PEATLAND FOREST FIRE: MITIGATION AND CONSERVATION MANAGEMENT IN BRUNEI DARUSSSALAM

(*Kebakaran Hutan Gambut: Mitigasi dan Manajemen Kawasan Konservasi di Brunei Darussalam*)

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ABSTRACT

Peat fire is the main cause of haze, and within ASEAN region, this is known as transboundary haze. Transboundary haze issue has been lingering in this region especially with the climate change. Hence, it is important to stop fire from happening. It is the top priority of the research because early detection and suppression of fire are the only way to minimize damages and losses. This paper covers the research taken from 2016 up to date in the mitigation and conversation management in Brunei Darussalam. The approach used an action research approach where the adoption of technology in particular wireless sensor in the form of Internet of Things was used, and the approaches were taken by the respective stakeholders within the context to minimize peatland forest fire. The forest biodiversity management as well as the whole nation approach to address the climate change will also be shared towards the country's target aiming to preserve 55% of its forest as permanent forest reserve for the future.

Keywords: Mitigations, Conservation, Management Peatland Forest Fire

ABSTRAK

Kebakaran gambut adalah penyebab utama kabut asap, dan di kawasan Asia Tenggara, ini dikenal sebagai kabut asap lintas batas. Masalah kabut asap lintas batas telah melekat di wilayah ini terutama dengan perubahan iklim. Oleh karena itu, penting untuk menghentikan kebakaran agar tidak terjadi. Ini menjadi prioritas utama penelitian karena deteksi dini dan pemadaman kebakaran adalah satu-satunya cara untuk meminimalkan kerusakan dan kerugian. Makalah ini mencakup penelitian yang diambil dari tahun 2016 hingga saat ini dalam manajemen mitigasi dan percakapan di Brunei Darussalam. Pendekatan yang digunakan adalah pendekatan action research dimana adopsi teknologi khususnya sensor nirkabel berupa Internet of Things, dan pendekatan yang dilakukan oleh masing-masing pemangku kepentingan dalam rangka meminimalkan kebakaran hutan lahan gambut. Pengelolaan keanekaragaman hayati hutan serta pendekatan seluruh bangsa untuk mengatasi perubahan iklim juga akan dibagikan menuju target negara yang bertujuan untuk melestarikan 55% hutannya sebagai cadangan hutan permanen untuk masa depan.

Kata kunci: Mitigasi, Konservasi, Pengelolaan Kebakaran Hutan Lahan Gambut

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INTRODUCTION

Peatland is a good source of carbon, and naturally it can guard itself against fire and drought. Unfortunately, when this eco-system is disrupted, it can no longer sustain this property. Once there is a fire break-out, an amount of carbon is released. As the eco-system has been disrupted, the natural source of water is no longer available. Degraded peat swamp forests are particularly vulnerable to fire and produce the most carcinogenic haze of any forest type. When it is burned, it can release a large number of fine particulates. Peat fire causes haze and results in air pollution which can actually cause a negative impact on economy, human health, environment and weather. When the quality of air deteriorates, it can cause various health problems. In dry condition, peat catches fire easily with the right situation. Peat fires can also go into the soil and travel underground which are troublesome and dangerous for fire fighters as it can surface anywhere. Hence, in a degraded peat forest area, to bring in water source to kill the fire will be a tedious and expensive task. Further in Brunei the degraded peatland occurs along the high-way where there are no fire hydrants available. Thus, in 2016, Brunei had to spend US$5.6 million to use water bomb to kill the peatland forest fire in the area using helicopter.

Brunei is situated in the island of Borneo, and it shares border with Sabah and Sarawak Malaysia. The land area is of 5,765 square kilometers where the 72% area is still covered with forest. There are 7 forest types: Kerangas/Heath, Mangrove, Montane, Mixed Dipterocarp, Freshwater swamp, Peat swamp and Cleared land which are the secondary forest for urban cultivation. In a recent MYCE conference (2021), Brunei targeted approximately 55% in which 322 thousand hectares will be preserved as a permanent forest reserve. Brunei is divided to four districts, and one of the districts of the Peat swamp forests covers almost 20% of the entire eastern part of Belait District. Part of the Belait Peatland is known as Badas Peatland which shares borders with Miri Sarawak. Badas Peatland is relatively in good condition, compared to the Miri side where the peatland in Miri has been converted to palm plantation. Unfortunately, the creation of Seria by-pass has converted the Northern edge of Badas peatland; thus, degrading this area. This is shown in Figure 1. Red dots in Figure 2 show the fire incidents in 2016 which shows the prone areas of fire were around the degraded peatland area.

