



Peatland Management and Community Engagement to Avoid Forest-Fire in Tebingtinggi Island Kepulauan Meranti Riau Province

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Abstract. This research focus on Community engagement program *Desa Peduli Gambut* DPG (translated as ‘Peatland Care Village’), by mitigation of forest fires and enhanced engagement community to the peatland ecological function of Pulau Tebingtinggi. But not much research evaluated the role and impact of this program. A qualitative research method involving survey and focus group discussions (FGDs) will be employed. FGDs are particularly suited for exploring complex issues by gathering diverse perspectives from participants with firsthand experience and knowledge of the subject matter. Through a comprehensive review of relevant literature, including studies on fire management, land-use practices, and socio-economic conditions in similar contexts, this research underscores the critical interplay between environmental concerns and livelihood realities. The main purpose of this study is to measure community engagement in restoration program 3R. The findings suggest that implementing community engagement, encompassing economic incentives, alternative livelihood opportunities, and targeted support for vulnerable communities, can effectively reduce the drivers of forest fires and land clearance. In conclusion, the intervention and involvement of local communities should refer to the maintenance of canal blocking, planting sago as an agricultural commodity and providing added value in local agricultural products as a focus in efforts to manage to avoid uncontrolled peatland fires.

Keywords: Peatland, Forest-Fire, Sustainability, Restoration, Community engagement.

1 Introduction

Sustainable peat is a strategic goal for the success of the peat restoration program. In addition to its (fungsi lindung) conservation function, peatlands are expected to fulfil socio-economic functions in the community (Fungsi budidaya)[1], [2]. However, not many studies have looked at the meso-side (translate as ‘district’ – Kabupaten) of community engagement around peatlands[3]. Especially in small island lowland peat areas.[4], [5]

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A. Hidayat et al. (eds.), *Proceedings of the International Conference on Multidisciplinary Studies (ICoMSi 2023)*, Advances in Social Science, Education and Humanities Research 829,

https://doi.org/10.2991/978-2-38476-228-6_56

Canal blocks have been constructed to retain water inside the peat dome for longer periods of time as mitigation effort to peat-fire disaster[6]. Canal blocking is also a peatland management between the conservation and cultivation functions[7], [8]. This water retention technology uses canal blocks, which are relatively simple to construct and require the involvement of the local community[9]. Canal blocking is a technology being implemented in the Peat Hydrology Unit as part of the 3R rewetting program[10]. It is important that these canal blocks are maintained, organised, and looked after by the local community[11]. If there is prolonged rain, the canal block will cause flooding. During the dry season it will have the opposite effect. This is because the canal blocks do not automatically adjust the water level needed to keep the peat wet and fire-resistant[12].

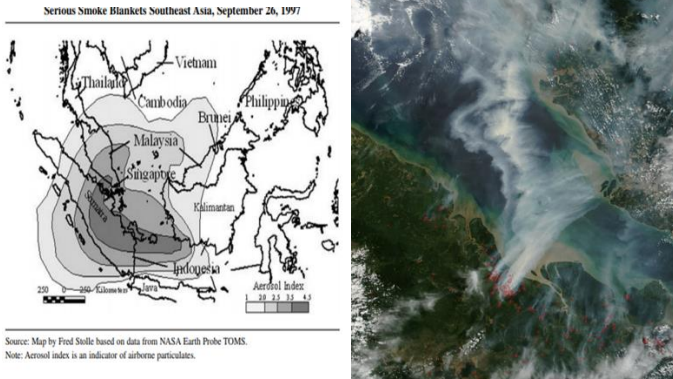
This peatland management requires the involvement of local communities to maintain and open and close the canal blocks so that the water level is maintained, and the canals remain flood and drought resistant[13]. The canal block management is also used by local community to grow fish for daily consumption or as a source of economic income. Rewetting, revegetation, and revitalisation (3R) from the Peat and Mangrove Restoration Agency has implemented this management to reduce the danger of forest and land fires in peat areas[14].

Fire disasters are one of the impacts of unconcern and lack of engagement of village communities in environmental conservation and sustainable agriculture. One of the locations of forest fires that has become an international transboundary haze problem is the forest fires in the Meranti Islands of Riau[15]. This fire is described in Fig. 1 below. Malaysia and Singapore were affected by the haze sent from the fires in Tebingtinggi. Peatland fires are a disturbing haze problem because the smoke produced by peatland fires has a higher smoke density than that produced by other types of forest fire[16].

The impact of peatland fires is widely understood by the local community, as for the past 20 years, such fires have consistently affected daily activities and health[16]. The dense haze resulting from peatland fires affects visibility, causes respiratory difficulties, and irritates the eyes and respiratory systems of those exposed.

Local community involvement in preserving peatland ecosystems is facilitated through the Desa Peduli Gambut (DPG) program. The village surrounding the peatland to be restored by BRGM is funded to participate in making the peatland in the area sustainable and resistant to both anthropogenic burning as well as those triggered by natural disasters such as el-nino. Funding for the Village Care for Peatland Program is obtained from the National Budget (APBN) and national private funding.

This study aims to reveal the engagement and participation among DPG and Non-DPG communities in the region. Riau province had constantly affected neighbouring countries such as Malaysia and Singapore due to forest-fire[12], [17]. Restoration program initiated since 2015. Program consists of 3R (rewetting, revegetation, and revitalization). These 3R's need community engagement through DPG program, to established sustainability of forest-fire eradication[18]. Below picture described the devastation impact of density of haze in transboundary issue. This article consist of secondary data from the dissertations of participatory research by Hapriadi Malik [19] and the local community FGD by researcher.



Source: Metzger (2014) dan Stelle (1998) in [20]

Fig. 1. Peat Fire Density and Transboundary haze issue

The distance between the centre of Tebingtinggi Island and neighbouring countries is outlined in the following table. (starting from the centre of Sungai Tohor village). From these data it can be explained that the city of Pekanbaru is further away than Singapore and Malaysia (see table 1). From these figures (1) and table (1) we conclude the important role of Kepulauan Meranti as the main target of central government to maintaining local livelihood from avoiding peats being burned and triggering transboundary haze problem. The disaster causing health issues and daily life activities.

Table 1. A straight line between Tebingtinggi island to neighborhood cities & countries

| No. | City or COUNTRY | Status | Distance (km) |
|-----|------------------------|---|---------------|
| 1 | Pekanbaru | Capital city of Riau Province | 160 |
| 2 | Bangkinang | Capital of Kabupaten Kampar | 220 |
| 3 | Batam | Largest city in Kepulauan Riau | 120 |
| 4 | Tanjung Balai Kari-mun | City hub in Kepulauan Riau | 50 |
| 5 | Singapura | Most impact country by the transboundary haze | 115 |
| 6 | Johor | Impacted by the Haze in Malay-sia | 120 |

Source: Google Earth

1.1 Peatland Forest Fire Cycle in Riau Province and Participatory Action

Forest and land fires in Meranti Islands Regency, specifically on Tebingtinggi Island, robust in 2015. Data from BNPB (National Disaster Mitigation Agency-mid 2023) shows that hotspots in Riau Province have increased due to the impact of the dry season or el-nino. BNPB data shows: 137,544 ha of land was burned in Riau province in 2012. Then in 2015 there was a spike to 183, 808.59 ha. After the intervention and

socio-economic and cultural engineering through 3R revitalisation, the impact of fires due to el-nino was reduced by half to 90,550 Ha. El-nino in 2023 continue to decline 5,302.30 Ha.

