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The Potential for Analysing How Small Scale Farmers Choose Burning as a Land Clearing Strategy in South Sumatra

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Abstract

Human induced burning events have proved to be devastating for Indonesia, Singapore and Malaysia alike. Land clearing through burning has been a common practice for generations, but the global demands for lucrative crops has driven fire to become an unsustainable and devastating tool. From a desk review and a set of unstructured interviews, this paper examines the factors that dictate how small-scale farmers choose burning as a land clearing strategy, and it offers the potential solutions for the adoption of more sustainable practices. The results and solutions presented in this paper add to discourse on Social and Environmental justice.

Keywords: *Land management; Fire; Wildfire; Haze; Ecological Distribution Conflict.*

1. Introduction

Clearing through burning has been a traditional way of managing land in Indonesia for generations, but in recent decades a drive by the global market for lucrative crops has led to unsustainable land conversion. Both private investors and smallholder farmers encroach into areas of forest converting them into economically productive land to keep up with global demand. The wet peatland of the swamp forests that locks in carbon and provides natural protection from wildfire events, is drained and cleared through burning releasing toxic smoke. Human induced land-clearing through burning has led to largescale wildfires in Indonesia, as well as transnational haze crises impacting both Singapore and Malaysia. Such crises have profound economic consequences, affecting crops, forests, houses, transport, agriculture, trade and tourism. The 2015 Transnational haze cost 16 Billion USD, 1.8% of Indonesia's GDP (World Bank 2016). The smoke from the haze causes a myriad of health problems including respiratory illness and cardiovascular diseases (WHO 2014), and one study estimates that the 2015 haze led to 100,000 premature deaths (Koplitz et al 2016).

In a bid to reduce transnational haze events, fire management intervention schemes have been established by government policy makers and NGOs alike. The most promoted is a Zero-burn policy. While this strategy prevents slash-and-burn, it leads to problems of social injustice, with small-scale farmers unable to afford expensive manual clearing (Dede Rohadi 2017). Moreover, the regulation of this policy is not uniform, creating confusion (RCA 2016).

However, as this paper will demonstrate, fire is a symptom of underlying socio-environmental conflicts, related to land ownership, security, economic pressure and cultural knowledge. This paper will examine the factors that go into the decision-making process of smallholder farmers when choosing burning as a land clearing strategy before suggesting solutions to remedy this issue of socio-environmental conflict.

2. Case Study

South Sumatra Province, covering nearly 100,000km² with a population of 10.68 million, was the worst affected region of the 2015 haze, suffering 3.9 Billion USD in losses (World Bank 2016). Situated within South Sumatra is 1,402,042 ha of peatland, 7% of the overall amount in Indonesia (Carbon Balance Manager 2017), but by 2011 61% of total natural peatlands was converted into managed land types (Miettinen et al 2011). Likewise, there has been severe degradation of primary forest.

In this region smallholder farmers depend on cultivating rubber and palm oil, with land-clearing through burning understood as an essential and traditional method (Ketterings 1999; RCA 2016). Between 2011-2014 the area under palm oil cultivation has increased from 0.87 million ha to 1.11 million. Almost half of this cultivation is situated on the 1-2 ha holdings of small-scale farmers (Rob Finlayson 2017).

