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Disentangling the Role of Environmental Regime Complexes in Local Forest Governance:

A study on Individual Regime Influence and Network Structure in Riau, Indonesia

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No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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ABSTRACT OF THESIS submitted by:
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Short-sighted practices concerning the burning of forests and peatlands to clear land and change the land-use have been the norm in the largest tropical rainforests in the world, including in Riau, Indonesia. Air pollution crosses the boundary of Indonesia, calling for global efforts in mitigating forest and peat fires. Many international environmental regimes have been ratified to assist the improvement of environmental challenges, including the mitigation of fires. In this regard, the aim of this thesis is to disentangle the role international regimes once they are adopted at a local level by studying the influence of regimes' and structure. The purpose of disentangling is to optimise the potential of individual regimes and network structure. This research explores the pressures on tropical rainforests and the role of international regimes on local forest governance, both as an individual environmental regime and a collection of regimes, which is referred to as a regime complex. In order to address its objectives, the study used a mixed methods approach including spatial information processing, in-depth interviews and network analysis.

The results highlight that between 2011 and 2015, the important source of pressure that contributed to forest fires included palm oil plantations, timber and non-timber concessions and human ignition of peatlands. The ASEAN Agreement on Transboundary Haze Pollution (AATHP), the convention of biological diversity (CBD), the United Nations Framework Convention on Climate Change (UNFCCC), the palm oil certification regime (RSPO) and the wetlands regime (Ramsar Convention) were found to have the most significant positive effect. As for their aggregate effect, international environmental and environmentally-related regimes as a unified network structure has the potential to mitigate the risk of forest and peat fires. With high centrality around the AATHP and CBD, the network connections between the regimes can facilitate policy integration and coordination of information services and support across environmental regimes.

Keywords: Socio-ecological systems, spatial and temporal information, Geographically Weighted Regression (GWR), International environmental regimes, regime complexes, regime influence, network analysis

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List of Abbreviations

AATHP	ASEAN Agreement on Transboundary Haze Pollution
ACC	ASEAN Coordinating Centre for Transboundary Haze Pollution
ADB	Asian Development Bank
ArcGIS	Aeronautical Reconnaissance Coverage Geographic Information System
ASEAN	Association of Southeast Asian Nations
BNPB	Indonesia's National Disaster Mitigation Agency
	carbon stocks in developing countries
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species
	conservation, sustainable management of forests and enhancement of forest
Csv	Comma separated value
DoEF	Department of Environment and Forestry
ENSO	El-Nino-Southern Oscillation
ESRI	Environmental Systems Research Institute
EU	European Union
FLEGT	Forest Law Enforcement, Governance and Trade
GADM	Global Administrative Areas
GOI	Government of Indonesia
GWR	Geographically Weighted Regression
IMF	The International Monetary Fund
INRA	International Natural Rubber Agreement
ISCC	International Sustainability and Carbon Certification
ISPO	Indonesian Sustainable Palm Oil
ITTO	International Tropical Timber Agreement
LEI	Indonesian Ecolabel Institute
LIPI	Indonesian Institutes of Sciences
LULUCF	Land-use, Land-use change and Forestry
MEA	Multi-Governmental Environmental Organisation
MoA	Ministry of Agriculture
MODIS	Moderate Resolution Imaging Spectroradiometer
MoEF	Ministry of Environment and Forests
MoMF	Ministry of Marine Fisheries
MoNP	Ministry of National Planning
MoT	Ministry of Trade
NASA	National Aeronautics and Space Administration
NCCC	National Council on Climate Change
NFTP	Non-forest timber product
NGO	Non-Governmental Organisations
REDD+	Reducing emissions from deforestation, forest degradation and the role of
RSPO	Roundtable on sustainable palm oil
SES	Socio-ecological system
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UNORCID	United Nations Office for REDD+ Coordination in Indonesia
WRI	World Resources Institute
WWF	World Wildlife Fund

1. Introduction

The conversion of tropical rainforests and clearance of secondary vegetation are significantly responsible for the global emissions of greenhouse gases. Fire has been acknowledged as one of the most important disturbances regarding terrestrial ecosystems to alter and manage land for various purposes (Nunes *et al*., 2016; Pausas and Vallejo, 1999). Biomass burning in the tropics significantly contributes to emissions of heat-trapping gases and particulate matter in the atmosphere, which affects global temperature and climatic variability (Phairuang *et al*., 2016). Additionally, man-made fires to clear an area easily induce wildfires because of the abundant source of fuel and periods of drought in tropical climate (Herawati and Santoso, 2011). Avoiding forest and peat fires in tropical rainforests therefore represents a major argument for reducing forest loss, preventing ecosystem segmentation and limiting the contribution of climate change.

Moreover, the long-standing trans-boundary haze problem transpired results from the practice of biomass burning practice. As a consequence, the damage from biomass burning is not only in the form of idle agricultural activity, but also public health, and other economic impacts both in countries experiencing forest fires and their neighbour (Quah and Johnston, 2001; Quah, 2002; Madiyarso *et al.*, 2004). There is an urgent need to re-adjust the socioecological relationship amongst stakeholders in tropical rainforest, including the public in general, and the natural state of the rainforest.

Addressing an issue regarding the socio-ecological system requires the establishment of powerful social institutions. Scholars from the field of public policy and political science study the formation of such social institutions through regime theory. Regime theory encompasses a major understanding of what happens in environmental governance within various political landscapes. According to the theory, parties that share similar interests in a particular issue will

form a regime in order to work on the problems more closely (Mayer *et al.*, 1993; Mayer and Rittberger, 1993). In the field of forestry, like any other environmental issue, there have been numerous attempts by the international community to influence national and local governance through environmental regimes. Bearing in mind the nature of environmental problem that knows no boundary and the worldwide consequences of failing to demonstrate effective forest governance, there is a trend of transnational cooperation in bringing about change in both a global and domestic context.

