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6 Shifting conflict into collaboration: peatland fires mitigation in the biosphere conservation transition zone in Sumatra, Indonesia

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ABSTRACT

1 **Background.** Many natural resource-related conflicts throughout the globe have resulted in environmental degradation. In Sumatra, Indonesia, a conflict occurred between a timber company and the local community over peatland water sharing, causing annual peatland fires in the transition zone of biosphere conservation. **Aim.** This study seeks to critically analyse what turning points shifted this conflict to collaboration and what roles did the convener play in the processes involved in transitioning these relationships from conflict to collaboration. **Methods.** The data were collected through face-to-face interviews, participatory observations, document analyses, and GIS mapping carried out in 2016, 2018, and 2020. **Key findings.** The findings show that: (1) the conflicting parties realised that there is uncertainty about the problem of peatland fires they face; (2) each party is mutually dependent, for example, concerning legitimacy and knowledge sharing of the fire mitigation; and (3) they are interested in obtaining consequential incentives, such as funding for the local community and mandatory regulation for the timber company. **Conclusion.** We argue that the convener's role through its legitimacy, facilitation, mandate, and persuasion is critical. **Implication.** Without the convener's presence, the conflict may have never been resolved and could not be turned into collaborative action.

Keywords: canal block, convener, cooperation, environmental degradation, GHG emission, Southeast Asia, uncertainty, wildfires.

Introduction

Renewable natural resources, such as tropical peatland, have significant values, for example, for carbon storage of the global climate mitigation and biodiversity conservation. However, when multiple parties have differing interests in access to peatland, it may lead to various conflicts. The existing research has shown that disagreements between opposing economic interests, limited capability of existing governance regime, and greater demand for natural resource utilisation have been seen as the main drivers of conflicts (Neudert *et al.* 2020). Moreover, many natural resource related conflicts have escalated into violence (Derkyi *et al.* 2014) and resulted in environmental degradation such as illegal logging and forest fires in the forestry sector (Carroll *et al.* 2011).

In Sumatra, Indonesia, despite the issues of climate change such as the decrease in rainfall, and weather anomaly (Edwards *et al.* 2020), the conflict between a timber company and villagers over access to peatland water resulted in annual peatland fires in the transition zone of the biosphere conservation. Between 2012 and 2015, 10 000 hotspots were captured by the NASA satellite in 14 villages around the area (Firms 2019). Although the dispute had a long period of contestation, the conflict turned into collaborative action in the form of peat water sharing, canal normalisation, construction of canal blocks, and water monitoring. In the Indonesian context, most conflicts in industrial plantations are rarely resolved (Gerber 2011) and the challenge of peatland fires never ends (Purnomo *et al.* 2019). Peatland fires produce large amounts of carbon, which make them one of the major contributors for the global increase in atmospheric CO₂ (Hoscilo *et al.* 2011; Tan *et al.* 2020;

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Widyastuti *et al.* 2020). The depth of the fires in the peatland can reach 1.1 m and the underground fires produce 15 much more smoke compared to crown fires (Ballhorn *et al.* 2009). Moreover, previous research has shown the reluctance of bureaucracy in dealing with forest fires in Indonesia due to the centralisation of power in fire response (Purnomo *et al.* 2021).

Unlike conflict, collaborative action promises better environmental management outcomes. As examples, collaboration has reduced ecological problems (Vodden 2015), improved environmental conditions (Scott 2015), and raised the household income of local communities living around the forest area (Mattor *et al.* 2020). However, shifting conflict into collaborative action remains a challenge, particularly in terms of how to mitigate the environmental problem and to sustainably govern the natural resources (Ojha *et al.* 2019). Some scholarly works have shown several methods for shifting conflict into collaboration. In the context of conflict of interest in decision-making processes regarding natural resources, Levesque *et al.* (2017) argue that collaboration could be developed if power had been distributed among the participants, trust had formed across core interests, and social learning had resulted in shared understanding. In Nepal, through adaptive learning and deliberation, conflict over access to the forest was able to be turned into collaboration (Ojha *et al.* 2019). Interdependence among group members, past experience with cooperation, and external aid was able to help turn conflict into collaboration in the context of a small boundary community (Chaudhary *et al.* 2015). Lastly, in the case of Sami cultural identity, conflict could also be managed with the help of a convener through network development (Olsen 2016).

However, little attention has been paid to shifting conflict into collaboration in the context of peatland fire mitigation and the convener's roles in these transition processes. Drawing upon the case study from the transition zone of biosphere conservation in Sumatra, Indonesia, this study is aimed at analysing what turning points that can shift conflict into collaborative action and what roles the convener plays in facilitating the conflict–collaboration transition processes. We argue that uncertainty, interdependence, and consequential incentives as introduced by Emerson *et al.* (2012) can be considered to not only be the drivers of collaboration, but also the turning points that can shift conflict into collaborative action. However, in this case study, we found that the convener played a critical role instead of the conflicting party leaders taking the collaborative initiative. Without the convener's presence, the conflict may have never ended, and the peatland fires would continue to reoccur.