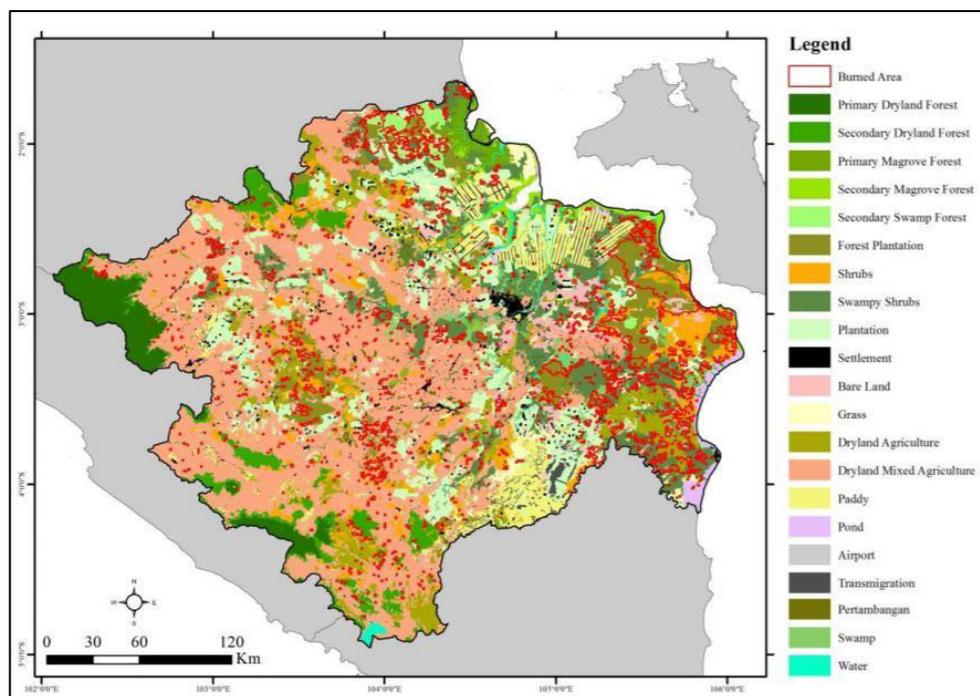


Illustration 1. Map of South Sumatra showing fire hotspots and different land type (Ardiansyah et al 2017)

The exploitation on the outer islands has been driven by the perception of there being huge natural wealth, in the form of abundant, uncultivated land, combined with low population density (McCarthy 2012). The conversion of land has been aggravated due to the lack of detailed maps and clear land tenure. Without clear land ownership, the government, relying on a development policy that depends on foreign investment and exploitation of the land, has sold large areas of land to private investors that were inhabited by rural communities for generations (Suyanto 2007). To resolve land conflicts President Jokowi proposed a One-map policy and clear land ownership, however until this scheme is fully introduced confusing over land will continue.

Recently steps have been made toward implementing sustainable land practises in South Sumatra, with the Green Land Growth Project and the Master Plan for Green Economic Growth. The regional governor is backing sustainable approaches for land development that provide equitable growth while maintaining ecosystems and a reduction of greenhouse gases (World Agroforestry 2017). This paper will aid the implementation of the Green Land Growth Project by dissecting the factors that lead a smallholder farmer to choose burning as a land clearing strategy.

2.1 Fire Management Intervention Strategies

There is a complexity to the law regarding the clearing of land, with laws, decrees and presidential instructions prohibiting activities on protected land without effecting burning practises on already productive land of smallholders (Dede Rohadi 2017). Nevertheless, the enforcement of the policy is unregular, with some land owners allowed to burn while others are treated harshly by police or military (RCA 2016).

Due to the location of hotspots in 2015 South Sumatra, as seen in Illustration 1, one would expect that fire management intervention strategies to have a greater focus in production forest and convertible production areas, targeting large-scale landholders, and agro-business. However, only 51% fire management intervention (FMI) strategies target companies, compared to 71% of targeting smallholders (Carmenta 2017: 4).

The classification of smallholders is problematic as it refers to both small-scale farmers, that may only own 0.2ha, to small/medium sized agro-business, that could be as large as 25ha. Medium sized landholders have higher assets and therefore they have greater ability to absorb any shocks related to the enforcement of fire management intervention strategies (Carmenta 2017). Contrastingly small-scale farmers are greater affected by the same strategies, and not being able to afford alternative land-clearing techniques may lead to them abandoning their land (Dede Rohadi 2017). Due to their vulnerability and their prevalence of converting land for palm oil production, this study will focus on small-scale farmers, and explain the prevalent factors when they choose burning as a land clearing strategy.

2.2 Ecological Distribution Conflict

In South Sumatra the issue of wildfire can be understood as an ecological distribution conflict. This describes when socio-environmental conflict is created through the ‘unequal distributions of power and income’ and ‘social inequalities of ethnicity, caste, social class and gender.’ (Martinez-Alier 2014: 49). In this scenario two different understandings of land management clash. On one hand, small-scale farmers who have been managing the land for generations in a sustainable manner, and on the other hand is the global market demands that force profound changes to the landscape, threatening the livelihoods of local communities. Under pressure from the capitalistic economy sustainable approaches that respect ecological processes are ignored, leading to unbalance in natural ecosystems (Escobar 2006, Martinez-Alier 2002). Local communities become swept up into global markets for lucrative crops contributing to the destruction of their traditional sources of livelihood (Rolston III 2017; Tsing 2005). The process is perpetual, as commodity frontiers restructure the landscape, requiring continuous expansion (Moore 2000: 410).

3. Methods

The methodologies for this working paper are a desk review and unstructured interviews. In the desk review the available evidence is studied and analysed. This evidence is then corroborated and compared with seven interviews from experts working for academic, social, and environmental organisations that work in the field of promoting sustainable practices of land management.