1.1. Problem definition: Influence of environmental regimes on local forest governance

Different levels of willingness and capacity among parties to bring change to local forest governance turns environmental regimes in to the most dynamic ones. Performing at its best, a regime (by which it refers to a cooperative arrangement around an articulated multilateral environmental agreement, as defined later) can be fully integrated in to the national and local context through comprehensive regulations. Conversely, a regime can also end up having an alienated collection of institutions and regulations with the minimum delivery of agreed actions (Alter and Meunier, 2009). A regime complex is a situation where the translations of regimes is somewhere between the ideal and the least favourable scenario (Keohane and Viktor, 2011). In addition, environmental regimes that are imposed by national governments can also turn into complex ones; they can grow stronger and more effective over the years, while several others are softened from the beginning.

In line with expanded organisations, approaches and financing mechanisms in attempt to improve forest governance in the tropics, a collection of environmental regimes is growing to be more complex. The interest and powers of dominant actors in local governance brings international environmental regimes to bear on entrenched economic and development interest.

As more international environmental regimes are established (Joyner, 2004; Meyer *et al.*, 1997; Mitchell, 2016), it is essential to investigate if and how the regimes can influence domestic governance in safeguarding a specific environmental problem related to forest governance. In this thesis, I will map the current structure of the collection of international environmental regimes in Indonesia, as these regimes are used to guide the effort to mitigate forest and peat fires. I will also analyse how each regime influences local forest governance as individual, and as a network.

1.2. Research scope

This thesis focuses on tracking the way international environmental regimes shape forest governance, in particular to mitigate the forest and peat fire, in Riau, Indonesia. Located exactly on the equator, Indonesia is endowed with one of the most extensive tropical rainforests areas in the world, giving rise to the possibility that it will become a global sink to balance carbon emissions (Margono *et al.*, 2014). The current situation regarding forestry in Indonesia, however, is very different to what was portrayed in the literature published several decades ago (Margono *et al.*, 2014). Riau Province alone, with one of the highest rates of deforestation in Indonesia, has lost more than 4 million hectares of forest in 25 years (Uryu *et al.*, 2008). Peatland and forest fires are known to be the principal contributors to the process of forest clearance in many parts of Indonesia (ADB, 1999; Page *et al.*, 2002). With the rise of international environmental regimes, there seems to be a gap between the negotiation stage of international agreements and its adoption process in national and local level.

Following the principle of *pacta sunt servanda* (Latin: “agreements must be kept”), countries that have signed and ratified multi-governmental environmental agreements (MEA) hold the duty to comply with and enforce the rules (Abbott *et al.*, 2000). Following the logic of the principle, this thesis narrows down the observed regimes only based on the ratified multi-

governmental environmental agreements (MEAs) agreed to by the Indonesian government, as well as those of which are relevant to the pressures on tropical rainforests in Indonesia. The research also analyses the network of various environmental regimes to help tease out how the social structure of environmental regimes and relations amongst them influence forest governance; and how the adopted international environmental regimes are being positioned by national and local governments. The mentioned scope is meant to bring the abstract concept of regimes into a practical setting, where regimes can be articulated only in favour of certain stakeholders. Simultaneously, the scope of this research allows a synthesis from looking at the collective environmental regimes governing effort at local forest governance.

1.3. Research aims and objectives

The majority of the literature and preliminary content analysis of various regimes points out the increasing number of international agreements, treaties and conventions around the issue of forestry and land-use change have created regime complex (Edwards and Giessen, 2014; Rayner *et al*., 2010). Based on the present literature review, there has not been an integrated regime governing effort that actually discusses the complexity of mitigating forest fires in tropical rainforests where international environmental regimes attempt to influence policies across various sectors to improve local forest governance. Moreover, much of the literature only discusses the concept of international environmental regimes in a theoretical realm.

While there is copious literature regarding the application of environmental regimes in biodiversity and protected areas, there are few academic articles discussing the role of regime complexes related to tropical rainforests governance, let alone the role of regimes in mitigating forest and peat fires. The lack of systematic attention to interactions amongst environmental regimes in tropical forest governance and the influence a collection of environmental regimes have on local forest governance leaves both a gap in the theory and in our understanding of

policy practice on the ground. Building on the observed gap, this research aims at disentangling the role of international environmental regimes on local forest governance in mitigating forest and peat fires by studying their influence and structure. Drawing from the all-encompassing research aim, several research questions are set in the following manner:

1) In order to focus on the pertinent environmental regimes that are potential in mitigating forest and peat fires, what are the main threatening pressures on tropical rainforests in Riau, Indonesia?
2) How do local authorities, experts and civil society make use of individual international environmental regimes to guide policies and mitigate the issue of forest and peat fires in Riau, Indonesia?
3) What insight can be gained from the implementation of various international environmental regimes, as a collective governing system, to mitigate forest and peat fires in Riau, Indonesia?

To help improve the understanding of the role of international environmental regimes in local forest governance, a literature review, field observation, and in-depth interviews with stakeholders were conducted to connect theory and policy practice. Under an overall framework, which includes the objectives and theory, this research employs various qualitative and quantitative social science approaches, network theory and analysis, and spatial information with regards to the issue.

1.4. Audience

The research will potentially be of interest to stakeholders who play active roles in ensuring the improvement of forest governance in Indonesia—a country that holds one of the largest areas of tropical rainforest.

First, international and donor organisations will be able to gain insight into the way international environmental regimes are treated in the local context. This thesis allows international organisations to receive feedback concerning the current regimes arrangement, as well as the whole process of mainstreaming and measuring the impacts of a number of international environmental regimes in mitigating a specific cause.

Second, national and local authorities will be provided with reflective input to understand the challenges in adopting and implementing MEA under the decentralisation and current political landscape. The research also taps into various potential opportunities in strengthening the adoption of some environmental regimes while expanding the coalition to improve the operation of MEAs amidst the temptation of gaining short-term unsustainable benefits from the tropical rainforest.