Conflict–collaboration transition: uncertainty, interdependence, consequential incentives, and roles of convener

In this study, we refer to collaborative action as a process where multi-level actors with diverse values and preferences,

with the help of a convener, come together to negotiate, learn, and work together on how access to natural resources should be shared to mitigate environmental problems. Our understanding is based on the argument posited by Emerson *et al.* (2012) that the approach of collaborative governance should go beyond the formal public sector to accommodate the myriad of community-based collaboration initiatives. Although most scholars and practitioners introduced the formal arrangement of collaboration to deal with the environmental problem, the collaborative practices are more likely transactional and flexible (Madden and McQuinn 2014). We refer to this practice as bottom–up collaboration, where the collaborative initiative came from the bottom, such as a non-state third party actor, instead of government-initiated arrangements (Fisher *et al.* 2020).

According to Emerson *et al.* (2012), there are four essential drivers that can drive actors to collaborate: (1) uncertainty; (2) interdependence; (3) consequential incentives; and (4) leadership. However, it is argued that there can be one or more essential drivers to initiate collaboration depending on the case study (Emerson and Nabatchi 2015). For example, in the case of Sami cultural identity and lake governance in Nepal, instead of the conflicting parties' leaders taking the initiative, the convener played a critical role in facilitating conflict resolution and fostering collaborative action through network development and adaptive learning, respectively (Olsen 2016; Ojha *et al.* 2019).

Uncertainty arises when related parties have limited knowledge about the nature of a 'wicked problem' they are faced with, the solution they should apply (Hossu *et al.* 2018), and the consequences of efforts they carried out (Ulbarri 2019). Many problems are commonly not fully understood, and due to such incomplete information, each party will face a challenge in formulating their solution (Whyte and Thompson 2012). Through collaborative action, parties can come closer together in an information and knowledge sharing system that helps turn many forms of ambiguity into identifiable, understandable, and meaningful threats (Walker *et al.* 2017).

Interdependence refers to a situation when conflicting parties perceive the need to work together (Hossu *et al.* 2018). Existing research has shown reasons why parties are interdependent. For instance, the problem may extend beyond the capability of one party (Emerson *et al.* 2012). Due to the unique distribution of resources, every party requires the sharing of resources such as knowledge, authority, and legitimacy (Zachrisson and Lindahl 2013). No single actor has adequate resources to tackle a wicked problem unilaterally, they are mutually dependent in defining and implementing joint efforts (Raitio and Saarikoski 2012).

Consequential incentives are internal and external pressures, either positive or negative, and opportunities that drive conflicting parties into collaborative action

(Hossu *et al.* 2018). These incentives can take many consequential forms. For example, internal pressure can be a matter of mandatory government regulation while external pressure can be unexpected conditions of natural or human-made disasters (Emerson and Nabatchi 2015). Previous research has shown how long-term funding from the European Union in Romania and the national share goals of higher education in Papua New Guinea have led parties to engage in collaborative action (Eldridge *et al.* 2018; Hossu *et al.* 2018).

According to Wood and Gray (1991), a convener is a third party actor who possess the ability to facilitate conflict–collaboration transition processes through legitimisation, facilitation, mandate, and persuasion. Legitimation refers to the fact that the convener is perceived as a fair actor who uses their formal authority to respond to the wishes of conflicting parties to arrange the conflict resolution. Facilitation means that the convener is a credible actor who utilises their knowledge to help parties develop shared understanding. Mandate implies that the convener, with its resources, can convene the conflicting parties to participate in collaborative action. Lastly, persuasion means that with its credibility, the convener helps to identify the possibility of the collaborative parties' mutual goals.

Context of the conflict, conflict resolution, and collaborative action

The current study closely observed conflict over peat water sharing, which resulted in annual peatland fires in the landscape of UNESCO's Giam Siak Bukit Batu (GSBB) biosphere conservation area in Sumatra, Indonesia. The GSBB landscape is divided into three regions; (1) the core zone (178 722 ha); (2) the buffer zone (222 425 ha); and (3) the transition zone (304 123 ha), in which about 90% of those areas are tropical peatland (Titisari *et al.* 2019). The core zone is a natural peat swamp forest, home to dozens of mammal species, hundreds of bird species, 13 species of fish, eight species of reptiles, and 52 endangered and protected plants (Titisari *et al.* 2019). Timber companies mostly occupy the buffer zone (upstream), while the transition zone (downstream) is reserved for community forestry and settlements where more than 10 villages exist in the area (Fig. 1).

To manage the water table, one of the timber companies (i.e. the examined company) developed thousands of ditches within its concession area (about 32 000 ha) and created primary canals (25 m wide) connecting two big rivers so as to transport their logs (BRG 2016). Villagers also dug secondary canals (between 5 and 7 m wide) in their community

