Educational Video

The following evaluation was given to the students of Ban Kor Judsan before and after they viewed the educational video that we created in order to determine the efficacy of the video in increasing their awareness of the wildfire problem and educating them on key concepts related to the topic. Correct answers are highlighted in green.

Pre/Post-Evaluation

This is not a test! Please answer these questions to the best of your abilities. If you don't know the answer, please select "I don't know" and move on to the next question. Thank you!

Grade level: _____

1. What are three basic resources a fire needs? (oxygen, heat, fuel source) [multiple-select]

    a. I don't know
    b. Oxygen
    c. Sunlight
    d. Heat
    e. A person
    f. Fuel source

2. What is the main cause of forest fires in Mae Ping National Park?

    a. I don't know
    b. Smoking
    c. Lightning
    d. Intentional burning
    e. Hunting

3. Do mushrooms grow better with or without the use of fire?

    a. I don't know
    b. With fire
    c. Without fire

4. What is the estimated area of the most recent bushfires in Mae Ping National Park that occurred during February 10th - 13th?

    a. I don't know
    b. 846 rai
    c. 52,052 rai
    d. 35,179 rai
    e. 2,914 rai

5. What are some of the negative health impacts of high $PM_{2.5}$ concentrations?

a. I don't know
b. Conjunctivitis (red eye)
c. Muscle soreness
d. Lung cancer
e. Kidney disease
f. Diabetes
g. Heart attack/heart disease

6. What is the standard measure for $PM_{2.5}$ concentration as a good air quality? (State by WHO)

a. I don't know
b. 10 microgram/cubic meter
c. 15 microgram/cubic meter
d. 20 microgram/cubic meter
e. 25 microgram/cubic meter

7. What is the average concentration of $PM_{2.5}$ in Thailand?

a. I don't know
b. 10 microgram/cubic meter
c. 15 microgram/cubic meter
d. 20 microgram/cubic meter
e. 25 microgram/cubic meter

8. What are some additional consequences of wildfires?

a. I don't know
b. Traffic jams
c. Climate change
d. Light pollution
e. Greenhouse gas emissions
f. Bad luck

Appendix B: Educational Video

https://youtu.be/liayXF4lj3U

Appendix C: Suggested Fire Club Activities for Students at Ban Kor Judsan

● Kids can learn how to orient themselves in relation to their home and the forest… need to know how to explain where the fire is for effective fire prevention
● Outside of the classroom, students take pictures of smoke/fire/damaged areas in their surroundings ○ Eventually they can create a storyboard or collage that depicts the impacts of wildfires
● Print map for children to record new fire hotspots as they appear on NASA FIRMS ○ This can also emphasize topics like how wildfires travel and grow from one small instance
● With this map, they can track the community's progress on fire mitigation and hopefully note a decrease in wildfires. This information could be shared throughout the community to note their progress and motivate them to continue such efforts

● Students design a weekly report to observe the effects of wildfires in their region, highlight good/bad weeks and progress towards fire independence
With Dr. Jain: ● Interactive lesson in NASA FIRMS/CuSense/Windy ● Interactive lesson on how to predict the spread of a wildfire based off this information
● Students create posters about fire prevention/wildfire safety to put up around school and community ○ Students should determine an impactful message and design posters around that ○ Include a contest at the end where each group is judged and the best poster will be displayed in the community
● Older children plan and teach a lesson to younger students about the impacts of wildfires
● Students participate in a field trip to Mae Ping National Park where they can meet with park rangers, understand their daily activities and see first hand damage that wildfires have on this protected ecosystem (similar to BSAC students trip)
Students host an event at the end of the club, once they have enough knowledge to share with the community ● Theme: Celebration of the value and importance of their surrounding forests ● Coordinate with Dr. Jain Charnnarong and park rangers and allow community to actively participate ● Organize a group effort to collect brush into termite containers (should be done in December or later, before the start of burning season) in order to promote growth of termite mushrooms that would support Ban Kor locals economy

Appendix D: Customer Journey for Ban Kor Weaving Facility

Appendix E: Ideal Customer Persona for Ban Kor Weaving Facility

Customer persona

Somying Toorpha
Age: 20 - 25 Occupation: Student
Income: 15,000~20,000 Baht (500~660 USD)

Description:
Somying is a university student, who lives in Bangkok, Thailand. She loves to travel and enjoy buying local products. She also have much concern on global warming and environmental issues, including helping local communities.

Interest:
eco-friendly desire, unique fashion, camping, music, eco-living products, nature-lover

Behavior:
enjoy shopping, especially organic market. Use unique but natural fashions. Healthy

Personality:
outgoing, energetic, creative, avoid-conflict, calm and peace

Goals:
consume quality products while supporting locals and helps society.

Appendix F: Infographic on Sustainability of Weaving Craft

Appendix G: Instructional Infographic on the LINE Application

Translation:

CUSense Caption: “CUSense is the website that monitors the air quality in each area, especially $PM_{2.5}$ concentration, which is an ongoing issue for Ban Kor, due to the bushfire.”

NASA FIRMS Caption: “NASA FIRMS is a website that monitors images from fire sensity satellites. The bushfire hotspots will be shown as red/orange dots on the satellite image. Those hotspots can be further analyzed to predict a possibility of bushfire in the future. Moreover, analyzing those hotspots can provide information of fire behavior, including starting point, type of bushfire, and overview of the bushfire in a specific period of time.”

Windy Caption: “Windy is a website that can tell wind direction, wind speed and wind power. It can also tell the cumulative rainfall and humidity to predict a rain possible.”

Caption under phone graphic: “Moreover, there are websites and videos about the bushfire crisis as a deliverable to assist the understanding and spread the information within Mae Ping National park and Ban Kor community. This is for the park rangers and locals to acknowledge the bushfire situation.”

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