Third, civil society and NGOs that safeguard their rights to an enhanced environment in their city, specifically in Riau, Indonesia will be able to understand the way international environmental regimes are treated pursuant to the mitigation of the forest and peat fires. Hence, they will understand what to expect from the local authorities and the private sector.

Finally, the thesis will be of interest to researchers and fellow students whose works focuses on environmental regime theory, the analysis of environmental commitments, and the network analysis in environmental systems and governance.

1.5. Thesis outline

The thesis is organised in to 6 chapters and structured in the following order:

Chapter 1 provides an introductory overview of the problem to be addressed in the research and focus of the study. It also offers insight on who will be the potential audiences in relation to this research.

Chapter 2 is a review of the relevant literature on environmental regime theory, including key concepts, such as socio-ecological systems, regime theory, interest-based bureaucratic politics, and network analysis. It also summarises the reviewed literatures in a diagram which helps to trace back the theories and rationalisations that build the analytical framework of this thesis.

Chapter 3 attempts to describes the problem and research questions from the point of view of national and local interests in tropical rainforests. It provides details of a selected case study in exploring the research aim and questions.

Chapter 4 explains the methods adopted to collect, produce and analyse data in fulfilment of the research aim and questions. It explains three different most advanced techniques in its respective fields that are employed to answer each research question.

Chapter 5 presents and discusses the results of the research in relation to the analytical framework, which also answers the research questions.

Chapter 6 addresses the findings and insights of the study together with recommendations for future research.

2. Review of the State of the Art

The literature review takes some steps towards coming to terms with a dynamic in local environmental governance stimulated by international environmental regimes. It begins with the concept of a socio-ecological system (SES), and is followed by the state of literature regarding international environmental regimes: the origin of the concept, application in the environmental arena, and contemporary development in the theory of international environmental regimes. It lays out the premise of international regime theory that has been introduced in the discourse of environmental governance.

The text also elaborates the phenomenon of regime complex which occurred after the multi-governmental environmental agreements (MEAs) were ratified, which is also expected to occur within the forest governance in Riau, Indonesia. It further sheds light on how the relevance of the problem and political actors' interests and capacities in the regimes are two important catalysts for the international environmental regime to have an impact regarding delivery outside the negotiating table. Finally, it elucidates the concept of network analysis to better understand the discussion of the results, where the results of data analysis indicate that a collection of environmental regimes that has the potential to interact among them, instead of individual isolated regimes, shapes the forest governance.

The analytical framework in relation to this research project is rooted in this literature review. The literature review contains a summary of existing knowledge regarding international environmental regimes. Rooted in the literature review, the framework analysis of this research attempts to shed light on the empirical analysis of environmental politics. A minimum of ten manuscripts, including articles, journals and books were reviewed for each section with the aim of building extensive theoretical support that brings in unexplored points of view on international environmental regimes. The pertinence of the reviewed documents was based on

the title, abstract and foreword with the further selection of the items based on relevant in-text keywords and concepts.

2.1. Social-ecological systems

The interaction between humans and the ecological landscape has become inseparable in this century. This requires a pledge from science and society to apply integrated perspectives and solutions on the pressing challenges upon an increasingly occupied environment. Ecological inquiry at any level, magnitude, and impact stands in need of advancement in systems science (Bertalanffy, 1968**).** In growing number of cases, the challenges humans place on the natural state of the environment can no longer be dealt with in isolation, but must be placed in the context of global environmental change and the global economy (Mauser *et al*., 2013). Hence, in line with the emergence of 'sustainable development', a central concept adopted in the discourse of overlapping economic, social and environment needs, we have social-ecological systems (SESs) (Rice 2013). In addition, novel forays to understand the insistence on the inseparability of societal and ecological systems are promulgated in the concept of SESs.

Many scholars have attempted to interpret and develop the concept of SESs based on various theories, such as the self-contained ecosystem, process analysis, spatial mosaic, and several others (Duncan *et al.* 2015, Holling 1973, Holt *et al.* 2015, Walters 1971). In spite of the assumption from the early conceptual development that SESs are entirely deterministic and quantifiable, there is a rising cognizance that SESs are ruled by multi-scalar factors that require appreciation of different knowledge systems and networks of both its small and large components. At this juncture, in relevance to this thesis, the definition by Janssen *et al*. on SESs is adopted. SESs, which in the context of this thesis are the tropical rainforest, are regarded as:

> *"Systems that are consisted of biophysical and social components where individuals have self-consciously invested time and effort in institutional infrastructure that affects pattern of outcomes achieved over time in coping*

> *with diverse external disturbances and internal problems* (Janssen *et al.* 2007)."

The idea that a complex system continuously undergoes changes in a highly uncertain environment stimulates many conceptualisations of SESs' attributes, which seek to explain the components and interactions between social and ecological systems (Berkes *et al.*, 2003). The attributes of SESs, such as resilience, adaptability and transformability are pivotal and deterministic with respect to planning and managing the systems (Walker *et al.*, 2004). The resilience of a system becomes an emerging core idea, as the predictability of a collapsing system caused by either minor or major disturbances is deemed insightful in conservation and resource management. One system, subjected to particular amplitude and the type of disturbances, can still retain the same functions it originally serves (Holling, 1973; 1996). The maximum amount a system can be changed from its modal state in order to tolerate and cope with the disturbances may or may not allow the system to be more adaptive and/or susceptible in the future (Carson and Doyle, 2002). In other words, the brittleness of a system which occurs due to its adaptive capacity reveals how a system cannot be robust for even a similar disturbance at a different point of time, let alone another type and degree of disturbance.