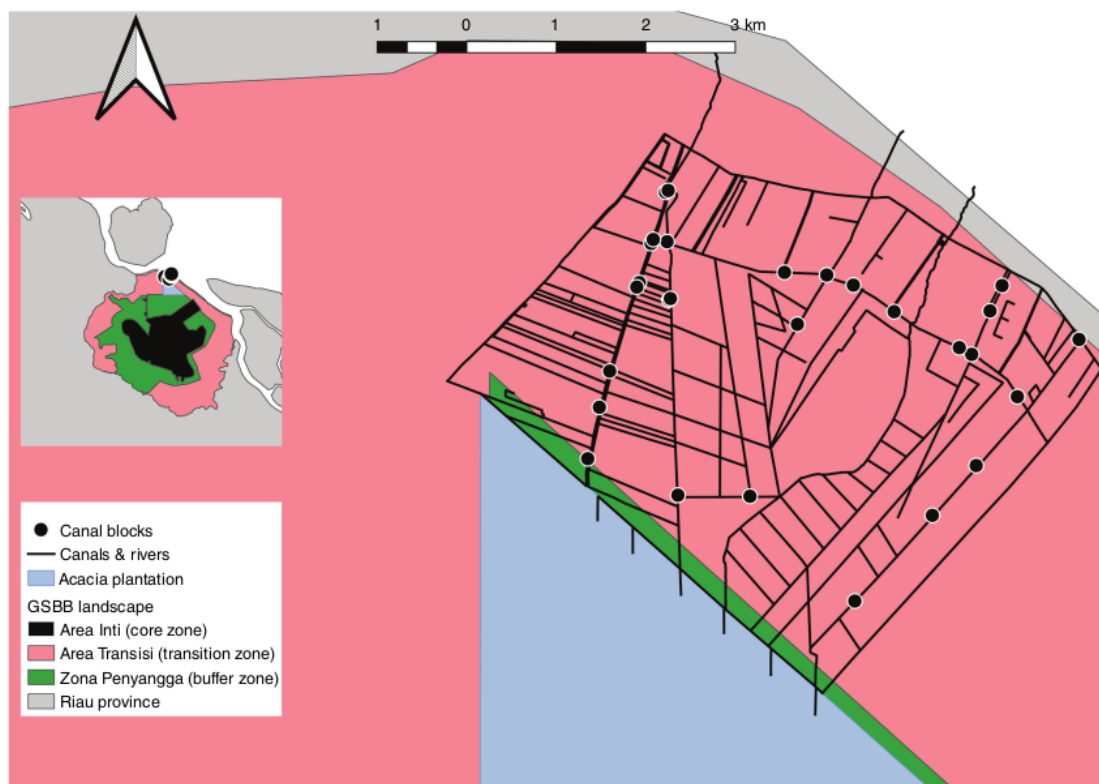


Fig. 1. GSBB landscape and the distribution of canal blocks in the village.

areas to drain the peatland where they planted oil palm trees. During the dry season, the timber company withheld water to maintain its water table following acacia's growth in its concession, while doing the opposite during the rainy season. As a result of water retention, the dry and woody peatlands in the community areas frequently burnt during the dry season.

After the 2015 mega-fires when many parts of Sumatra were affected by the El Niño event, the United Nations Development Program (UNDP) under the REDD+ project and Worldwide Fund for Nature (WWF) came to the village to build 17 canal blocks in the community area. Canal blocks or dams is a technology to stem water flow in the canals by building a water dam out of wood, sandbags, or other materials such as steel and concrete (BRG 2016). The canal blocking objectives were to re-wet and to raise the water table in the degraded peatlands previously drained and vulnerable from the fires (Wilson *et al.* 2016). In 2016, in collaboration with three local Environmental Non-Government Organisations (ENGOs) and experts from a local university, the REDD+ facilitators and WWF facilitated conflict resolution dialogues between timber company representatives, villagers, and local authorities. However, the timber company showed little commitment to share the water with the community area.

By December 2017, the Tropical Peatland Society Project (TPSP) was launched by an international university from Japan in collaboration with a local university and with the political support of the Indonesian Peatland Restoration Agency (IRPA) (Mizuno 2018). The 5-year programme attempted to address the tropical peatland's vulnerability through an integrated effort of scientific findings and local practices such as building canal blocks in the village (Mizuno 2018). Researchers from both universities have a long-term history (since 2011) of conducting studies relating to peat decomposition in the village. By March 2018, three TPSP facilitators started living in the village and facilitating meetings between villagers, village officers, and researchers from the universities. After local assistance, villagers agreed to collaboratively work with TPSP under a local organisation called Peat Care Community (PCC), which had existed in the village since 2013. Through the financial support and assistance provided by TPSP, 20 members of PCC worked to reforest the degraded peatlands and build canal blocks in the community area.

In 2019, TPSP facilitated Focus Group Discussions (FGDs) among villagers, village officers, and timber company representatives. The FGDs were conducted in the village office and the capital city of Riau Province and attended by local ENGOs. TPSP researchers, timber company representatives, and IPRA deputy also met several times in private meetings in Indonesia's capital city, Jakarta, to achieve a win-win solution in the dispute. Following the negotiation processes, the timber company finally agreed to share water from their concession area and work together with TPSP, PCC, and the village office on canal normalisation and canal blocking

construction in the village area. For example, the timber company committed to open four canal gates on the concession boundary bordering with the local community area and their excavators were freely used to normalise non-functional canals in the community area. Simultaneously, TPSP covered the operational cost and materials such as sand, cement, and wood beams. The PCC and village office supported workers in all activities. During 2019 and early 2020, about 20 km of the canals had been normalised, and 10 canal blocks had been built in the village area (Fig. 1).