The peat-forest fire emergency alert phenomenon has begun to diminish in this research area. However, this article will evaluate the community engagement of an area in the eastern sub-district of Tebingtinggi that is particularly vulnerable to fire. This is a result of previous canalisation and drainage of peat dome areas. Land clearing, canalisation and land burning are hereditary processes known by local communities to convert land into fertile, nutrient-rich, easily cultivated and pest-free land.

Orlando Fals Borda's participatory action research aims to encourage active participation from the community in formulating and conducting research relevant to their local needs. Its purpose is to discover new knowledge for the sustainable management of peatland areas, with a particular focus on achieving harmony between human activities and ecological functions. The term 'Sustainable Peatland' refers to the balance between ecological and cultivation functions. Inclusive processes ensure that individuals, regardless of age, ability, religion, or nationality, have equal access and participation in all aspects of an activity or service, just like any other member of the community.

1.2 Mangrove and Peatland Restoration Agency (Badan Restorasi Gambut dan Mangrove-BRGM) and Tebingtinggi Peat-Restoration

The Mangrove & Peatland Restoration Agency (BRGM) is a non-structural institution under and directly responsible to the President of the Republic of Indonesia. The agency was established on 6 January 2016 through Presidential Regulation No. 1 Year 2016. BRG's function and task is to coordinate and facilitate peat restoration in 7 provinces: Riau, Jambi, South Sumatra, West Kalimantan, Central Kalimantan, South Kalimantan, and Papua. BRG is targeted to restore approximately 2 million hectares of Indonesia's degraded peatlands since 2020. The target is mainly successfully achieved but sustainability aspects require community support in the region.

Since 2016. BRGM was formerly called BRG (Peat Restoration Agency), and launched the 3R (Revegetation, Revitalisation and Rewetting) approach in the peat restoration program, namely:

- a) Revegetation is an effort to restore land cover in peat ecosystems through planting native plant species in protection functions or with other plant species that are adaptive to wetlands and have economic value in cultivation functions.
- b) Revitalisation is the empowerment of the community's economy to use peatland for cultivation while maintaining the sustainability of the peatland ecosystem.
- c) Rewetting is the reflooding of peatland material that has dried out due to the lowering of the peatland water table by increasing the water content and water level of the peatland, among others through the creation of barriers in canals that already exist in the peatland (BRG, 2016).

The story of restoration on Tebingtinggi Island is inseparable from the history of two large corporations that have converted peatlands since 2011[20]. However, since

the catastrophic peat fires of 2012 and 2015, the government has returned the land to local communities. However, the land on the eastern side of the island has been canalised (shown in Figure 2 below). The canalisation also dug into the peat dome area. This technically contributed to the drying of the dome and subsidence. In 2018 the Corporation had its licence revoked and the land was returned as communal land (shared ownership by the local indigenous community). This story has led to the canal blocking becoming very dependent on the local community. Both in terms of cultivation and conservation[21].

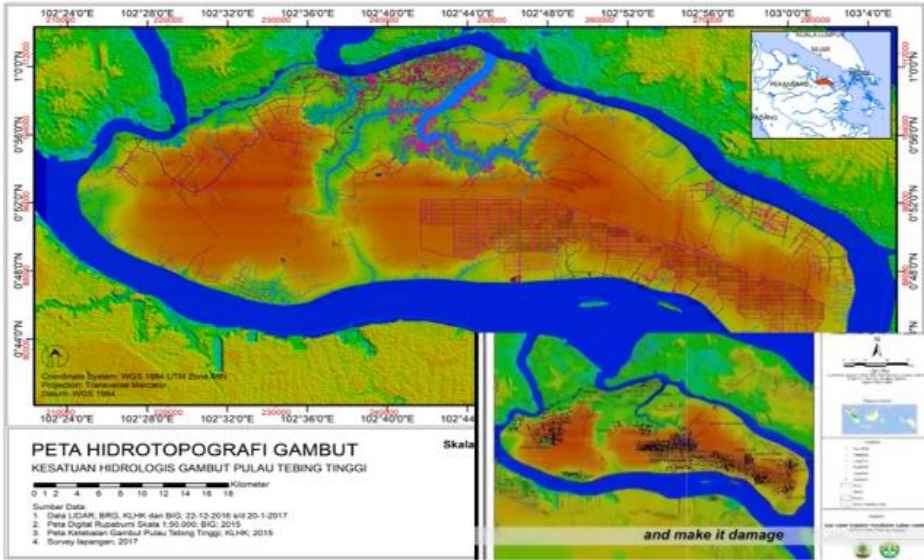


Fig. 2. Kepulauan Meranti Peatland, hotspot, and land canalization

1.3 Community Engagement

Community engagement data was collected using a random questionnaire in peat care villages (Sungai Tohor Village and Nipah Sendanu Village with a population of 2,484 with a sample size of 373 respondents) and non-peat care villages (Teluk Buntal Village and Tanjung Sari Village with a population of 2,374 with a sample size of 356 respondents). The data were analysed using comparison to determine the mean rank of each community action towards peatland 3R restoration. But only 356 respondents being analysed due to comparison frequency equalization.

Focusing the engagement community theoretical framework, researcher use below elements to arrangement with local phenomenon in the region.

Table 2. Community engagement Elements

| Elements of Engagement | Description |
|-------------------------------|--|
| Learning behaviour | Behaviour change |
| Engagement | Involvement in the program |
| Tasks | Willingness to engage voluntary or compensated |
| Commentating | Influencing the decision making |

Source: researcher 2023

The engagement of DPG and non-DPG communities in sustainable peat restoration and fire prevention activities has been implemented since 2016. In this case, the government invites various actors and or stakeholders. One of them is through village communities around peatlands. In its development, land clearing by burning has long been carried out by local village communities. Although it is called local wisdom, they do not burn more than 2 hectares. This is done under strict supervision and by experienced groups. It is guaranteed that village communities are involved in land clearing or gotong royong in land clearing.

The theoretical framework of ‘community engagement’ is defined as follows: The UN Brisbane Declaration on Community Engagement (International Conference on Community Engagement, 2005) defines community engagement as a two-way process whereby 1). the aspirations, concerns, needs and values of citizens and communities are included at all levels and across all sectors in policy development, planning, decision-making, service delivery and assessment; and 2). Governments and other business and civil society organisations engage citizens, clients, communities, and other stakeholders in these processes[22].