As the exploitation and growth phases of SESs combine into the conservation phase, resources are restrained, and the systems are reasonably less responsive to external disturbance (Walker *et al.*, 2004). Such a seemingly predictable state, borrowing the explanation from Walker and Holling, is inevitably followed by chaotic collapse and a release phase that leads to a phase of reorganisation (Walker *et al.*, 2004). Although the cycle does not necessarily happen in the aforementioned order, adaptability plays a key role in ensuring the survival of SESs. This is when the actors come in to manoeuver the failing SESs. Despite what Levin implied concerning a typical virtue of an adaptive system that is self-organising without intent (Levin, 1998), the dynamics of SESs prevail over actors who do reveal and manifest their interests. The intents

and interests of the actors in SESs intentionally or unintentionally drive collective capacity in resilience management. Furthermore, adaptation to variability entails the capacity of actors in the system to influence resilience.

There is a similar involvement regarding the intent and interests of the actors in determining the transformability of SESs. The capacity to create a fundamentally new system at times when ecological, economic, political and social conditions become unsound for existing SESs (Beisner *et al*., 2003) is mainly a function of the social component. Four attributes of SESs discussed above are, to some extent, designed and influenced by humans. Drawing from the concepts above, the domination that actors establish on SESs to maintain sustainability brings about several implications in relation to the interpretation of SES dynamics. There should be a changing focus of the actors in SESs: from seeking maximum states, which generate Pareto-optimal outcomes, to guiding SESs to achieve their yield of optimum resilience components through adaptive resource management and governance.

2.2. Regime Theory in Environmental Governance

Acknowledging the involvement of actors in the resilience management of SESs produces broader opportunities and challenges in natural resource governance. The forces that the actors impose on the management of SESs through patterns of behaviour exhibiting their intentions, are influenced by, and are affecting the use of certain normative values. Characteristics of the patterns of behaviour reinforce the converged expectations over SESs. In the context of the tropical rainforests governance issue, both normative significances and shared expectations extend beyond the priority of local civil society, which has to deal directly with the SESs. They must not be based on self-interest alone, but also rooted in a broader social environment that nurtures the conditions required for functioning tropical rainforests.

Amidst unprecedented changes in major aspects of the biosphere, including the atmospheric climate system, the marine system, soil nutrients and biodiversity crises (IPCC, 2014), growing international concern about the environment is not incidental. These biophysical alterations and the impaired restorative capacity of nature in lieu of our resource-intensive economies, have inextricable impacts on the socio-economic stability of many countries. There is a global trend of cooperation in mitigating the drivers of change, so that pressure, state and impact on the environment can also be subsequently improved (Carr *et al.*, 2007; Kristensen, 2004). In order to monitor the state of the global environment and make constructive progress, cooperation among actors to mitigate multi-faceted trans-boundary issues, such as the environment, is required. Addressing an issue regarding SESs, where geographical boundaries of environmental change are impossible to draw, requires establishments of powerful social institutions. Hence, scholars from the field of public policy and politics have encapsulated the formation of such social institutions in an international regime theory.

International regime theory encompasses a major understanding of what happens in global environmental governance in various political landscapes. The theory contends that states, which share similar interests in an issue, will form a regime, in order to work on problems more closely (Mayer and Rittberger, 1993; Meyer *et al.*, 1993). To hasten the concern, states build regimes to bring about benefits from cooperation e.g. reduced costs from conducting projects, a set of priorities regarding the issue, credibility of actions taken by parties, and compliance monitoring (Keohane, 2003; Keohane and Nye, 1977). A regime itself, as elaborated by Le Pestre is defined as:

> "*A set of interrelated norms, rules, and procedures that structure the behaviour and relations of sectors so as to reduce uncertainties they face and facilitate the pursuit of a common interest in a given issue area*" (Le Prestre, 2002).

As opposed to the conventional structural realist arguments from the field of international relations, which view regime as an unexpected phenomenon that requires careful explanation, this research considers regime as a fundamental assumption in international affairs (Keohane, 2005; Krasner, 1982; Milner, 1992; Strange, 1983; Young 1991). This research treats regime as a basic formulation that is supposed to reinforce patterned behaviour reflecting intents and calculations of interests. In this vein, the upsurge in international environmental regimes happens as environmental issues are framed as problems of collective concerns and actions among sovereign states.

In agreement with regime theorists from the field of international relations, game theory political economy also gives us the lowdown on global cooperation in mitigating environmental issues in a local political setting. Actors tend to cooperate with each other because of the long-term benefits (Finus, 2000). Adherents of public cooperation at local and national levels to the duties of the prescribed regime duties explain that a certain environmental issue has been a concern, par excellence. Such cooperation exists by building reciprocity to construct its own social norms (Gsottbaeur and van den Bergh, 2011)

2.3. Environmental regime complex

Based on the all-encompassing definition and understanding, the concept of regime can be practiced flexibly given that norms in the environmental governance are problematic to define. Norms as standards of behaviour in terms of rights and obligations within global environmental governance are still undergoing contestations (Okereke, 2008). Moreover, as the regime is made of multi-lateral agreements, the rules and decision-making procedures are very much dependent on codification of negotiations that evolve throughout the process of converging expectation (Chasek *et al.*, 2013; Keohane and Viktor, 2011; Young, 1997). The nature of an

environmental regime is developmental, which can yield gradual progress or an irreversible overreaching impact on the environmental governance (Young, 2010).

Without putting aside the concept of 'governance' in the analysis of global environmental governance and politics and the importance of putting the theories of SESs and regime elaborated thus far in to practice, this research also includes the interpretation of the term 'governance'. Although there are multiple perspectives to the term, they suggest a continuum system of governing, beyond government, intended for resource allocation and coordination (Rhodes, 1996). The system authoritatively considers that the main actors are bureaucrats, although they are not necessarily the only participants; non-state actors play important roles in the creation and maintenance of environmental regimes at the local level.

The complexity of powers and interests of the dominant actors in global and local governance came late to the environmental scene, which explains why transitions and the improvement of SESs cannot be simply achieved once the international environmental regimes are introduced. Transitions are supposed to cascade in human-environmental interactions subsequent to the shifts happening on the national and domestic level once international regimes are introduced. Following the adoption of international regimes, transitions are supposed to be reflected in societal behaviour through an adjustment in government in the first place—as the authorities are the regimes' first point of contact and determine the implementation of such regimes.