Methods

In order to understand the turning points that have brought the conflict into collaboration and the convener's roles in the conflict-collaboration transition processes, the first author conducted: (1) face-to-face interviews with key informants in 2016, 2018, 2020; (2) participatory observation; and (3) relevant document analyses in early 2020. Such methods were suitable to study an issue within a real-life context allowing researchers to gain detailed information from different actors involved in the conflict mediations and collaborative processes of a case study (Yin 2018).

The first stage of observation in the village was conducted in early 2016. The observation was aimed at mapping out factors relating to forest fires and the transformation of peat swamp forest into oil palm plantation. From several interviews conducted (see Table 1), it was found that despite the decrease in rainfall and weather anomaly, conflict over peat water sharing was one of the critical drivers in terms of annual peatland fires in the village. In 2018, the second stage of observation was conducted, and progress was found in conflict resolution and collaborative activities initiated. Between January and March 2020, the third stage of observation was conducted to extensively examine the turning points and the convener's roles in the conflict-collaboration transition processes. During the stay, the first author participated in various processes that the conflicting parties engaged in, such as negotiations, meetings, and seminars, and in several collaborative activities such as normalising non-functional canals, constructing canal blocks, and monitoring the water table. Those activities were recorded in a fieldnote diary.

To obtain in-depth and detailed information, face-to-face interviews were conducted with 35 key informants in 2016, 2018, and 2020 (Table 1). The key informants represented the conflicting parties, convener, and other collaborative actors, such as villagers, PCC members, oil palm farmers, village officers, sub-district officers, timber company representatives, international donors, leaders of ENGOs, and IPRA (Table 1). In 2016 and 2018, the snowball-sampling method was employed to engage with the informants, whereby the previous informant pointed out the next informant, while in 2020 the purposive sampling method was applied since the first author had lived in the village for

Table 1. Data of key informants interviewed in 2016, 2018 and 2020.

Informant	N, 2016	N, 2018	N, 2020	N, total
Actors at the village level				
Villagers	1	1	2	4
Peat Care Community (PCC)	1	2	6	9
Smallholder palm oil farmer	0	0	3	3
Village officer	1	0	3	4
Government institutions				
Sub-district officer	1	0	1	2
Army of sub-district station	0	0	1	1
Indonesian Peatland Restoration Agency (IPRA)	0	0	1	1
Environmental Non-Government Organisations (ENGOS)				
International ENGOS	0	0	1	1
Local ENGOS	0	0	3	3
Donors				
Tropical Peatland Society Project (TPSP)	0	0	4	4
REDD+ project	0	0	1	1
Corporation				
Timber company representative	0	0	2	2
N, total				35

3 months (January–March). Semi-structured questions following the conceptual framework of collaborative drivers and convener's roles were used to retain focus on the topic. Each interview took about 1.5 h in Indonesian language to obtain detailed information. All interviews were recorded using a voice recorder and further transcribed into written texts.

During the stay in the village, the first author also collected documents relating to information on collaborative activities and their background. For example, documents relating to village history and numbers of villagers and their livelihood were collected from the village office. The sub-district office shared the document of fire incidents recorded in the village while PCC shared the number of canal blocks and year of construction. The basic layer of village area and notes pertaining to the list of meetings between the local community and the timber company were acquired from TPSP. The timber company shared a power point slide about their roles in the process of canal blocking construction and water management inside their concession areas. Lastly, copies of regulations concerning the timber company's responsibility for fire mitigation outside the concession areas were collected from the timber company representatives and online database.

The diary notes, recorded–written texts, and documents were further imported to the NVivo 12 plus software. NVivo is a set of tools that assists researchers in undertaking qualitative data classification and analysis (Bazeley and Jackson 2013). In this research, NVivo 12 plus was used mainly for data classification wherein every informant statement and information were coded according to the framework in the node. This part of data classification is aimed at: (1) identifying the issue of uncertainty and interdependence between conflicting parties; (2) exploring the consequential incentives expected in the collaborative action; and (3) analysing the roles of the convener (i.e. legitimation, facilitation, mandate and persuasion) in the process of conflict resolution and collaborative action (see Wood and Gray 1991).

In addition, by using the basic layer of village area acquired from TPSP, the Quantum Geographical Information System (Q-GIS) software was utilised to map and visualise the distribution of canal blocks in the village (Fig. 1). The basic layer of the map (in SHP format) was converted into PDF, and it was transferred into AVENZA apps (<https://www.avenzamaps.com/>) installed on a mobile phone. With the help of a PCC member, the first author took the coordinates of all canal blocks in the village. The coordinates were transferred into Q-GIS in SHP format, and they were merged with other spatial data, namely a basic layer of the Riau province area, canals and rivers in the village, concession areas, and biosphere conservation landscape. The basic layer of Riau province area and canals and rivers data were accessed at <http://webgis.menlhk.go.id> while the concession areas and biosphere conservation landscape were purchased at <https://www.lapakgis.com/>.