4. Framework of Analysis

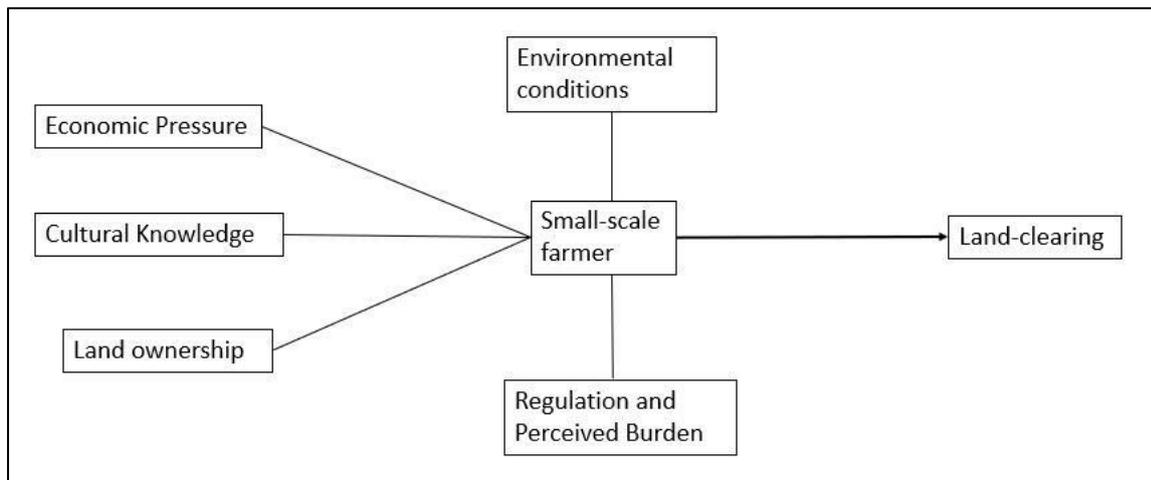


Illustration 2. The process of a small-scale farmer choosing a land clearing technique

The illustration above highlights the different variables that affect a small-scale farmer in the decision-making process of which land management strategy will be adopted. The illustration takes some variables as ‘foundations’, in that they are more static, or long-term. These are Economic Pressure, Cultural Knowledge, and Land Ownership. The two variables that are placed in the vertical axis from ‘Small-Scale Farmer’ are ‘Environmental Conditions’ and ‘Regulation and Perceived Burden’. These variables are subject to greater change than the aforementioned. The environmental conditions may depend on season or EL Niño events, while the ‘Regulation and Perceived Burden’ depends on the level of government enforcement in the area, such as if the officials allow small-scale farmers to burn, or if police presence is low. These six variables all affect a smallholder in their decision making about how, or if, they will manage the land, be it with fire or other techniques.

By identifying the variables from the graph that have the greatest impact on the behaviour of a small-scale farmer, it is possible to recognise where the greatest focus of implementation of policy may lie to influence better land management strategies.

5. Desk Review

5.1 Economic Pressure

As sizes of land parcels are reduced with increasing populations, farmers tend to focus on economically lucrative crops (Ketterings 1990: 138). Within the Sumatran Riau province, between 2002-2009 15% small-scale wet rice field converted to other uses- fish pond, mining, rubber, coconut, palm oil (40%) (LANDac 2016).

Global demand for palm oil has had a staggering increase over the last decades with the demand at 17.7 million tonnes in 1997 to an estimated of 68 million tonnes in 2020 (Palm Oil Research 2016). The crop has increasingly been embraced as a mainstay crop, with Indonesia producing 27 million tonnes of oil palm annually with a revenue of 18.6 billion USD (Purnomo 2017: 22). Indonesia is the world’s largest exporter of palm oil, exporting 22,500 tonnes a year, compared to 17,200 tonnes of the Malaysia, the next largest exporter (Agricultural Sciences 2016). Land cultivated with palm oil is valuable, with prices ranging from \$960-3340 USD/ ha. In comparison rubber is valued at \$72/ha, rice fallow at \$28/ha, and cassava at \$19/ha (World Growth 2011). Palm oil provides farmers a high return-to-labour than other crops, with good yields being produced by four years of planting (RCA 2016; McCarthy 2012). A high demand and desire to cultivate the crop has put pressure on land, leading to the clearing of forest (Purnomo 2017).

5.1.1 Fire as a tool

Fire has been used worldwide as a land management technique, and it is a traditional tool in the Indonesian islands. Rural communities consciously use fire as a tool to meet an objective (Suyanto 2005: 6), and the use of fire in land-clearing provides a cheap means of managing the land and providing an area for new planting (Ketting 1999: 163). Burning also leads to a reduction in pests, diseases and weeds (Suyanto 2005: 6).