Community engagement binds together the vision and mission to achieve a common goal of avoiding forest-fire disaster[23]. The difference between villages without peat care programmes and those without peat care programmes will again trigger peatland fires on islands where 80 percent of the land is made up of peat. Comparing the success of village peat care programmes with non-DPG programmes will shed light on the level of success of peatland governance in small island areas that are prone to exporting haze to neighbouring countries such as Malaysia and Singapore. There are several challenges faced in engaging communities to prevent fires. The conceptual assumptions are: lack of trust in government programmes, lack of resources such as social capital and collective consciousness, conspicuous differences such as ethnicity, religion, land tenure, economic level or status and engagement of financial capital. A lack of communication and an imbalance of commitment between organisations to communities who secluded from the program.

1.4 A *Desa Peduli Gambut*-DPG Program (Peatland Care Village) and Non-DPG Community engagement

Peat care villages and non-peat care villages are classified by the intervention of the central government, regional governments or donor agencies that participate in fund-

ing sustainable peat restoration. Sustainable peat is expected to avoid recurring fires and or turn into a cross-country jerebu (haze in local dialect) disaster due to uncontrolled land fires. The Peatland Restoration Agency (BRGM) created the Peat Care Village program to restore the ecological function of peatlands and improve the welfare of the people living around them¹. In this study, non-DPG villages are categorised as villages or communities that have not received funding or assistance from the BRGM program. Table below indicates the determinants and engagement indicators use in this research study.

DPG program inline with the community forest enterprise (CFEs) that initiate by Hajjar et. al [22], but their study focusses in the perspective of economic and environmental impact. This study focusing on the sustainability and engagement of local community in the level of restoration and forest-fire avoidance.

Table 3. Determinants and Engagement Indicators

| No | Determinant | Engagement | Indicator of scale |
|----|---|---|--|
| 1 | Climate | Avoiding drought of land Rewetting | No idea- Just let it- Report to apparatus-Invite friends or alone preventing |
| 2 | Land Conversion | Avoiding land clearing Revegetation | No idea- Just let it- Report to apparatus-Invite friends or alone preventing |
| 3 | Native Peatland Plant's | Paludikultur Revegetation | No idea- Just let it- Report to apparatus-Invite friends or alone preventing |
| 4 | Cleaning peatland | Managing Revitalization | No idea- Just let it- Report to apparatus-Invite friends or alone preventing |
| 5 | Anticipating forest-fire | Peat fire suppression Revitalization | No idea- Just let it- Report to apparatus-Invite friends or alone preventing |
| 6 | Canal Blocking | Building the canal Revitalization | Never – Seldom – Mostly - always |
| 7 | Maintaining canal blocking | Providing ideas Rewetting | Never-Once-Twice- More than twice |
| 8 | Seeing when the canal is spilling or damage | Maintaining Rewetting | No idea- Just let it- Report to apparatus-Invite friends or alone preventing |
| 9 | Urging others to build canal blocking | Rewetting | Never – Sometimes - Frequently- Every time |

Data extracted from Malik's research (dissertation) mention 9 measures of engagement from peat care villages (DPGs) compared to non-DPGs. A scale of 5 was used and only the frequency was seen and will be analysed with 3 elements of community engagement by the researcher.

¹ <https://brgm.go.id/upaya-badan-restorasi-gambut-pulihkan-ekosistem-gambut-dengan-revitalisasi-ekonomi/>

1. Engagement in efforts to prevent peatland drought
2. Engagement of DPG communities in preventing peatland conversion through burning 2.
3. Engaging communities to develop native peatland plants or paludikultur[24] knowledge or practices.
4. Engagement in clearing peatland
5. Anticipating/following up on peatland fires
6. Engagement in building canal blocking
7. Engagement in canal block maintenance
8. Engagement when you see a damaged canal block
9. Encouraging others to build/fill canal blocks 9.

Table 4. Survey Location in DPG & non-DPG communities

| DPG (Villages Name) | Population | Households | Respondent |
|----------------------|------------|------------|------------|
| Sungai Tohor & Barat | 1,409 | 347 | 188 |
| Nipah Sendanu | 1,203 | 341 | 185 |
| | 2,612 | 688 | 373 |
| NON-DPG (Villages) | Population | Households | Respondent |
| Teluk Buntal | 1,246 | 347 | 188 |
| Tanjung Sari | 1,132 | 324 | 168 |
| Total | 2,378 | 671 | 356 |

Population Data: Ministry of internal affairs Desa Peduli Gambut DPG, 2020

2 Research Method

The research was conducted through a qualitative approach by performing focus group discussions (FGDs) with local community. By first extracting data from DPG and non-DPG community engagement research that had been conducted in Hapriadi Malik's dissertation in 2020. Malik's research refers to the function of peat hydrological units in the area. He conducted a community engagement survey on the maintenance and sustainability potential of canal blocking as an application of the 3R programme. However, only the frequency of answers from respondents was used as secondary data. The secondary data was then confirmed through FGD responses conducted by researchers in the same research location. The analysis form survey then reconfirmed and discuss by the FGD. The FGD result is in the box of frequency analysis.

Interviews and questionnaires were conducted to collect data on community involvement. This research focused on Tebingtinggi district, comparing the participation of Peat Care Villages (DPG) and Non-Peat Care Villages (NDPG) by random sampling. FGDs were conducted with stakeholders associated with the management and demonstration plots of the canal blocked area.

The research location was conducted in Tebing Tinggi Timur Sub-district and several villages around the western part of Meranti Islands Regency, Riau Province. The peatland research location was chosen because the impact of peatland fires in the lowland areas of the islands is considered to have a direct impact on the haze impact of cross-border peatland fires.

Community engagement with peatland hydrological restoration activities is still heavily influenced by government programs. BRGM restoration was analysed in a quantitative descriptive manner, based on qualitative data. According to Singarimbun and Effendi (1989), to quantify each variable, a score or value was given based on a Likert scale. In this research questionnaire, the attitude of the community in participation is divided into two attitudes/behaviours, namely: Engagement element Learning behaviour consists of: question 1-4. Engagement Element of Tasks is divided into: questions 5-7. And influencing the programme of 3R: questions 8-9.

2.1 Data Collection and Analysis

Data collection techniques using Survey, observation, interview, and Focus Group of Discussion (FGD) methods. The results obtained from the preliminary survey show an ecosystem that is in accordance with the research material. Furthermore, the implementation of research includes several things that become basic research data including:

- a) Secondary data, including the results of desk studies of dissertations, journals, and scientific publications as well as reports on research activities from BRGM and informants in the field.
- b) Primary data, obtained from FGDs with environmental groups on Tebingtinggi island and key informants to obtain both qualitative and quantitative data; and
- c) Determination of the size of the area to be studied in accordance with the results of the satellite image study that has been presented. The determination of the size of this area determines the sampling area and the number of sources to be collected.