Results

Uncertainty in dealing with the conflict and peatland fires

Conflict over water causing seasonal peatland fires in the biosphere's transition zone was the main uncertain issue relating to the turning point of collaborative action. Based on the interviews, villagers, conveners, local authorities, and ENGOS were uncertain why the timber company withheld water during the dry season while doing the opposite during the rainy season. Although unsustainable land clearance by using fires for agroforestry with oil palm as the main crop had been practiced for a long time by villagers, both ENGOS and local authorities also saw peatland fires occurring as a result of water retention by the timber company (Interviews 9b and 5a).

In contrast, the timber company also faced an uncertain regulation relating to the water level in the concession area, which needs to meet the 0 cm criteria since it is located in the peat dome area (Interview 12a). They also doubted the water infrastructure readiness in the community forestry

area if they shared the water. Without proper water infrastructures in the community areas, sharing the water may lead to flooding. The water would also directly flow into the sea, harming the ecosystem in coastal areas (Interview 12b).

All parties, such as the company, the village office, government institutions, and NGOs, had negative assumptions about one another. The villagers argued that the existence of the timber company was the main cause of the fires due to the water retention. They also felt that they had less benefit from the company's business activities (Interviews 1a, 1b, and 1d). Moreover, both the village and sub-district office with NGOs' support opposed the company's business activities instead of taking roles in the conflict resolution. The timber company representative contrarily argued that villagers' unsustainable land clearing practices were the main driver of peatland fires instead of water retention (Interview 12a). The timber company also distanced itself from the villagers, village office, sub-district office, and NGOs since those actors were perceived to blame their business activities (Interview 12a).

The conflicting parties were also doubtful about the efforts they would have to make and whether those efforts would have positive outcomes in mitigating peatland fires. The villagers were unsure whether the 17 canal blocks developed with the help of WWF and REDD+ financial support were able to re-wet the dry peatland since fires still occurred in the village, for example in 2017. By 2016, the village office also established the Fire Care Community (FCC) where every day, three of its 20 members conducted a voluntary fire patrol around the village area. One of village officers said:

Even though we already have 17 canal blocks in the village and also established the FCC to monitor the occurrence of the fires, the fires still occur, and we need to focus on mitigating fires by building more canal blocks to re-wet the peatland, not to fight with the fires.

At the same time, the timber company argued that the village was not ready with the water infrastructure for water sharing, and the villagers also had unsustainable cultures in using the fires. Burning the land to plant oil palm trees had been practiced by the villagers since the beginning of their living in the village, where most of them originally came from different regions in Sumatra. According to the timber company representative, dealing with the fires in the village had to promote awareness of the environment, particularly regarding peatland protection. For example, one of the timber company representatives said:

We are always ready to support the villagers with our water pumps if fires were to happen in the village area. We can also share water from the concession area if the village is ready with the water infrastructure. However, if villagers still use fire for land clearing, fires may still occur.

Interdependence in re-wetting the degraded peatland

Peatland fire mitigation in the village was beyond one party's capability to handle. Both the villagers and the village office were unable to independently normalise the non-functional ditches and build canal blocks. Many canals around the village were dried up and covered with bushes that needed to be normalised. Although the village office had annual funding allocated by the national and local governments, the budget allocation was mainly for basic infrastructure and human development such as roads, irrigation, education, health, and cultural events. Hence, the village office always welcomed donors such as WWF, REDD+, and TPSP to help the village construct canal blocks. During the interview, the village office leader said:

We cannot build the canal blocks and normalise the [non-functional] ditches. Those are high cost. We prioritise the budget for basic development such as road maintenance and education, and there is no special budget transferred from the local and national governments to mitigate peatland fires. So, we are happy and welcome any party or donors who want to help us mitigate the peatland fires here, mainly in constructing the canal blocks.

The timber company was also interested in sharing resources such as authority and legitimacy. We define 'authority' and 'legitimacy' as formal and moral justifications to make a decision or intervention (Gritten and Saastamoinen 2010). As an example, to intervene in the area outside its concession, the timber company required an official invitation from the village office and a clausal agreement for research purposes with the TPSP. According to the Indonesian forest regulation, the status of the community forestry area in the village is a state production forest. Without an official permit from the MoEF (Ministry of Environment and Forestry), the forest should be free from any business activity (Interview 12a). However, with the village office's official invitation and the clausal research agreement with the TPSP, the timber company could legitimately conduct canal normalisation and participate in the construction of canal blocks (Interview 12a).

Besides, the conflicting parties and convener were dependent upon mutual knowledge sharing. To measure the water level in the community area and calculate the water volume in the canal blocks, the TPSP researchers used the 15-year rainfall record data from the timber company. According to the timber company's water expert, the 15-year rainfall record data could be processed for forecasting the rainfall discharge in water planning (Interview 12b). In return, the timber company gained the water volume data recorded in the community area from the TPSP researchers, and the timber company engineers used the data to evaluate whether water sharing has a positive impact on re-wetting the peatland (Interview 10c).