Research shows that farmers understand that a use of fire improves soil structure and provides plant nutrients through the ash layer (Suyanto 2005; Ketting 1999). Burnt land is referred to as *terima abu*, 'giving the ashes', the perception of improving soil increases its value to \$856/ha rather than \$665/ha for manually cleared land (Purnomo 2017:25).

Fire in land-clearing is not haphazard, and there are specific community norms in place to ensure that fire does not spread. In Suyanto's (2005) research in Trimulyo, Lampung, he describes that 97% of the respondents to his study explicitly mentioned the importance of following the rules. This includes constructing fire breaks, burning wood residue in the middle of the field, taking wind direction and slope into account, informing neighbours and having sufficient helpers to control the fire. Due to the importance of livelihood placed on the production of crops, farmers are obliged to pay a compensation to neighbours if fire spreads and damages their plants (RCA 2016; Suyanto 2005). Such norms ensure that fire remains in control without spreading uncontrollably and causing wildfire.

5.2 Cultural Knowledge

The worldview and knowledge of small-scale farmers in localities in South Sumatra may be profoundly different due to the large-scale transmigration of people from different islands. Such varying cultural background brings contrasting worldviews and a different knowledge set. This is especially prevalent with the use of fire. Locals have reported that in some instances migrants do not have a proper understanding of the use of fire, or how to control them (RCA 2016). The lack of knowledge of fire therefore leads to out of control fires sweeping through lands, destroying crops, while making fire a culprit.

Bambang Trihadmojo's (2016) study on the psychology of fire in Kalimantan demonstrates that the continued adoption of slash-and-burn was influenced by factors of collectivism, burning to feel part of the group, and social norms, burning when neighbours are burning. Trihadmojo also demonstrated that the formation of perceptions of fire in formative events are very crucial in burning behaviour. He noted that farmers burnt land because it was something that their parents had done, and they were 'performing' their culture.

Colfer et al's (1989) study highlighted the impact that ethnicity has on agricultural practises and land management among three ethnic groups in West Sumatra. They found that ethnic differences through contrasting behaviour, value placed on land, and gender roles, led to profound differences in practises between Javanese and Sundanese migrants, and native Minang. While smoke and haze are generally understood as having devastating effects on health, research demonstrates that due to lack of awareness, small-scale farmers may continue to burn the land without perceiving the dangers. Rural communities in South Sumatra understand that the smoke has negative effects, but they perceive other health issues, such as drug abuse, to be more serious (RCA 2016). This understanding leads to the propagation through the selection of land-clearing through burning.

5.3 Land Ownership

The 1999 Forestry Law divided land into two categories, State Forest, 70% forest, and Private Forest. The law empowered the Department of Forestry the control over land tenure rights issued by the 1960s Basic Agrarian Law (Contreras-Hermosilla and Fay 2005). Many communities are situated within the Indonesian's government state forest and although they have lived there for generations they may not have complete land rights, with customary rights often being ignored (LANDac 2016). Much land has been misidentified, although the 2013 AMAN won a landmark request to change classification of areas of state forests to customary forest. President Jokowi, in the National Medium-Term Development Plan 2015-2019 aims to distribute 9 million hectares of land, consisting of 4.1 million forest area and 4.9 million non-forest area (LANDac 2016).

5.3.1 Land Competition

Competition for land use is driven by demand for lucrative crops, with strong prices and good yields influencing expansion (McCarthy 2012 531). Large scale land acquisitions are commonplace and have been increasing exponentially since the 1990s (LANDac 2016). Unclear land tenure of local communities leads to land rights of smallholders and communities being ignored by investors leading to land conflict and subsequent deforestation (Santika et al 2017). Policy makers continue to facilitate access to cheap at the expense of villagers with insecure tenurial rights. In this regard current land policy fails to provide adequate protection for local communities against large-scale land acquisition (McCarthy and Robinson 2016). Decades of confusion of legal status of land, over-lapping of land categories, has led to conflict and tension. Inside Indonesia reports that during Yudhoyono's 10-year presidency there were 1391 recorded land conflicts, covering 5 million ha, and involving 926,000 households, and resulting in 70 deaths (Nanang Indra Kurniawan). When land is abundant in relation to population, strong land tenure is not necessary. Contrastingly, when population size puts pressure on the land, it is vital to provide land security (Contreras-Hermosilla and Fay 2005: 18).

Land Titling: A Prerequisite to Sustainable Management



Figure 1. Farmers in South Sumatra call for land reform. ‘We are ready to protect peatland and forest from fire, but give us land to live on’ (Sapariah Saturi 2015).