The selection of informants and respondents was done by considering the following points: (1) having lived in the area of the two villages, Desa Peduli Gambut (DPG) and Non Desa Peduli Gambut (non-DPG): To provide information on the history of peat conversion in a neutral and open manner, the area must meet two criteria: a) it must have been inhabited for at least 5 years; and b) it must be over 30 years old.; and (2) Distinguishing between community within the DPG group and non-participation (as peatland inhabitants) in their respective areas is the focus of this study. The research method employed is descriptive comparative analysis, comparing results from DPG and non-DPG communities.

3 Result

3.1 Region Characteristics

| | |
|-----------------------------------|-----------------|
| Profile DPG | Profile Non-DPG |
| Sungai Tohor & Tohor Barat Profil | Teluk Buntal |
| Nipah Sendanu profil | Tanjung sari |

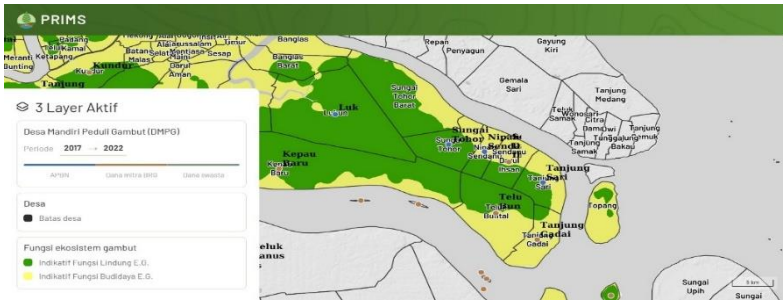


Fig. 3. Location of DPG and non-DPG villages in Tebingtinggi Island

Within Kecamatan Tebingtinggi Timur there are basically only two 'old villages' from which the other villages originate (Table 5). These two villages are Lukun and Sungai Tohor. According to sources of information that can be traced, Lukun was founded long before 1900, supposedly even in the early 19th century. Meanwhile, Sungai Tohor is said to have been established in 1905. However, a more in-depth historical study is needed to confirm the veracity of this information. The first history of village expansion was recorded in 1942, when Tanjung Gadai, which was previously part of Sungai Tohor, was declared a new village. Approximately 70 years later, the Sungai Tohor area underwent another division that resulted in the creation of a new village, Nipah Sendanu, in 2008. Lukun was only divided recently, in 2011/2012, when part of its territory became a new village named Batin Suir.

Table 5. chronology of the history of village expansion

| Establishment | Village | Description |
|---------------|---------------------|---------------------------------|
| 1800-1820 | Lukun | Origin Village |
| 1905 | Sungai Tohor | Origin village |
| 1942 | Tanjung Gadai | Expansion from Sungai Tohor |
| 1982 | Tanjung Sari | Expansion of Tanjung Gadai |
| 1998 | Teluk Buntal | Expansion of Tanjung Gadai |
| 2000 | Nipah Sendanu | Expansion of Sungai Tohor |
| 1999 | Kepau Baru | Expansion of dari Teluk Buntal |
| 2011/2012 | Sungai Tohor Barat | Expansion of Sungai Tohor |
| 2011/2012 | Sendanu Darul Ihsan | Expansion of dari Nipah Sendanu |
| 2011/2012 | Batin Suir | Expansion of dari Lukun |

Source: Research interviews

The process of village boundary expansion, as summarised in Table 5, reflects the way in which the population has spread over time in the Tebingtinggi Timur region. The population of Sungai Tohor extends from the West of Sungai Tohor to Tanjung Gadai and Teluk Buntal, while residents of Lukun have spread to the area that later became Batin Suir. As most of the inhabitants are from the same families, especially from the Malay and Akit communities, the spread of the population has created a network of kinship between the villages.

Initially, the community leadership in Lukun, Sungai Tohor, and Kepau Baru was traditional, with each community being led by a headman. In the past, a chief was selected based on the collective recognition given by a community to one of its members who was considered to have skills, wisdom, physical or spiritual strength, and contributions to society that exceeded those of other members. Therefore, someone who was appointed as chief usually had several privileges.

3.2 Comparison of village community engagement in degraded peatland management

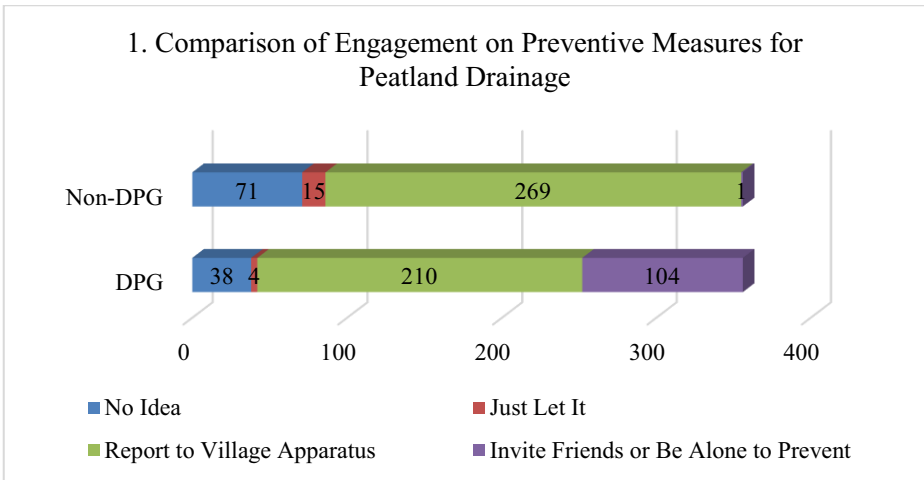


Fig. 4. Comparison of engagement on preventive measures for peatland drainage

| Percentage Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|--------------------|---------|-------------|-----------------------------|---------------------------------------|
| DPG | 10,7 | 1,1 | 59,0 | 29,2 |
| Non-DPG | 19,9 | 4,2 | 75,6 | 0,3 |