The main objective of the research is to adopt technology to stop the occurrence of peatland forest fire. The research investigated the use of IOT involving sensors to monitor the ground parameters such as soil moisture, soil temperature, water level and weather parameters in the mitigation of forest fire. If we stop peat forest fire from happening, this will also stop haze from happening.

The research also addressed the water source issue in order to kill the peat forest fire as it is difficult to get access to water especially in degraded peat swamp areas. At the same time, the possible use of dam to assist in regulating the water to avoid floods within the area during wet and fire during dry period. The expansion of the research in adopting visual IOT was also attempted as it can act as a trustworthy warning mechanism. A non-technical/social approach was also attempted by involving the respective relevant parties in realizing the intention.

Stakeholders

There are multiple stakeholders involved in addressing the issue of peatland forest fire. Fire is handled by Brunei Fire Rescue Department (BFRD). When fire occurs under the National Disaster Plan, BFRD will be in charge and assisted by other agencies. The National Disaster Management Centre (NDMC) will act as the center to manage this incident. The Public work department under the Drainage and Sewerage department will also be involved since they will provide assistance in transporting water via tankers while other agencies such as Royal Brunei Police Force, Royal Brunei Armed Force, British Gurkha Garrison, Belait District office and paramedic will be involved in coordinating and ensuring safety to the

Figure 1 Badas, Brunei and Miri, Malaysia Peatland Area

Figure 2 Prone areas for fire incident

public while Department of Environment Recreational and Park (JASTRE), Heart of Borneo (HoB) under Department of Forestry, Brunei Shell Petroleum (BSP) and Brunei LNG (BLNG) for the public awareness. Coordination meeting with the relevant agencies is important to strengthen the coordination among the relevant agencies. Other activities such as continuous patrolling and working closely with the village communities are also common practices.

MATERIALS AND METHODS

The research was conducted through a longitudinal action research approach where the report covers a summary of four research cycles of prototype developments that took place from 2016 to up to date supervised by the author. The attempt towards the adoption of technology in particular IoT in the mitigation of peatland forest fire was approached in various means. The project also proceeded with findings via social gathering approach from BFRD, HoB, NDMC, BSJV, BSP, BLNG, UBD through SMART.

RESULTS AND DISCUSSION

Technological Approach

With the gathered information from BFRD, the author's team initially researched the use of wireless sensor network in the form of irrigation. The research was conducted by two students separately. Both used the concept of dam in irrigating the peatland area. The idea is to make sure the area is always wet, and this will lead to the mitigation of peatland forest fire. Once the degraded peatland area is consistently wet, this will stop fire from spreading. Hence, in either wet or dry condition, this can minimize the widespread of fire if it does happen. The research findings from 2016 and 2017 were reported in Haji Hamzah *et al*, (2018). This approach made use of IoT to sense whether the soil was wet or dry. The result then

Figure 3 Wet and Dry conditions of Peatland

activated the valve to regulate water out to wet the area. This was presented in CIIS2018.

Then in 2018, in order to understand the context further, a site visit to the area was conducted. Two approaches were undertaken; the technological approach after the meeting with NDMC and social approach after meeting with HoB. The linkage and network with Heart of Borneo opened a new dimension to the project. An exposure to all the other research activities and initiatives within Badas provided a good grounding. We were able to understand and appreciate the problems and assessed several suitable solutions. The two peatland conditions are shown in Figure 3.

From the site visit, we were able to create several awareness videos to assist in the initiative and create appreciation and understanding of peatland in a more visual manner. One version of the videos was even used as the launching mechanism in one of the workshops on peatland communities within Brunei attended by a few audiences and speakers from the region including Indonesia, Malaysia and Japan. As reported by Suhaili, (2018), the technological approach was expanded to the use of visual IoT after discussing with the representatives from NDMC. Two main data were collected: rainfall and visual to verify the water level. The development of a warning system made use of visual IoT to confirm the water level once the rainfall sensor reached a certain threshold. This image would confirm the status and have a better impact in relaying the information. This acts as an early warning system for the relevant agencies to take action. This was presented in Regional Conference on Natural Disaster 2019 and published in IOP series

Next, under the involvement of Networked ASEAN Peatland Communities and ASEAN IVO 2018 project funded by NICT Japan, the use of Lora was also attempted to obtain a real time data from the identified area concerned. More parameters were considered; ground parameters, water level, soil temperature, soil moisture and humidity were collected while the weather parameters were collected by the weather station. This was presented in BICTA2021 and Essa, *et al* (2020) discussed the integration of the components.