Although the application of the regimes and their impacts has varied due to the diverse level of compatibility, willingness, and capacity among parties to bring change on a state level, environmental regimes are the most dynamic ones. Many of the impediments of productive measureable improvement in the environmental field at local level occur because of the instinctive nature of the political and economic landscape—for instance, malicious intentions perceived by other governments, or an unsustainable decision that appears otherwise

(Carpenter, 1998). The malleable and prone-to-power-and-interest feature of a regime, amongst many operational reasons, has bogged down the success of a regime in having an impact at the local level.

Incorporating the environmental regime into state regulatory bodies and regulations is a challenge for all regime parties in both developed and developing countries. Due to the various influences each regime brings, there is an increasing yet overlooked concept of *regime complex*. At its best, a regime can be fully integrated into the context through comprehensive regulations. Conversely, a country can also end up having an alienated collection of institutions and regulations with minimum delivery of the agreed actions (Alter and Meunier, 2009). In between two extremes, there is a broad range of semi-hierarchical regime translations, where the variety of regulations and institutions are loosely coupled (Keohane and Viktor 2011). Regime complexes are located in the middle of the continuum, as described in **Figure 2.1** below.

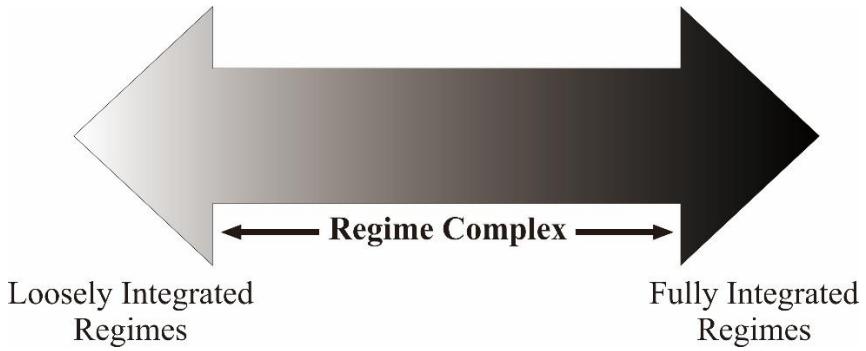


Figure 2.1. Visualization of Regime Complex

An inherent ambiguity has existed ever since the international regime was chosen to be one of the mainstream discourses in relation to restoring global environmental conditions. Recent scholarship has characterised the regime as an international forest regime complex consisting of a number of partly competing or partly reinforcing regimes (Art *et al.*, 2013; Gluck *et al.*, 2010; Humphreys, 2006; McDermott *et al.*, 2010; Rayner *et al.*, 2010). Such regime

complex, although unwanted, was somehow predicted to occur during the adoptions. Regime complexes can be identified from the vague connections they have with existing regimes. Furthermore, regime complex weighs down the positive change the regimes offer by some legal inconsistencies (Raustiala and Victor, 2004) and a lack of architecture telling the overall picture of the governing structure.

2.4. Influence of international environmental regimes on local setting

To counterbalance the phenomenon of regime complex in the application of international environmental regimes, many scholars have been developing the concept of regime effectiveness (Miles *et al*., 2002; Underdal, 1992; Young, 2001). The big concept of regime effectiveness points out the complexity of assessing the performance of regimes. Effectiveness is relative to several factors, which cannot be measured instantly, revealing regime performance on the spectrum ranging between the no-regime counterfactual and the ideal optimum outcome (Mitchel, 2008; Underdal, 2008; Young, 2011). The order of complexity is still multiplied by the fact that ideal optimum is a function of collective outcome (Hovi *et al*., 2003) from a nexus of critical area of governance—agriculture, trade, environmental protection, etc., assumption on no-regime counterfactual can be assumed nil. Nevertheless, it does not provide an insight into how existing local interest is regarded in relation to the international recommendations. The difficulty of modelling the most effective outcome led those influenced by the proponents of regime effectiveness theory to choose expert valuations of optimum solutions instead of utilising theory (Bernstein and Cashore, 2012).

This research offers a less ambitious concept of the international environmental regimes' impacts on local forest governance and directs attention to regime influence. Within the aim and objectives of this research that focuses on how certain regimes shape domestic forest

governance, regime influence facilitates a more practical and rapid analysis of the combined effects of networked environmental regimes on local practices and policies.

There are international environmental regimes that although demonstrate a strong initial impact, decline in performance over time. However, a number of international environmental regimes that are imposed can grow stronger and more effective over time from the time they are initially established. Many others are thawed from the beginning; whereas the rest which are ineffective at the beginning, gain success with the passage of time. The following subsections briefly argue that there are two main dimensions which determine how influential an international environmental regime can be in shaping local environmental governance: the problem relevance and actor's interest.

2.4.1. Problem relevance

The difference in relevance, hence the acceptance and impact, of an international regime in any given domestic context, principally depends on the problem relevance (Krasner, 1983; Le Pestre, 2002; Young, 1989). Due to the regime theory, in order for an international regime to contribute to a cause, it needs to have high problem relevance pertinent to an issue that is of the country's priority. Relevant regimes that are considered to be of importance in a domestic context make a difference beyond the outcomes, but also in terms of solving the root of the problem (Young, 2011) faced by the country.

It is therefore important to step back and examine the bigger picture that is occurring at the local level; its driving forces, pressures, impacts and current responses. Despite the universality of the international environmental regimes, several aspects can only be relevant within particular territory due to biophysical features. For instance, addressing the issue of forest fires in Canada would not be undertaken through all the regimes that function well in tropical

rainforest. In contrast, it is also common to see some regimes, which have high problem congruity and no biophysical boundary, are not applied domestically.