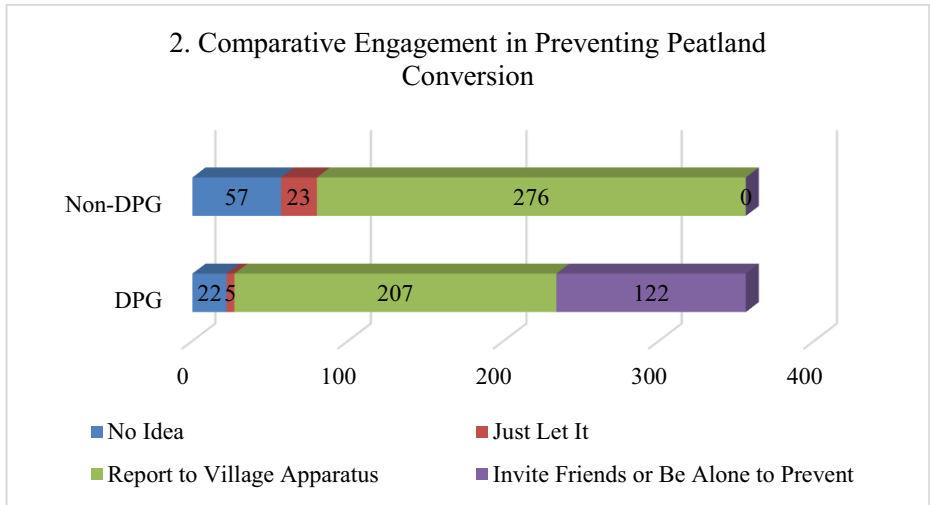


Fig. 5. Comparative engagement in preventing peatland conversion

| Percentage Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|--------------------|---------|-------------|-----------------------------|---------------------------------------|
| <i>DPG</i> | 6,2 | 1,4 | 58,1 | 34,3 |
| <i>Non-DPG</i> | 16,0 | 6,5 | 77,5 | 0,0 |

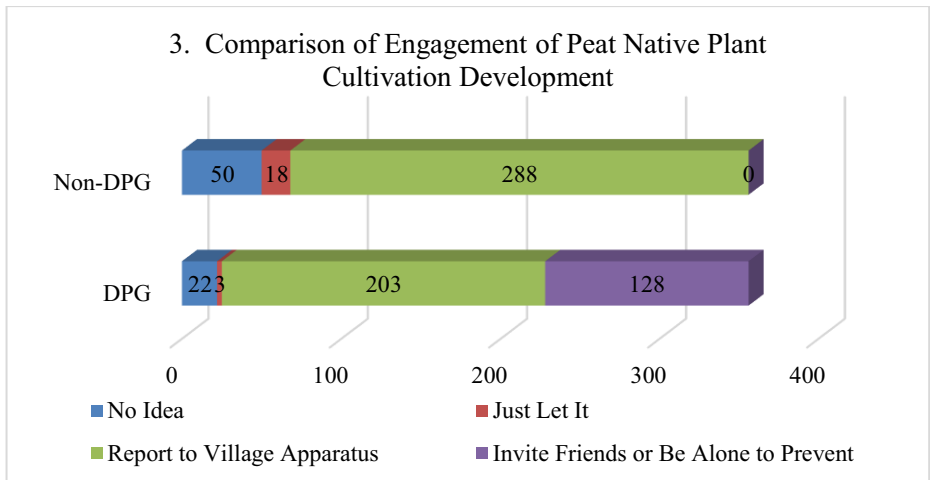


Fig. 6. Comparison of engagement in peat native plant cultivation

Percentage

| Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|----------------|---------|-------------|-----------------------------|---------------------------------------|
| <i>DPG</i> | 6,2 | 0,8 | 57,0 | 36,0 |
| <i>Non-DPG</i> | 14,0 | 5,1 | 80,9 | 0,0 |

| Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|---------|---------|-------------|-----------------------------|---------------------------------------|
| DPG | 6,2 | 0,8 | 57,0 | 36,0 |
| Non-DPG | 14,0 | 5,1 | 80,9 | 0,0 |

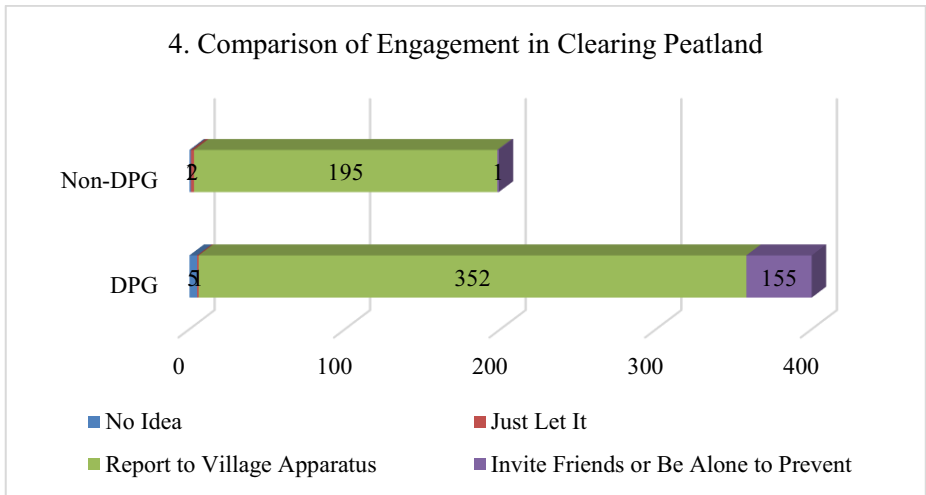


Fig. 7. Comparison of engagement in clearing peatland

Percentage

| Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|----------------|---------|-------------|-----------------------------|---------------------------------------|
| <i>DPG</i> | 1,0 | 0,2 | 68,6 | 30,2 |
| <i>Non-DPG</i> | 0,5 | 1,0 | 98,0 | 0,5 |

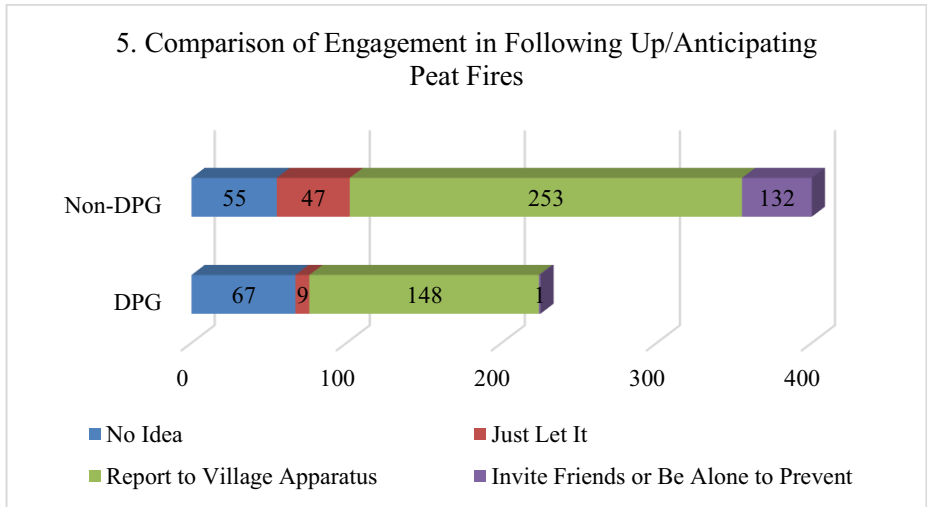


Fig. 8. Comparison of engagement in anticipating peat fires

| Percentage Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|--------------------|---------|-------------|-----------------------------|---------------------------------------|
| DPG | 29,8 | 4,0 | 65,8 | 0,4 |
| Non-DPG | 11,3 | 9,7 | 52,0 | 27,1 |