The image above shows farmers in South Sumatra calling for land reform, stating ‘We are ready to protect peatland and forest from fire, but give us land to live on’. The image, highlights frustration from small-scale farmers. One farmer was reported saying “If we are given our own land to farm,

clearly we'll protect the peatlands and forests from fires. We don't need to be paid or given firefighter uniforms. We'll protect it because we own it." (Sapariah Saturi 2015). The perception amongst these farmers is that if they were the owners of the land then fire suppression strategies would not be necessary, as they would care for the land themselves. The perception of these farmers suggests that land titling is a prerequisite to sustainable management.

Scholars (Suyanto 2005, 2007; Contreras-Hermosilla and Fay 2005) suggest that strengthening land tenure is a precursor to farmers adopting better management techniques, and reducing wildfire events. Robinson et al (2014: 2) describe that how residents perceive land tenure has a greater impact on the chosen land management techniques than whether the tenure is formal or legalised. Several studies (Contreras-Hermosilla and Fay 2005; Suyana 2005; Suyana 2007) show that when land ownership has been unsecure or unknown, there is a greater tendency for fire management strategies to be poor, with uncontrolled fires spreading over land which has unsure ownership. It has also been reported that forested land that has no ownership becomes subject to clearing through fire as opportunists seek to expand, or sell the cleared land to buyers in the local communities or private sector. Contrastingly when land rights are more secure it has been reported that communities manage land more sustainably (Contreras-Hermosilla and Fay 2005; Suyana 2005, 2007; Santika and Meijaar 2017).

Suyanto (2007; 2005) demonstrated that coffee-based agroforestry provides rehabilitation of the land. His research in Lampung indicated that post 1998 weakened government control 'indirectly strengthened farmers informal tenure', which lead to a reduction in repeated wildfire events (Suyanto 2005). Suyanto (2005) suggests that while the relocation of communities out of the forest is met with resistance, a partnership approach in which communities are involved in the co-management of the forests has potential for better protection of forests while reducing social conflict. Suyanto et al (2007) suggest that by using land rights as a reward system, communities support 'environmentally friendly land management in protected forests'.

Community, or village, forest programmes aim to empower local communities alongside rehabilitating state forests. These usufruct land rights allow communities to manage the land while extracting non-timber-forest-products (NTFPs) (Banjade 2016). Between 2015-2019 the government allocated 12.7 million ha of land to marginalised groups. This project is the precursor to securing land tenure and resolving conflict over land ownership. In a study across Sumatra and Kalimantan Santika and Meijaar (2017) found that, in general, these schemes avoid deforestation, but result this is variable over both spatial and temporal scales. In order to provide secure solutions, the scholars (Santika and Meijaar 2017) stress that it is essential to understand how different social forestry schemes benefit and effect communities.

5.4 Environmental Condition

The Indonesian archipelago, situated along the equator, is subject to tropical weather conditions with high average temperatures and rain well distributed throughout the year. The dry seasons run from May-September, and the wet seasons run between October-April. These periods are understood intimately by farmers in rural areas of Indonesia.

In South Sumatra the annual rainfall is 1633.0 mm with the wettest month in April, followed by the hottest month in May (Time and Date 2017). The Land clearing through burning usually takes place during the dry season and it has been noted that extra care is taken in times of prolonged dryness with extra fire breaks, and more lookouts to watch out for unwanted spreading of fire (Ketterings 1999; RCA 2016). There is a complex institution and knowledge set in place for many farming communities that use fire as a tool and other conditions such as wind, soil type and the slope of the ground are also considered before burning (Ketterings 1999).

A weather condition that greatly affects the regular turning of the seasons, and has been attributed as a major driver of the transnational haze events is that of El Niño. El Niño South Oscillum, ESNO, a

periodically warm water stream in the Pacific Ocean, is a global climate conditions that causes extreme weather events and is experienced at local levels through floods, droughts and famines in Indonesia, South America and South-East Asia (Hohler 2017). The ENSO climate condition is unpredictable, making it a difficult environmental condition to judge in land management.

5.5 Regulation and Perceived Burdens

The laws of forest management are complex in South Sumatra, especially regarding the policies that focus on land management. The first ban on slash-and-burn is articulated in Law no. 5 of 1990 Conservation of Natural Resources and its Ecosystems, but focused on protected areas. Law no. 31 of 2009 on Management and Protection states that it is illegal to open land through burning, and will lead to up to 10 years in jail and a fine of 10 billion rupiah (Faolex 2009). Most recently, in response to the transnational haze crisis, the 2015 Presidential Instruction Number 8 declared that on improving the control of forest and land fires there is a ban placed on clearing peatland. This instruction also declares that any entities responsible for slash-and burn practices would lose their concessions (APBI-ICMA).