In the process of canal blocking construction, all parties, such as PCC, the village office, and the timber company, agreed to utilise the canal blocking infrastructure model introduced by a TPSP researcher from a local university who was also a hydrological expert of the IPRA. However, despite considering the scientific approach, TPSP researchers also accommodated the local knowledge of villagers in the process since the PCC members had experiences working on canal blocking construction with WWF and REDD+ project. The PCC members also informed TPSP researchers and facilitators of any potential conflict of interest in the area. The PCC members also guided the timber company excavator operators in canal normalisation, and they negotiated with the forest owners alongside the normalised canals for any refusal. A TPSP facilitator stated the following:

Before developing the canal blocks, we always have a discussion with PCC members because we do not know about the existing situation in the area. They [PCC members] will tell us about any possibility of conflict, for example, if the owner is not satisfied with our activity. They also have many ideas on how the canal blocks should be constructed based on their experiences working with the WWF and REDD+ funding.

Consequential incentives of peatland fire mitigation activities

Peatland fire mitigation had allowed the consequential incentives for all parties. Based on the first author's observations, almost all villagers depended on their income by planting oil palm trees and hardening natural rubber. Through the TPSP funding, the villagers had the opportunity to get additional income from their involvement in the project. Every collaborative activity, such as normalising non-functional canals, constructing canal blocks, and monitoring the water table, was paid with a basic daily fee when PCC members were actively involved in the process. For example, a TPSP facilitator stated:

For canal normalisation and canal blocking developments, we pay them [villagers/PCC members] between IDR 100 000 and 200 000 [USD 7–15] per day. Many people's lives here depend on a daily income. If they do not work for a day, such as harvesting fresh fruit bunches for an oil palm landlord, they will have no money. For water monitoring, we hired four young villagers who are given a monthly salary because they work every day, in the morning and afternoon.

The TPSP researchers also obtained mutual benefits, such as research data. Every 2 months, a TPSP researcher who is also a professor of hydrology from Japan regularly came to the village with PhD students to analyse the characteristics of peat water flow in the canals (Interview 10c). In collaboration

with the Centre for International Forestry (CIFOR), two TPSP researchers from a local university and a senior researcher from Japan regularly observed the effect of re-wetting on the growth of native peat plants in the community forestry area (Interview 10a). According to a TPSP researcher, one of the TPSP programme outcomes was in the form of a research publication where the local university and international researchers published an article together (Interview 10b).

For the timber company, the current regulation issued by the MoEF, following Ministerial Regulation No. 32/2016, has stipulated that timber companies are responsible for fire mitigation 5 km outside their concession area. Since 2018 this provision has been mandatory, where it was previously voluntary. Sharing the water and being involved in collaborative efforts on canal normalisation and canal block construction were perceived to be more efficient in the peatland fire mitigation than fighting against the fires. In the case of the mega-fire in 2013 and 2014, for example, the timber company group spent about IDR 30 billion to help the government deal with the fires in Riau province. However, the company spent much less budget through the collaborative action in the fire mitigation. One of the timber company representatives said:

I can say that this collaboration is much more efficient than fighting the peatland fires. In our collaboration today, we do not need to rent helicopters for water bombing, which is really expensive, like what we did in 2013 and 2015 when we spent billions of IDR to deal with the mega-fires in Riau.

At the same time, government institutions at the grassroots level, such as the sub-district and village offices, were under political pressure from higher government administration levels. In 2016, the Indonesian president, Joko Widodo, announced that police and military commanders of districts who put in minimum efforts to mitigate forest fires in their jurisdiction would be removed (Cabinet Secretary 2018). The sub-district and village office leaders confirmed that this presidential statement also influenced the local administration's burden of work since they were regularly required to report the fire situation to the sub-district police and army stations (Interviews 4a and 5b). Army and police officers from the sub-district stations confirmed that the collaborative efforts made in the village to re-wet the degraded peatland had reduced the number of fire cases (Fig. 2). For example, one of the army officers monitoring fires in the village said:

I can see myself that after the collaborative effort on constructing the canal blocks was made, peatland fires seldom occur compared to five years ago. So, this is great for people suffering from the haze and our government image in the international community since we are on the border with Malaysia.

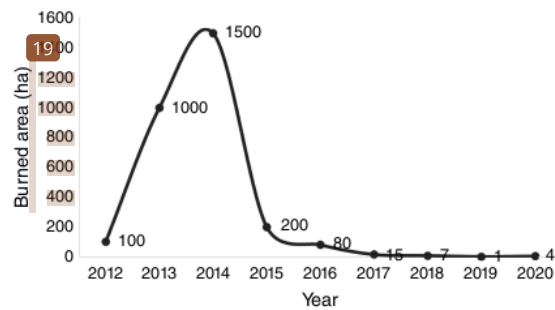


Fig. 2. The burned areas in the village between 2012 and 2020 (in ha) based on fire data recorded in the village office.

Data from the satellite also confirmed that since 2017 the number of hotspots in the village has been decreasing. Between 2017 and 2019, only 270 hotspots were captured in the area compared to around 10 000 hotspots in the previous 3 years (Firms 2019). The fire-recorded data from the village office showed that between 2017 and 2020, only 27 ha of peatland were burned, which was the lowest level compared to around 2780 ha from 2013 to 2016 (Fig. 2).