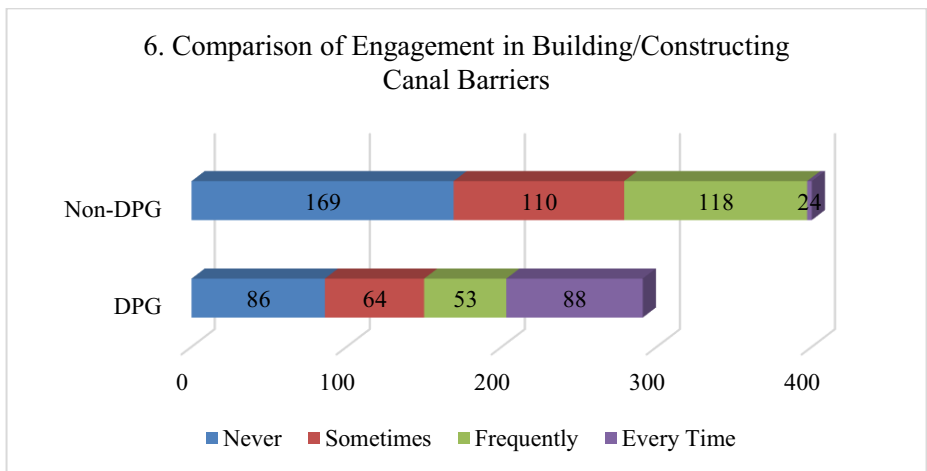


Fig. 9. Comparison of building or installing canal blocking

| Percentage Village | Never | Sometimes | Frequently | Every Time |
|--------------------|-------|-----------|------------|------------|
| DPG | 29,6 | 22,0 | 18,2 | 30,2 |
| Non-DPG | 40,1 | 26,1 | 28,0 | 5,7 |

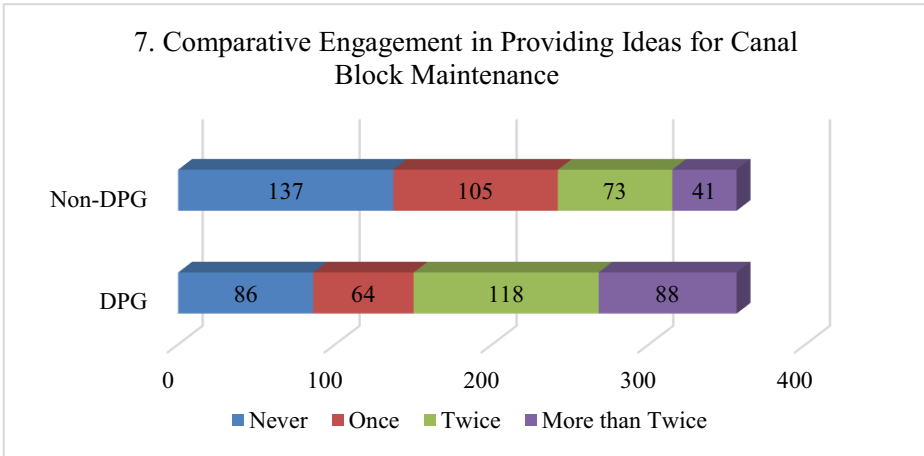


Fig. 10. Comparison engagement in providing ideas and or maintaining canal blocking

| Percentage Village | Never | Once | Twice | More than Twice |
|--------------------|-------|------|-------|-----------------|
| DPG | 24,2 | 18,0 | 33,1 | 24,7 |
| Non-DPG | 38,5 | 29,5 | 20,5 | 11,5 |

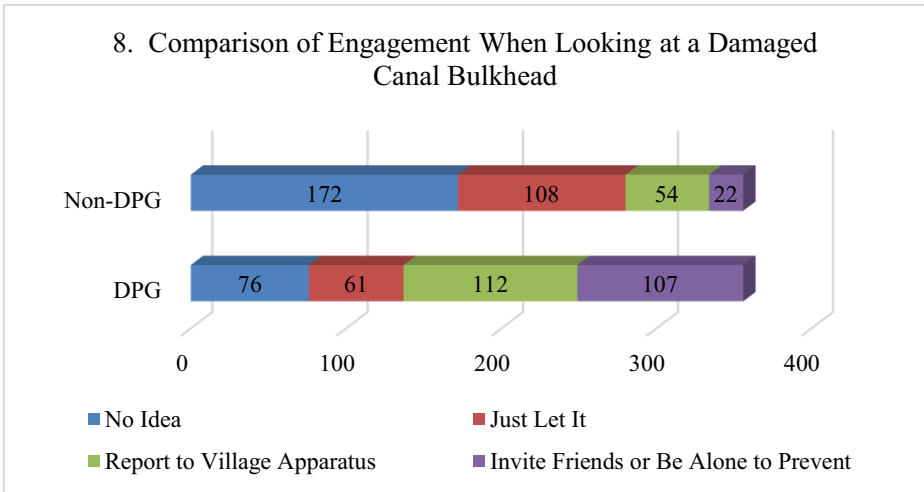


Fig. 11. Comparison of engagement when looking canal damage's

| Percentage Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|-----------------------|---------|-------------|-----------------------------|---------------------------------------|
| DPG | 21,3 | 17,1 | 31,5 | 30,1 |
| Non-DPG | 48,3 | 30,3 | 15,2 | 6,2 |

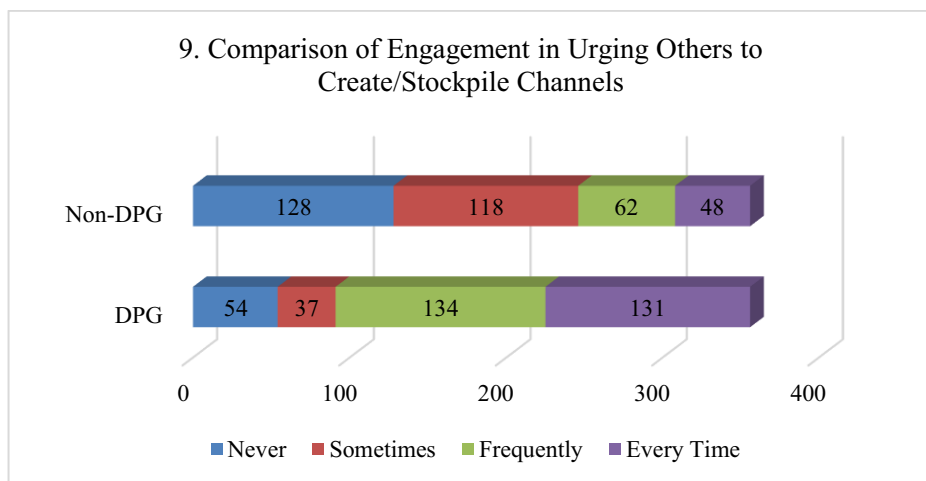


Fig. 12. Comparison of engagement in urging others to create or stockpile canal in case of flood

| Percentage Village | No Idea | Just Let It | Report to Village Apparatus | Invite Friends or Be Alone to Prevent |
|-----------------------|---------|-------------|-----------------------------|---------------------------------------|
| DPG | 21,3 | 17,1 | 31,5 | 30,1 |
| Non-DPG | 48,3 | 30,3 | 15,2 | 6,2 |