5.5.1 Zero-Burn Policy

The fire-management regulation has received the most exposure is the Zero-Burn policy. The authors of this policy understand fire as a dangerous element and is capable of causing catastrophic damage, both on a local and an international scale. As such they try to eliminate any use of fire.

The organisation Fire Free Alliance reported a reduction in wildfire events since the 2015 haze crisis (FFA 2016). There is confusion as to the proper regulation of this policy, and since 2015 there have been reports of strict enforcement of the zero-burn policy, while in other areas the enforcement has been weak (RCA 2016; Dede Rohadi 2017). Cory Rogers reported in Mongabay that fire events will lead to the demotion of governmental, police and forestry officials leading to any detected fire being extinguished (Cory Rogers 2016). There is little clarity on the policies regarding small-scale farmers clearing existing productive land.

Farmers perceive this preventative policy to be a great burden. With an enforcement of the zero-burn policy small-scale farmers may allow uncontrolled fires to spread over areas of land as they benefit when this land is cleared by fire. Farmers have been reported remarking that unwanted fires from the 2015 haze were a 'blessing in disguise', as the newly clearer land offered new opportunities (RCA 2016).

5.5.2 Alternative land clearing

Parallel to the implementation of the zero-burn policy, alternative land clearing strategies have been promoted, involving cutting and gathering vegetation. The alternatives are expensive, labour intensive and provide none of the benefits of clearing the land with fire (RCA 2016; Ketterings 1999). Manual clearing takes 1-2months for the area that fire clears in a matter of days (Dede Rohadi 2017), and studies show that yield rates are lower on unburnt land (RCA 2016; Ketterings 1999) There have even been reports of local farmers abandoning their land due the expense in manual clearing strategies, leading to greater risk of wildfires as unattended land provides a great amount of dry vegetation in the summer months (Dede Rohadi 2017). Research demonstrates that there is a great disparity between the government non-burn policies and what is possible on the land (RCA 2016: 49). Farmers will not adapt to new approaches if it leads to a decrease in yield and an increase in labour and capital investment (Ketterings 1999: 138).

To incentivise alternative land clearing no-burn-rewards have been implemented, with villages that refrain from burning for a year receiving monetary privileges. The Fire Free Alliance leads the No-Burn-Awards with their initiative of Fire-Free-Village. The organisation provides visible rewards

through infrastructure such as roads, community halls, mosques and bridges (FFA 2016) and gifts that promote manual clearing of the land, such as hand tractors, are presented to village leaders (FFA 2016). The FFA have reported the difficulty in finding the balance between communities taking the initiative and too much assistance, the organisation explains that perhaps by being ‘overly paternal in its support and instruction’ they are ‘breeding dependency’ among villagers (FFA 2016).

Initiatives such as the Fire-Free-Village offer incentives to villages to spend a year without burning. The programme has had some success, but such strategies pose problems. Village elites may benefit from the rewards from refraining from burning, while others are affected on a household level.

6. Interviews

Seven un-structured interviews were conducted (1 in person; 6 over skype) with experts from CIFOR, WRI, SNV, Aidenvironment, as well as a professor from UNPAD. All interviewees had conducted, or were conducting field research regarding land management. The location of this research was not specific to South Sumatra, but the insights gleaned from the interviews are enlightening and transferable. The themes from the interviews are presented here, and the writing is generated from statements made from the seven un-structured interviews.

6.1 Fire as a tool

Two interviewees talked of fire as a tool, explaining how it is formally impossible to ban fire due to a general perception that fire is the most beneficial and cheapest land clearing tool. Without viable alternatives to burning, the zero-burn policy is unsustainable. If farmers do not have a solution they will abandon their land, which in turn leads to long-term social and environmental damage. While policy makers do not intentionally want to hurt farmers, they do not have an understanding that the household levels are diverse, and that fire is used with control. Therefore, the proper implementation of a zero-burn policy must be developed alongside an understanding of the contexts in which fire is more appropriate than manual clearing, and vice versa.

6.2 Fire: An Unsustainable Land Management Tool

Several interviewees stressed that fire is an ‘absolute no-no’ and ‘completely unsustainable’ and that there should be no nuance in the policy, but complete prohibition. According to one interview the character of Indonesian farmers is such that if they see their neighbours burning land, they will copy. He also explains that there is a tendency for farmers to start a fire and then claim it was not them, ‘throwing the stone and hiding your hands’.