2.4.2. Actor's interest and capacities

The second dimension of regime influence in a domestic context is based on the actor. Without reducing the meaning of governance and role of community in SESs, in this context actors refer to officials who own political and legal authority to be the regime's point of contact, business sectors, NGOs, and other parties that can make some changes accordingly. The actors' interests and capacities to operationalise a particular regime to some extent reflect the degree to which actors are going to participate. Based on the characteristics and power each authority, agency and organisation will vary in their delivery of impacts for a particular regime (Abbott and Snidal, 2009).

According to the interest-based bureaucratic politics theory, a regime can be made relevant in a given domestic context due to active use by domestic policy even if the problem the regime is trying to address does not pertain to the country in question (Krott *et al.*, 2014; Krott, 2005; Peters, 2010). An environmental regime can function as a platform to promote socialisation through which actors can express their ideas on an environmental problem. In the long-run, consistent treatment on a certain regime can produce a common perception of solutions on a particular issue (Smouts, 2008). This can be conducted without making any reference to the problem relevance; and moreover, international policy issues may be avoided or made available according to the interests and domestic political agenda of powerful actors.

2.5. Network analysis: Theory and application

There is a big temptation to approach the collection of novel social institutions like international environmental regimes with a static term, by isolating the problem from the impact of regime's

individual and collective presence. While the preceding section shows how an individual environmental regime influences local governance through a combination of problem relevance and actor supports, the use of network analysis in this thesis further examines the potential for making several interventions based on the existing relations between the influence of each environmental regime. The prospect of network science, the emerging field of study, helps to study empirical studies relating to network-based policy networks, including the management of environmental systems and mitigation of an environmental issue.

Interest in the field of network science has been growing recently. In fact, a journal dedicated to the field of network science, "*Network Science*" published its first issue in 2013. Despite the overlap in research themes regarding network analysis application, a major statement made by Brandes *et al.*, as the main editors of the newly established journal, elucidates their view on network science as:

> *"The study of the collection, analysis, and interpretation and presentation of relational data"* (Brandes *et al.*, 2013).

It proves that network science is relevant across multiple-disciplinary boundaries. The scientific commonality of network science was realised in the middle of the 1990s, as it is capable of addressing deep and complex questions about human, economic, social and biological systems that unveil scales and variations of dependencies (Berkes *et al*,. 2003; Levin, 1998). The deepest underlying argument in network science that unites various branches of the discipline is a conceptualisation that appears at the stage of research hypothesising, before there is anything to analyse at all; that the organisation is well connected. Therefore, it builds upon assumptions that a collection of networked regimes must showcase a causal pattern based on relations and associations between elements of the problem (Marin and Wellman, 2010).

Pertaining to the existence of network science, there are a few basic features that are essential in describing and presenting a research question or phenomenon. The minimum features related

to network structure include at least some individual elements (nodes or network members), some pair-wise relationships between the elements and a large-scale pattern that should paint the overall network structure (Borgatti *et al*., 2009). This network structure hinges primarily on the relationship among involved parties or elements. These relational data should be based on the specification of the phenomenon represented in data, via observations or measurements, depending on the nature of the phenomenon, which is necessarily disciplinary (Robins, 2015). A specification is subsequently abstracted in to a more general pattern, where relational data form a substantive conceptualisation.

In the field of environment and natural resource governance, network theory has begun to be applied, yielding several studies of various social-ecological phenomena in management units interacting within and/or across geographic boundaries, sectors and levels of governance (Carlsson and Sandström, 2008). The inseparable, dependent character of any SES expands the notion of environment and natural resource management and governance. Attention is therefore directed to understanding the new concept of governance, including the renowned co-management and adaptive governance, as an institutional response to governing the dynamic of SESs (Armitage *et al.*, 2009; Folke *et al*., 2005). Thus, networks allows us to comprehend the governance system and suggest an effective enforcement and compliance with the agreed environmental regulations (Scholz and Wang, 2006).

However, the focus of recent research in policy networks, network governance and the environment, and the natural resource system principally highlights the relevance of network governance in pushing the impact of governance structure (Berardo and Scholz, 2010; Sandtrom and Carlsson, 2008; deLeon and Varda, 2009; Robins *et al*., 2011). The discourse using network analysis on environmental governance, still lacks empirical studies to date, and

rarely have structural characteristics that are explicitly measured and formally analysed (Robins, 2015).

Although the network structure is not of major interest in isolation, social-political processes occurring in environmental governance are always treated as the main object of observations (Bodin and Crona, 2009). Nonetheless, not all networks are applied and implemented equally. Quite the opposite, the structural pattern regarding the relations of a network brings significant insight on how actors rule the influence of certain social institutions, so as to manage environmental issues (Bodin and Crona, 2009). Taking network analysis seriously calls for an understanding that is further than the attributes of social elements. It is interested in the measurement of network characteristics, such as network centrality, density and inter-connections; those of which describe the relations among elements. The theory argues that the causation is not primarily possessed by the characteristics of the social element, but also the relations among the parties.

Investigating both attributes of each individual element and the potential relationship among the network structure is thus essential. Therefore, the influence of both individual and collective environmental regimes should be described thoroughly, as it underpins the reasons whether, as individual and unified structures, the network of regimes strengthen or hinder the delivery of the regime's positive influence.

2.6. Summary of literature review and the proposed analytic framework

In spite of evident degradation in the quality of tropical rainforests, there are positive global initiatives and efforts to mitigate the problem. There have been increases in the number of international environmental regimes and global concerns regarding unsustainable economic practices, which potentially influence local forest conditions. International environmental

regimes and forest-related regimes have been extensively studied for more than three decades (Edwards and Giessen, 2014; McDermott, 2012; Meyer *et al*., 1997; Sprinz 2005). Much of the discussion, However, with a few exceptions the discussion is focused on the importance of the regimes application and importance in the global and multi-lateral context.

This research attempts to provide insights into the combined effect of environmental regimes on existing local governance by studying regime influence. It analyses the varied influence of environmental regimes with regards to two proposed dimensions: problem relevance and the actors' interest. The way individual environmental regime is positioned on local forest governance is in line with the influence it potentially brings Investigating the influence of individual regimes is a prerequisite for studying their implementation in depth and researching their interplay and collective influence on local forest governance.