Role of convener in the conflict–collaboration transition processes

The TPSP had played the role of a convener working on facilitating conflict resolution and initiating collaborative action in the village. Both the villagers and the timber company perceived TPSP as a neutral actor with no close affiliation to any conflicting parties (Interviews 1a, 2a and 12a). The TPSP researchers and facilitators came from international and local universities free from any conflict of interest (Interviews 4b and 12a). With the legal support given by the Indonesian Peatland Restoration Agency (IPRA, under the Indonesian presidential office coordination), the TPSP received its formal authority to negotiate with the timber company and to collaborate with local level government institutions, such as village and sub-district offices (Interview 10a). Both the TPSP researchers and facilitators had worked patiently to elaborate the timber company's wishes and local community's interests and to find common goals between the conflicting parties, such as through FGDs and regular meetings at the village office (Interviews 10c and 10d).

The backgrounds of TPSP researchers were hydrologists, biologists, and forest scientists, while the facilitators were experts in community empowerment and development. Based on their expertise, the TPSP researchers were able to address the timber company's uncertainty regarding the water volume required in the village area and they were able to present scientific evidence to prove the positive effect of canal blocking construction (Interview 12b). Simultaneously, the TPSP facilitators have had a long experience in building relationships with the villagers. During the interview, a

local villager said that the TPSP facilitators not only conducted regular meetings with PCC members but also participated informally in the local community's religious and cultural events (Interview 1c). Through such personal approaches, the facilitators had reassured the local community that the timber company was committed to sharing the water and that the construction of canal blocks had a positive effect on wetting the degraded peatland.

Through financial support provided by the Japan International Cooperation Agency (JICA), TPSP funded all negotiation and collaborative processes. For example, TPSP provided gasoline for the excavator operations during the canal normalisation, covered all expenditures in the canal blocking development process, and facilitated all FGDs, workshops, and meetings among the parties conducted in the village and in the capital city of Riau province (Interview 10c). Professionally, TPSP employed its international and local facilitators and hired four young PCC members to calculate the water volume and water table in the community forestry area (Interview 10d).

Lastly, TPSP was able to identify the mutual goals of all actors involved in the collaborative action. For example, all parties expected the biosphere transition zone to be free of peatland fires (Interviews 2b, 4a, and 5b). Villagers were frustrated by the vulnerability of the village areas from the fires (Interview 1c). The village and sub-district offices worried about the effect of peatland fires on public health (Interviews 4c and 5a). The timber company is responsible for mitigating the fires 5 km outside their concession area and they need to minimise financial expenses more efficiently (Interview 12a). Moreover, Indonesian peatland fires had become an international concern, wherein the smoke from the Sumatra fires directly passed to neighbouring countries such as Malaysia and Singapore (Interview 6a).

Discussion

The research evidence from our case study has shown uncertainty, interdependence, and consequential incentives between the conflicting parties can shift conflict into collaboration. This finding differs from other case studies, such as in Maine, USA and in Nepal as well as in Finland, wherein power distribution, trust, adaptive learning, and network development are key elements in shifting conflict into collaboration (Olsen 2016; Levesque *et al.* 2017; Ojha *et al.* 2019). In our case study, through facilitation provided by a convener, uncertainty, interdependence, and consequential incentives have driven the conflicting parties to engage in collaborative action and activities subsequently reducing the village's vulnerability to the peatland fires.

According to Davis *et al.* (2015), understanding the uncertainty in the forest fire related impacts is critical for decision making. In our case study, uncertainty of knowledge about the conflict over access to peat water sharing and the

impacts of their efforts in peatland fire mitigation has brought about the need for conflicting parties to reduce ambiguities, share information, and build intervention together. Due to such an uncertain situation, numerous conflicts were far from being mitigated and resolved (Whyte and Thompson 2012; Ulibarri 2019). Yet, collaborative action can facilitate in sharing information and turning ambiguities into identifiable threats (Walker *et al.* 2017), where in our case study information sharing and problem identification were aimed at mitigating peatland fires. For example, through the FGDs and meetings facilitated by TPSP, the timber company was able to inform the villagers about the uncertain situation relating to the water table regulation in the concession area. In contrast, the timber company obtained the answer to how many metric litres of water were needed to share with the village.

In Nepal, Chaudhary *et al.* (2015) have found that interdependence among group members in the context of a small boundary community can help turn conflict into collaboration. In our case study, interdependence occurred not only among local community organisations but other organisations as well. Our case study has clarified that no single actor had adequate resources to unilaterally tackle a 'wicked problem' (Whyte and Thompson 2012) such as the peatland fires. For example, although the timber company is considered a powerful actor with its financial resources, it still needs legitimacy, authority, and knowledge sharing from other parties such as the villagers, the village office, and TPSP. Both the villagers and the village office were also dependent on the financial support given and knowledge shared by others. According to Ansell and Gash (2008), high interdependence among related parties can foster a commitment to collaborate. Collaborative action leads the related parties to develop a new entity as they have merged their unique resources to maximise their respective capabilities (Bryson *et al.* 2006) as also shown in our case study.