Another interviewee explained that slash-and-burn, combined with shifting cultivation, once a sustainable technique, is no longer ecologically harmonious due to increased population and land competition. As such land management practises should adopt to the current situation. To facilitate this, several respondents stipulated, there should be increased productivity on the existing farmland before any expansion. As there is a lot of empty grassland/ scrubland, there is no need to encroach onto the forest, only to consolidate farming practises on the currently available land.

6.3 Knowledge

An interviewee with a long background in human ecology research explained that the adoption of land management strategies depends a great deal on cultural background. In his own research he found that Javanese migrants adopted an R-strategy of land management, that led to constant expansion of land to farm paddy fields. This was, in part, due to the essential role of rice in the diet. Contrastingly, Balinese migrants had a varied diet, and demonstrated themselves as K-strategists by consolidating in one area and diversify crops. This cultural difference of diet had a profound impact on land management, as the Javanese migrants were constantly encroaching into ‘undeveloped’ land.

Similarly, another interviewee explained to me that ethnic groups in Kalimantan, used to gathering from the forest, were unable to cope economically with the Javanese migrants that brought with them agriculture.

Several interviewees explained that often smallholder farmers are practising land management strategies without proper knowledge, and without realising that they break regulations, or are not operating sustainably. Sustainable land management also involves the use of fertilizer, but the right amount. Many farmers are dissuaded by the high price of fertilizer and the high prices of replanting palm oil, and are not farming with 'no clear planning'. One interviewee stressed that before expanding productive lands into forests, smallholders must improve farming techniques to consolidate the existing productive land to increase and maintain higher yields.

To raise awareness and add to knowledge on sustainable farming practises, organisations like SNV provide training to small-scale farmers, smallholders and large-scale agriculturalists and companies alike.

6.4 Land Ownership and Clear Mapping

In areas of land that have clear land ownership, such as where government initiatives have granted transmigrants 2 ha of land, there is little need for strict fire regulation as villagers control fire to prevent unwanted clearing. Contrastingly, forest buffer zones are a high-risk area for unwanted fire. In these areas there are no clear land titles, and often people take advantage of the lack of ownership to start clearing land for profit or for village use. An interviewee explained how one village head had admitted that up to 4,000 ha of forest had been cleared and converted into coconut plantations.

In this way drivers of deforestation come from the outside, and not from within the forest. The one-map policy is the precursor for establishing proper land ownership and without implementation encroachment into the forest will continue unabated.

A policy that can help local people by increasing their land security, as well as managing forests well, will be successful. An example of this is social forestry a, '100% important', strategy that allows communities access into forests to sustainably collect non-timber forest products. When a powerful income is created from these products, and trees become valuable outside of resource as timber, then it becomes impossible to cut down the forest. This method provides protection for the trees while offering low carbon development and promoting sustainable land management practises.

6.5 Economy as driver for unsustainable practices, and an Entry Point for solutions

In the interviews market mechanisms were described as a main driver of unsustainable and degrading land management strategies. For organisations concerned with social and environmental issues, they often focus too much on social or environmental justice, and struggle to work with local authorities. Aidenvironment and SNV have recognised that the key to collaborations with regional governments is a focus on economic development. In this way the economic factor is understood as the entry point into improving how people farm.

Oil palm is a lucrative crop with good yields and easily manageable, so feasible alternatives must be provided to make the switch to other crops easy. If you leave it to market mechanisms, then it is impossible for low carbon development. Market interventions from NGOs and government are required to facilitate shift in production. To facilitate this an important aim of SNV is to incorporate smallholders into the supply chain. Many markets now require sustainable products (e.g. RSPO). By including smallholders into sustainable, and economically stable, supply chains, they will have to adopt good land management practices. While met with resistance by some farmers, if organisations, such as SNV, can prove that sustainable practices are economically beneficial, then such schemes are adopted. In this way the organisations support economic development while achieving conservation of peatland and forests.

7. Results and Discussion

The desk review combined with the interviews highlights that while all five factors; environmental condition, regulation and perceived burden, economic pressure, cultural knowledge, land ownership, are all important when smallholders choose burning for land clearing, the most critical are economic pressure, land ownership, and cultural knowledge.

7.1 Economic Pressure

The global market demand for lucrative crops drives land conversion, with productive land increasing into areas of peatland and forest. In this scenario a global capitalist model has hijacked a land management technique that used to be sustainable, shifting cultivation and burning land through clearing, to one that does not respect natural processes, or characteristics of land that provide protection against uncontrolled burning, such as wetlands.