Owing to the concept of network science, we can advance the discussion of regime influence beyond the context of individual regimes, as a group of regimes that has relational ties among themselves. The hypothesis for last part of the research, by reason of network concepts (Bodin and Crona, 2009), is that the more environmental regimes involved in the effort of advocating environmental challenges, the more joint projects can be empowered to influence local governance. The hypothesis seeks for explanation through statistical examination of collected data from interviews and document analysis. This needs to be conducted for knowing the kind of structure of environmental regimes bring the potential impact on local forest governance.

In the long run, the way international environmental regimes are positioned, both as a group and individually, may create discourse that produces a common perception of the issue area (Smouts, 2008). The combination of network analysis and regime influence assessment can therefore lead to a new perspective on the potential utilisation of international environmental regimes to achieve positive change in local forest governance.

Figure 2.2 presents the conceptual framework for this research. The arguments in this research are built from various strands of research drawn from books and journals over a period of time. The references include both the fundamental theory, as well as the advanced version that have been developed over time. In order to track down the validity of the arguments made in Chapter 2 and how arguments are presented in each of the sections, **Figure 2.2** is provided.

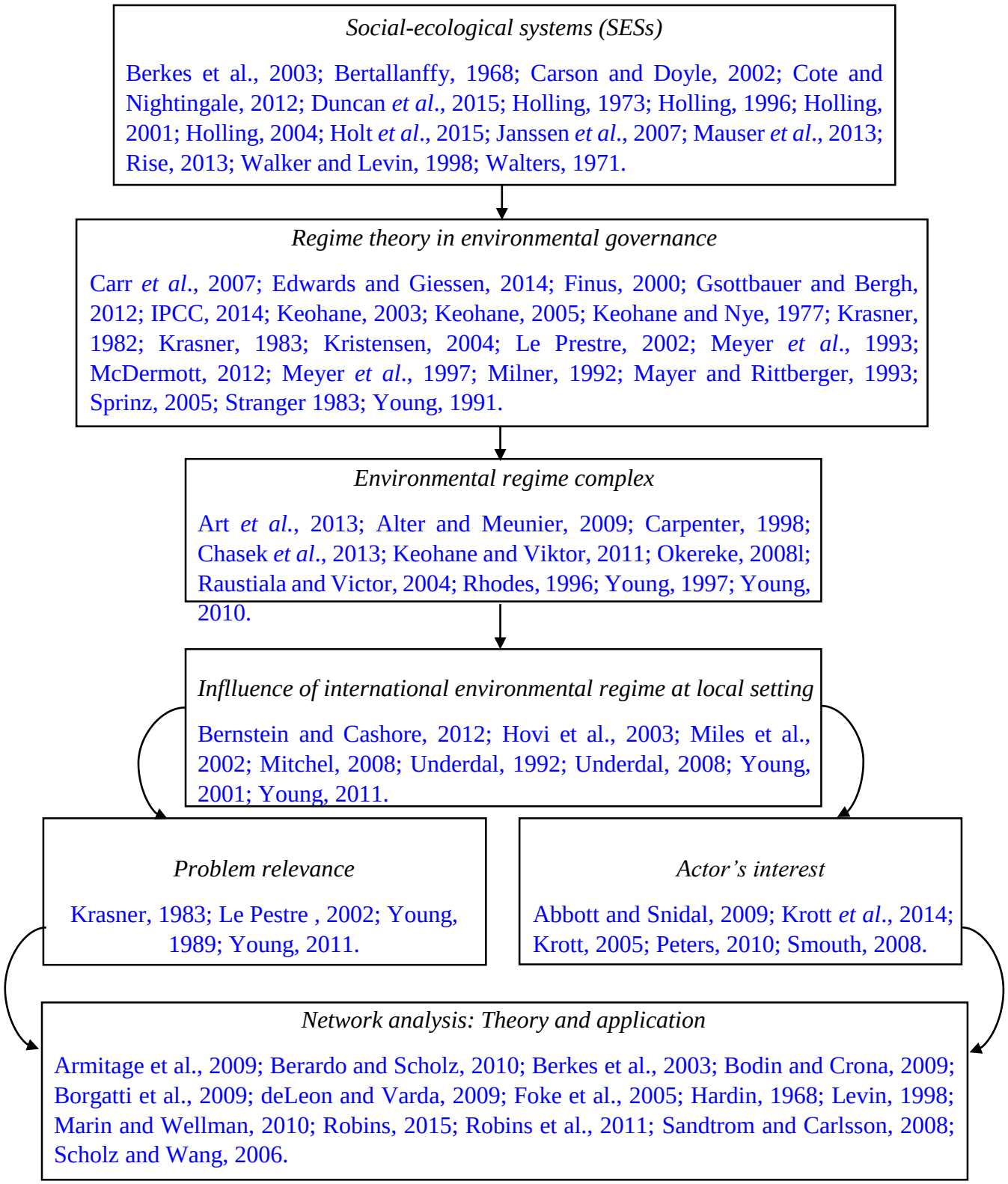


Figure 2.2 Schematic representation of the initial literature review for conceptual framework of this research

3. The case: Man-made forest and peat fires in Riau, Indonesia

To place the preceding discussion into perspective, this chapter elaborates the case of local forest governance in Riau, Indonesia. Tropical rainforests in Indonesia are the keystone of civilization and a source of livelihood for many generations. With decentralisation now established in Indonesia, the implication of local autonomy in land and forest management is regularly overlooked. The deforestation continues to occur as the pressure on the forests increases. In line with the amount of land required to support not only the basic needs of the people, but also additional new economic activity on the land with the purpose of generating higher monetary returns, tropical rainforests transformation has been a persistent issue in Indonesia, since the early 1970s (Sahide and Giessen, 2015; Steffan-Dewenter *et al.*, 2007). This is particularly so in Riau province, where many of the illegal practices including man-made forest fires to clear out primary tropical rainforests have been noticed (McCarthy, 2002).