4 Analysis

Based on the data in Fig. 4 shows a significant difference in the preventive measures for peatland drainage. 71 out of 356 people in the Non-DPG group did not know the preventive measures for peatland drainage, while 38 out of 356 people in the DPG group did. A total of 15 out of 356 people in the Non-DPG group ignored the prevention of peatland drainage, while 4 out of 356 people in the DPG group did not. A total of 269 out of 356 people in the Non-DPG group chose to report to the village apparatus to prevent peatland drainage, while 210 out of 356 people in the DPG group did so. A total of 1 out of 356 people in the Non-DPG group invited a friend or was alone to prevent peatland drainage, while 104 out of 356 people in the DPG group did so. From FGD indicates that local community reluctant to involve in peatland care since

the initiative of restoration. But they sincerely acknowledge that the forest-fire is common threats to environment and daily life disruptions.

Informants of FGD more dependent to the program 3R from the government. The engagement to the canal blocking construction did not properly maintain by the community because they are not attached to the program (in Non-DPG community). But they are aware of the crucial environment purpose of the 3R program.

In Fig. 5, 57 out of 356 people in the Non-DPG group did not know how to prevent peatland conversion, while 22 out of 356 people in the DPG group did. A total of 23 out of 356 people in the Non-DPG group left it alone in preventing peatland conversion, while for the DPG group there were 5 out of 356 people. 276 out of 356 people in the Non-DPG group chose to report to the village apparatus to prevent peatland conversion, while 207 out of 356 people in the DPG group did so. None of the Non-DPG groups invited friends or were alone to prevent peatland conversion, while 122 out of 356 DPG groups did.

In Fig. 6, 50 out of 356 people in the Non-DPG group did not know about the development of peatland native plant cultivation, while 22 out of 356 people in the DPG group did. A total of 18 out of 356 people in the Non-DPG group left the development of peat native plant cultivation alone, while for the DPG group there were 3 out of 356 people. A total of 288 out of 356 people in the Non-DPG group chose to report to the village apparatus for the development of peat native plant cultivation, while 203 out of 356 people in the DPG group did so. None of the Non-DPG groups invited friends or were alone for the development of peat native plant cultivation, while 128 out of 356 DPG groups did so.

In Fig. 7, 1 out of 356 people in the Non-DPG group did not know how to clean peatlands, while 5 out of 356 people in the DPG group did. As many as 2 out of 356 people in the Non-DPG group left the peatland clearing alone, while 1 out of 356 people in the DPG group did not. 195 out of 356 people in the Non-DPG group chose to report to the village apparatus to clear peatlands, while 352 out of 356 people in the DPG group did so. 1 out of 356 people in the Non-DPG group invited a friend or was alone to clean up peatlands, while 155 out of 356 people in the DPG group did so.

In Fig. 8, 55 out of 356 people in the Non-DPG group did not know how to follow up/anticipate burnt peat, while 67 out of 356 people in the DPG group did. As many as 47 out of 356 people in the Non-DPG group just left it alone in following up/anticipating burnt peat, while for the DPG group there were 9 out of 356 people. 253 out of 356 people in the Non-DPG group chose to report to the village apparatus in following up/anticipating burnt peat, while 148 out of 356 people in the DPG group did so. 132 out of 356 people in the Non-DPG group invited friends or were alone in following up/anticipating burnt peat, while 1 out of 356 people in the DPG group did so.

In Fig. 9, 169 out of 356 people in the Non-DPG group never built or constructed canal blocks, while 86 out of 356 people in the DPG group did. A total of 110 out of 356 people in the Non-DPG group sometimes built or constructed canal blocks, while 64 out of 356 people in the DPG group did so. 118 out of 356 people in the Non-DPG group often build or construct canal blocks, while 53 out of 356 people in the DPG group. 24 out of 356 people in the Non-DPG group always build or construct canal

blocks, while 88 out of 356 people in the DPG group always build or construct canal blocks.

In Fig. 10, 137 out of 356 people in the Non-DPG group never gave ideas for canal block maintenance, while 86 out of 356 people in the DPG group did. A total of 105 out of 356 people in the Non-DPG group had once given ideas for canal block maintenance, while 64 out of 356 people in the DPG group had. A total of 73 out of 356 people in the Non-DPG group had 2 (two) times provided ideas for canal block maintenance, while 118 out of 356 people in the DPG group. 41 out of 356 people in the Non-DPG group gave ideas for canal block maintenance more than 2 (two) times, while 88 out of 356 people in the DPG group gave ideas for canal block maintenance.

In Fig. 11, 172 out of 356 people in the Non-DPG group did not know when they saw a damaged canal block, while 76 out of 356 people in the DPG group did. A total of 108 out of 356 people in the Non-DPG group just let it go when they saw the damaged canal block, while 61 out of 356 people in the DPG group. 54 out of 356 people in the Non-DPG group chose to report to the village apparatus when they saw damaged canal blocks, while 112 out of 356 people in the DPG group did so. 22 out of 356 people in the Non-DPG group invited friends or were alone in following up/anticipating burnt peat, while 107 out of 356 people in the DPG group did so.

In Fig. 12, 128 out of 356 people in the Non-DPG group never encouraged others to build/fill canals, while 54 out of 356 people in the DPG group did. 118 out of 356 people in the Non-DPG group sometimes encouraged others to build/fill canals, while 37 out of 356 people in the DPG group did so. 62 out of 356 people in the Non-DPG group often urged others to build/fill canals, while 134 out of 356 people in the DPG group did so. 48 out of 356 people in the Non-DPG group always encouraged others to build/fill canals, while 131 out of 356 people in the DPG group did so.

From the results of interviews with DPG and Non-DPG groups regarding peatland management and community involvement to avoid forest fires, it can be seen that there is a significant difference in the role of the community in managing peatlands and preventing forest fires due to dry peatlands. DPG communities have a greater role and concern for peatland management than Non-DPG communities. However, not all DPG groups are concerned and contribute directly to peatland management. Non-DPG groups are groups that have not received funds or assistance from the BRGM program. Although Non-DPG communities have little role in managing peatlands, they have knowledge in managing peatlands and preventing forest fires. Non-DPG communities only care less and contribute less to managing peatlands and preventing forest fires. This problem is caused by funding from the government so in this case Non-DPG communities can only rely on government officials in following up peatland management and forest fire prevention.