Social Approach

This section outlines and highlights the conservation and mitigation management initiatives of the respective agencies from BFRD, HoB, NDMC, BSJV, BSP, BLNG, UBD through SMART.

In the social approach, our findings started with BFRD where we found out the common causes of forest peat fires included illegal farming, post fishing activities, open burning and prolong dry seasons. During the 2016 haze outbreak, the incident started from 25 January 2016 to 29 April 2016. The operation took 98 days with 200 firefighter personnel deployed and 10 sectors were set up. The fire suppression methods used were total flooding which required adequate water supplies from open water source

and water tankers, water bombing via helicopter and making fire breaks or temporary lake or pool which slowed down the spread of the fire to minimize the fire damage and; thus, made it easily accessible for the firefighters. Some of the difficulties faced during operations included the inadequate water supplies, inaccessible areas, broken down equipment during prolong operations, too many calls at one time, windy conditions and wild animal attacks. Some of the recommendations are to coordinate meetings with relevant agencies to strengthen the enforcement committee, strengthen the coordination and cooperation with relevant agencies, work closely with village communities, increase the public awareness, and put up sign-board and patrol continuous.

Peatland is under the protection of Heart of Borneo, a department within the Minister of Primary Resource and Tourism. Heart of Borneo is an initiative that was started with an exploratory international workshop hosted by Brunei Darussalam with the assistance from from World Wildlife Fund for Nature, in short WWF, in 2005. The workshop successfully formulated a vision Statement - the "Heart of Borneo: Three Countries, One Conservation Vision" including the Vision highlighted the benefits of a large-scale conservation efforts and the importance of partnerships at all levels to ensure effective management of the forest resources and its biodiversity in the Heart of Borneo. From thereon, after series of discussions and meetings, on 12 February 2007, in Bali, Indonesia, the three countries, Brunei Darussalam, Indonesia and Malaysia, represented by Ministers responsible for Forestry signed the Heart of Borneo Declaration, and the journey began from thereon. The conservation initiatives and programs cover strengthening forest law enforcement and forest policy implementation, forest re-greening and rehabilitation program, nature education and awareness programs, intensifying research and development

collaboration with local higher education and foreign research institutions. Hence, Badas location has hosted a number of research and conservation activities for the betterment of Peatland area.

The research and development activities were conducted by Wetland International under the Brunei Shell Join Venture team. They have developed the biodiversity action plan, fire communication plan and implementation plan for restoring the degraded areas. Canal blockings were created to help raise the water table within the Badas area.

Badas area has hosted a number of research and development projects aiming to conserve peatland forest fire and mitigate peatland forest fire. By SMART and UBD, they proceeded to conserve the area by adopting the enrichment planting as well as by studying the carbon and water level within the area.

From the Forest Biodiversity Management, several acts have been enforced. and with the climate change, Brunei has launched a Brunei Darussalam National Climate Change Policy to pave towards a low carbon and climate-resilient nation. The policy outlines 10 strategies focusing on industrial emissions, forest cover, electric vehicles, renewable energy, power management, carbon pricing, waste management, climate resilience and adaptation, carbon inventory and most importantly on awareness and education.

With all these involvements of the respective relevant agencies, the updated data from the BFRD show a downward trend of emergency forest fire call within Belait. There was a drop from 55% in 2019 to 15% in August 2021 as shown in Figure 4.

CONCLUSIONS

The NAPC deployed solution in Badas is shown in Figure 5. The collected data are currently under further research to assess its validity and trustworthiness. It is hope to make the data available to all respective stakeholders to help in making decisions for the mitigation and conservation of Peatland ensuring water table to be at the optimum level.

Brunei takes a conservative approach in forest exploitation to avoid overexploitation of forest resources

Figure 4 Data received from BFRD on the Forest Fire in Belait

Figure 5 NAPC Deployed solution in Badas

and applies a sustainable forest management to increase forest preservation of the total land area of forest reserve from 41% to 55%.

Re-wetting is essential for degraded peatland forest to avoid any fire incidents especially now with the climate change. In order to protect, mitigate and conserve peatland forest from fire and any other disaster, a collaborative effort from all agencies is required. By doing so the effort can be more rewarding and beneficial for the country. If such effort is expanded throughout the region, we can secure it for our future generations. Peatland is a good carbon sink/storage so let us work together to restore and keep it that way.

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