Emerson *et al.* (2012) argue that consequential incentives may come from internal or external pressures, either positively or negatively, as shown in our case study. For example, due to the lack of financial capability, both the villagers and the village office understood that collaborative action was an opportunity to mitigate peatland fires and gain additional income. From the measures taken by the researcher, the TPSP researchers also gained mutual benefit in research data such as peat water flow and the growth of the native peat plants in the degraded peatland. The current regulation specifies that timber companies are responsible for mitigating peatland fires within 5 km outside its concession boundary, while the village office is under political pressure from police and military institutions. Moreover, the effects that peatland fires have on public health are negative consequences that have brought the conflicting parties to collaborate.

We could not examine which factors have a more powerful influence in fostering collaborative action of peatland fire mitigation in the village. In a Romanian case study, Hossu

et al. (2018) found that long-term funding opportunities provided by the European Union best explain the collaborative initiative. The same phenomenon was also found in the collaboration of tertiary education in Papua New Guinea (Eldridge *et al.* 2018). However, in the case of peatland fire mitigation in Sumatra, Indonesia, the turning points that we identified, namely uncertainty, interdependence, and consequential incentives, complement one another. For example, although the villagers and village officials were interested in funding opportunities, uncertainty relating to the conflict over peat water-sharing and the interdependence of knowledge sharing, such as the technology of canal blocks, had also influenced each party's involvement in collaborative activities. Moreover, without the government's pressure exerted through its regulation and political statement, both the timber company and the village office might have been less committed to the collaborative effort.

Our study is also consistent with the argument Emerson *et al.* (2012) posited that there can be one or more collaborative drivers, which in this case are uncertainty, interdependence, and consequential incentives. However, instead of the conflicting party leaders taking the collaborative initiative, our case study shows that the convener plays a critical role in the conflict–collaboration transition processes. Previous researches in Nepal and Finland have shown a group of university researchers (Ojha *et al.* 2019) and NGOs (Olsen 2016) playing the role of a convener. In our case study, the TPSP researchers from an international university in Japan, in collaboration with researchers from a local university, played the convening role in the facilitation process of formal and informal meetings between the conflicting parties and the negotiation process for conflict resolution. TPSP was able to bring the conflicting parties to the table to express their interests, share information and knowledge, and learn and work together on peat water governance to mitigate the peatland fires. Without the TPSP's facilitation and negotiations, no actors might have been able to facilitate the conflict, and the peatland fires around the transition zone would have continued to have alarming effects (Fig. 2).

We consider legitimacy, facilitation, mandate, and persuasion introduced by Wood and Gray (1991) as roles that TPSP played in the conflict–collaboration transition processes. Given IPRA's proper support, TPSP used its legitimacy to negotiate with the timber company and organise grassroots local government institutions. Regarding their expertise, the TPSP researchers and facilitators was able to respond to the timber company's questions regarding the uncertainty of water volume. They were able to provide scientific evidence on the impact of canal blocking development. Through financial support provided by JICA, TPSP had sufficient financial resources to fund the negotiations and collaborative processes and employ international and local facilitators alike. Through its facilitation of conflict resolution and joint initiative, TPSP was able to identify the mutual goals among the parties. Those efforts indicate

that TPSP held a critical role in conflict resolution and collaborative initiation.

Since TPSP is a non-state action initiative, we also support the argument posited by Fisher *et al.* (2020) that collaborative action works if the initiative comes from the bottom and is applied in a flexible and transactional way rather than in a top-down and rigid form of government intervention (see also Madden and McQuinn 2014). The previous research has shown the failure of top-down collaborative arrangement in dealing with forest fires in Indonesia due to bureaucratic inertia where power is centralised in vertical government institutions (Purnomo *et al.* 2021). The evidence from our case study suggests that informal collaboration from a non-state initiative has enabled the local institution in the peatland fire mitigation. Moreover, parties conducted the process of negotiation and collaborative efforts in a flexible manner. For instance, the negotiation process, such as meetings and FGDs, took a long time, indicating flexibility in time and place. The observation and interview data also show that collaborative efforts such as canal normalisation and canal blocking construction are not dependent on a rigid planning process; instead, it has followed the learning process between the parties.

Conclusion

The findings from our study in Sumatra, Indonesia have suggested that uncertainty, interdependence, and consequential incentives can be considered to not only be the drivers of collaboration, but also the turning points that can shift conflict into collaborative action. These collaborative activities have reduced the village's vulnerability to peatland fires. In our case study, uncertainty relating to the nature of peat water conflict causing annual peatland fires has led the conflicting parties to realise that there is a need for reducing ambiguities and sharing information. The evidence has demonstrated that no single actor had sufficient resources to unilaterally address a wicked problem such as peatland fires. The respective parties were interested in the consequential incentives, either in the positive or negative forms of internal and external pressures.

We also found that the convener holds a critical role in the conflict-collaboration transition processes. Without the presence of the convener, the conflict might not have been resolved, and the peatland fires would have continued to have alarming effects. Since the convener is a non-state actor initiative, this study supports the argument that collaborative action, particularly in peatland fire mitigation, works if the initiation comes from the bottom, and is carried out in a flexible and transactional process, rather than a top-down rigid form of government intervention. Our evidence, indicating the accomplishment of a bottom-up, flexible, and transactional collaborative initiative, can serve as an alternative for dealing with forest fires in Indonesia, since

the rigid and top-down arrangement is reluctant due to the centralisation of power.

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