Desa Peduli Gambut (DPG) is still not broad enough to reach all actors with an interest in fire prevention. In the end, accusations of burning continue to be levelled at the site. The provision of non-cash incentives or stable prices is transparent. Social capital (organisational institutionalisation) for peatland management should involve Taukeh actors, children of landowners, and customary leaders. Taukeh is no longer a debt provider. He is a crowd funding figure, who can invest his money in education and health. The organisation could take the form of a scholarship arisan for farmers'

children, a village organisation with the aim of sending children to school by bridging the Taukeh ethnicity with the Malay ethnicity or other migrants.

4.1 Demographic profiling analysis

The islanders of Tebingtinggi are a mixed community between the patrilineal coastal community and the talang community, which means the inner or land community that has a matrilineal kinship system[20]. This can be seen from the genealogical history of the people living in Sungai Tohor Village, who came from Pelalawan and Bugis, Lukun Village, who came from Minang and Siak, and Kepau Baru Village, a mixture of the Akit tribe who used to live in sea waters and then settled, the Chinese and Malays. Tan-jung Gadai Village is a coastal Malay village that is matrilineal, so according to residents, the management of gardens such as sago, rubber and coconut is done by men. However, social change has meant that women in these villages are also involved in natural resource management. The diversity and mixing of ethnicities have affected the loosening of the role of customary institutions. The customs of the Petalangan community are not very visible and found in the villages of East Tebingtinggi, as well as the role of customs originating from the Malay peisisir. There is no communal land, no village forest, and no role for the batin, which has power over land ownership and customary laws, as is the case with petalangan indigenous peoples in other places such as Rimbo Panjang, despite being in the same culture of the Kampar River. However, Sungai Tohor Village is still a predominantly Malay village, so this homogeneity creates a common goal of restoring sago as a local natural plant alongside local natural trees and making it a local food security. The case is different with other villages that are more multi-ethnic, such as Sungai Tohor Barat, Tanjung Sari, Kepau Baru, and others.

Table 6. Number of inhabitants by ethnic group in each village

| Com | Village | Ethnic/National Group (Inhabitantants) | | | |
|-------------|--------------------|--|------|-------|---------|
| | | Melayu | Akit | Jawa | Lainnya |
| DPG | Sungai Tohor | 1.315 | - | - | 13 |
| | Sungai Tohor Barat | 399 | 100 | 449 | 50 |
| | Nipah Sendanu | 834 | - | 334 | 24 |
| Non- DPG | Tanjung Sari | 707 | 11 | - | 404 |
| | Teluk Buntal | 806 | - | 230 | 115 |
| Total | | 4.061 | 111 | 1.013 | 606 |

Sumber: Hasil analisis berdasarkan data dalam monografi desa dan wawancara

The ethnicity and nationality of Tebingtinggi's population is generally linked to their religious beliefs and practices. The Malay, Javanese and Bugis ethnic groups are all Muslim. Thus, most of the population (11,127 people or 82.8%) in this sub-district is Muslim. Meanwhile, the population of the Akit tribe has a variety of beliefs or religions. Their original belief system is animistic.

4.2 Discussion on managing peatland, avoiding forest fire, and community engagement.

Discussions about local wisdom, local knowledge and peatland management cannot be separated from an understanding of how to refer to or implement new knowledge. The condition of canalisation and land engineering in degraded peat areas certainly requires sustainable restoration. Restoration does not only apply to one village with assistance and funding. It requires education and socialisation on what to do with natural conditions that have been altered in their origin and use. The debate on the harmony between conservation and cultivation functions at least answers whether land fires will be a disaster or not. The local government's local regulation to work together in clearing land by limiting the land clearing area to 2 ha has not been effective in suppressing the number of hotspots.

The latest news is that since 2018, villagers have been migrating to neighbouring countries to work as contract workers in neighbouring factories (Singapore and Malaysia). There is one thing that saves both DPG and non-DPG villagers. If local communities return to planting sago as a native peatland plant. Sago is not impacted by excess water or drought. One household on Tebingtinggi Island will avoid starvation if they still have sago plants on their farm. Rewetting keeps the land from being damaged by floods and droughts. Revegetation by choosing sago as a crop on peatlands. Revitalisation by bringing each tribe, religion, and gender closer together to participate in economic actions that support sustainable peat. Such as using sago as a local food product. Planting rice in former peat areas will be difficult due to the lack of fertility of peat for rice plants. Local food security should not refer to rice transactions. Instead, it should return to the economic utilisation of sago, pineapple, and swamp fish as local food bases.

5 Conclusion

In the survey results and confirmed through FGDs, it was concluded that there are differences between DPG and non-DPG communities. Villages with communities supported by DPG management score better than Non-DPG. This can be understood because engagement is facilitated by the government. Interesting to discuss further is whether community sensitivity drives the success of restoration programs. Importance of Peatland Care Villages (DPG): The presence of Peatland Care Villages (DPG) in the region plays a pivotal role in promoting responsible peatland management and fire prevention. These villages have likely received training, resources, and support for sustainable land practices. This is reflected in their relatively lower incidence of forest fires.

Community Engagement Matters: The data suggests that community engagement is a key factor in reducing forest fire risk. Peatland Care Villages (DPG) have likely embraced practices that prioritize fire prevention, such as controlled burning, early detection, and reporting mechanisms. This level of engagement is critical in areas with a high risk of peatland fires.

Need for Outreach to Non-Peatland Care Villages (non-DPG): The statistics indicate that non-Peatland Care Villages (non-DPG) are at a higher risk of forest fires. It is essential to intensify efforts to engage these communities in sustainable land management practices. Outreach programs, training, and resource allocation should be extended to these villages to bring them in line with responsible land management practices.

Collaboration and Knowledge Sharing: The differences in engagement levels highlight the need for collaboration and knowledge sharing between Peatland Care Villages and non-Peatland Care Villages. Successful strategies and best practices developed by DPGs should be shared with non-DPGs to enhance the overall fire prevention efforts in the region.

Policy and Regulatory Support: The government and local authorities should play a significant role in supporting and enforcing sustainable peatland management practices. Strengthening regulations and providing incentives for responsible land management can further encourage community engagement and reduce forest fire risks.

In conclusion, to avoid forest fires in Tebingtinggi Island, Riau Province, it is imperative to continue and expand community engagement initiatives, especially in non-Peatland Care Villages. By fostering collaboration, sharing knowledge, and implementing supportive policies, the region can work towards a more sustainable and fire-resistant landscape.

Acknowledgement

I would like to extend our deepest appreciation and gratitude to Professor Azwar Maas, Professor Rijanta, and Professor Suratman from Universitas Gadjah Mada (UGM) and Dr. Hapriadi Malik (Fellow researcher from Riau Province) for their invaluable contributions in writing of this journal article. Their expertise, guidance, and unwavering support have been instrumental in shaping the content of this research.

Author Contributions

Romeyn Perdana Putra played a pivotal role in conceiving the research idea, verifying analytical methods, interpreting results, and significantly contributed to the writing the final manuscript.

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