In attempts to follow the market, natural processes have been ignored and large swathes of land are converted for economically productive use. The data from the interviews corroborate this, and demonstrate that the understanding among organisations is that economic pressure is a crucial factor that leads to unsustainable practises. There is also an understanding that the economic factor interests farmers and local government, and by proving that sustainable practises are economically beneficially, interest is stimulated to adopt practises that are ecologically harmonious.

7.2 Land Ownership

Alongside economic pressure the status of land ownership is of vital importance in the choosing of land management technique. With uncertain land titling and no clear mapping, encroachment into areas of forest and peatland is commonplace with communities and private investors converting areas of land into productive economic areas. Data gathered from both the desk review and the interviews demonstrates that the status of land ownership is crucial when small-scale farmers decide on using burning as a land-clearing strategy. The evidence highlights that when land titling is uncertain, not only is burning a common strategy to clear the land, but unwanted and uncontrolled fire is allowed to pass over land that has uncertain or disputed ownership. By providing land security for small-scale farmers through titling there may be a large reduction in wildfire events without the need for FMI strategies.

7.3 Cultural Knowledge

How people understand land management through cultural knowledge is an important factor. The evidence highlights that farmers clear and treat the land in ways which are familiar to them. For many rural people burning has been a technique used for generations and they have an intimate relationship with the characteristics of fire, and take care when burning. For the people who perceive that fire works for them, resistance to new, unfamiliar, strategies is expected. This is prevalent if alternative

land clearing strategies offer none of the benefits of fire. Training is therefore required to demonstrate to smallholder farmers that sustainable alternatives are economically beneficial.

7.4 Solutions

Solutions that have the potential of addressing both factors and thus leading to sustainable land management techniques are that of social forestry and agroforestry. Through training and awareness of sustainable practises and incorporation into the supply chain these strategies can address economic pressure, land ownership as well as issues of social and environmental justice.

An agroforestry model that has dealt with issues of social and environmental justice is that of the Savannah Fruits Company in Ghana. Shea Butter has been used as a cooking oil and a cosmetic for generations, with women dominating the market. Savannah Fruits recognises this and is in partnership with 4950 women that manage land in a Community Management Resource Area to produce shea butter. Old trees are cleared to be used for biofuel, and the land is managed sustainably. The industry for shea butter is growing and brings \$260m a year to Ghana, as the 3rd biggest shea trader globally (Savannah Fruits 2017). By tapping into such a big market, projects like Savannah Fruits can be long-term, viable and economically prosperous, while offering sustainable management of the land.

While community forestry schemes have the potential to be successful, it is not so simple as just giving the land to communities and expecting them to manage land well and adopt sustainable practices. Rather there must be a deep understanding of the communities interaction with their land, as well as the power structures within the communities. Cultural differences of communities and their knowledge of the land may affect how they treat the land, and once land is given over village elites may use the projects to benefit themselves.

8. Conclusion

This paper has demonstrated a potential framework for examining the process of how small-scale farmers choose burning as a land clearing strategy by highlighting three critical factors; land ownership, economic pressure and cultural knowledge. The evidence presented has demonstrated that these factors are crucial when burning is chosen as a land clearing strategy. Through this analysis it is possible to offer potential solutions that can lead to the adoption of land clearing strategies that are suitable to the current land situation while minimising events such as the transnational haze crisis in 2015.

The potential solutions that may address the underlying factors that lead small-scale farmers to burn land and lead to sustainable land management are offering land titling and inclusion in sustainable supply chains. To fully implemented this the proposed One-Map Policy is essential. At the same time organisations can relieve the economic pressure, and weight of global demand that drives unsustainable practices by incorporating farmers into supply chains. This requires training and endorsement of sustainable knowledge, as well as demonstrating the viability of alternative land clearing strategies.

Campaigns such as the Green Land Growth Project in South Sumatra are admirable but to see success in the coming years there must be a sound understanding as to why small-scale farmers manage the land in a particular way, and how they can be incorporated into the overall aim of sustainable development and progress. In this way it will be possible to achieve equitable low carbon economic development while promoting social and environmental justice.

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Illustrations

Illustration 1. Ardiansyah et al 2017 *IOP Conf. Ser.: Earth Environ. Sci.* 54 012058

Illustration 2. Author's own illustration

Images

Image 1. Sapariah Satri. 2015. As haze chokes Sumatra, farmers ask Jokowi for greater land rights. [ONLINE] Available at: <https://news.mongabay.com/2015/09/as-haze-chokes-sumatra-farmers-ask-jokowi-for-greater-land-rights/>. [Accessed 13 December 2017].