This chapter is primarily historical and descriptive, but nevertheless offers a basis for the possible implications of alternative actions in the future. It highlights the background to the persisting issues regarding forest governance, covering previous national programmes on land-use change that shaped the local forest governance, historical establishments of several cornerstone regimes, the current disgraceful rate of deforestation, as well as timber and non-timber export booms in Indonesia. The author also argues that a number of sporadic economic activities have strong associations with man-made forest and peat fires. The discussion will pre-select the international environmental regimes that have the potential to regulate the transformation of tropical rainforests and improve forest governance.

3.1. Provincial and country background of Riau, Indonesia

Located on the Equator, Indonesia has one of the largest tropical forest areas in the world with high soil fertility and biodiversity-rich habitats. Comprised of tropical rainforests, the country has the potential to be a biodiversity hotspot and the capacity to be an essential carbon sink (Anwarie *et al.*, 2010). However, ultimately, instead of serving as the heart of ecological diversity and functioning as a global cooling asset, tropical forests with no visionary forest management in place, have established peat and forest fires that threaten the health of living species, including humans. In 1991, the forest covered 64.4% of the land in Indonesia (World Bank, n.d.). Returning forest cover to the same amount that was in place a quarter of a century before will be an immense challenge, considering the rate of deforestation in the country, which by 2012 was experiencing an annual primary forest loss of 840,000 Ha (Margono *et al.*, 2014).

It is worth noting that peatlands are one of the most significant features in the tropical rainforests in Indonesia (Usup *et al.*, 2004). Tropical peatlands have a considerable effect on regional and global environments, providing an extensive range of products and services that are important for the welfare of wildlife and maintenance of environmental stability in the tropical rainforests (Maltby and Immirzi, 1996). Tropical peatlands are one of the largest near-surface reserves of terrestrial organic carbon and their stability therefore has important implications for climate change (Page *et al.*, 2002). Extensive peatlands in Indonesia, as confirmed in **Figure 3.1**, are a primary storage for carbon in Southeast Asian countries due to their sequestration function. Conversely, being the largest tropical peatland in the world (Jaenicke *et al.*, 2008) with no strategic management poses fatal consequences not only for Indonesia, but also several neighbouring countries. Situated in between the Pacific and Indian Oceans, Indonesia connects both the benefits and consequences of having tropical rainforests and peatlands to a number of other countries.

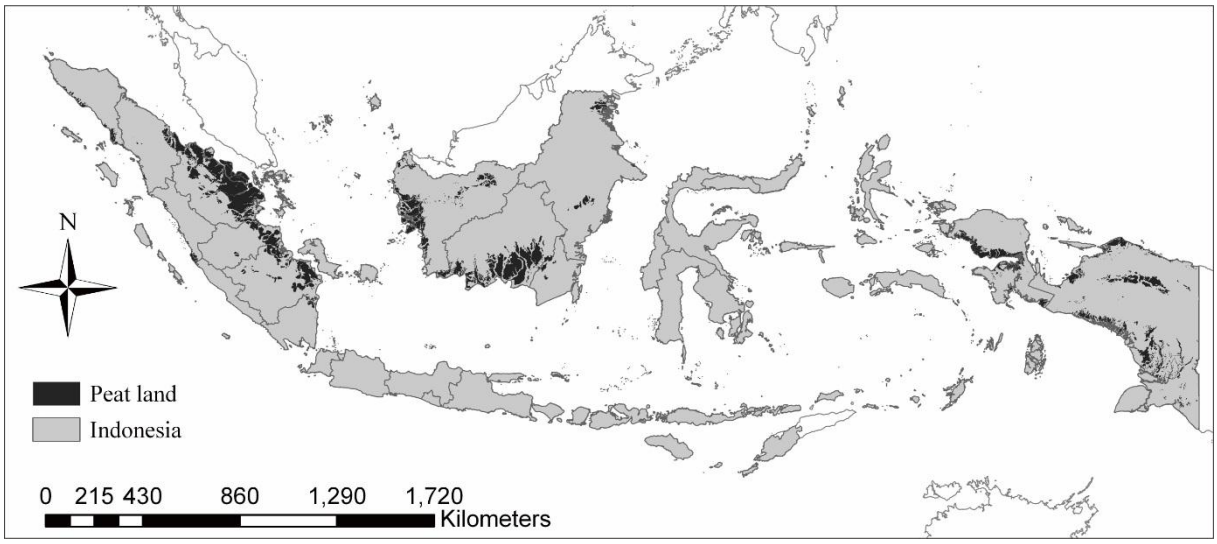


Figure 3.1. Peatland area in Indonesia

Data source: (WRI, 2016)

Indonesia is an archipelagic country consisting of five major islands: Sumatra, Java, Kalimantan, Sulawesi and Papua. Riau includes a large part of east Sumatra Island, the major outer island of the country. **Figure 3.2** illustrates the location of Riau, a province on the eastern coast of Sumatra, which faces the territories of two other countries, Singapore and Malaysia. Riau is at the crossroads of a busy international shipping route that connects the Pacific Ocean with the South Chinese Sea and the Indian Ocean. In addition, it is close to Singapore, one of the principal trading headquarters in Asia and the Pacific.

Riau is naturally rich in biodiversity, owning several national parks and protected areas. There are Sumatran tigers (*Pantheratigrissumatrae*) and Sumatran elephants (Elephas maximus sumatrensis) roaming around Tesso Nilo National Park, which are fighting for survival in the remaining patches of forests in Riau (WWF, 2010). Despite the presence of the petroleum industry in the province, Riau's income is predominantly obtained via agricultural activities (Wee and Chou, 1997). Revenues from timber logging, rubber plantations, rice paddy fields and palm oil plantations have greatly altered the livelihood options of the communities, and

have created conflicts between communities and companies over land tenure (Suyanto *et al.*, 2004).

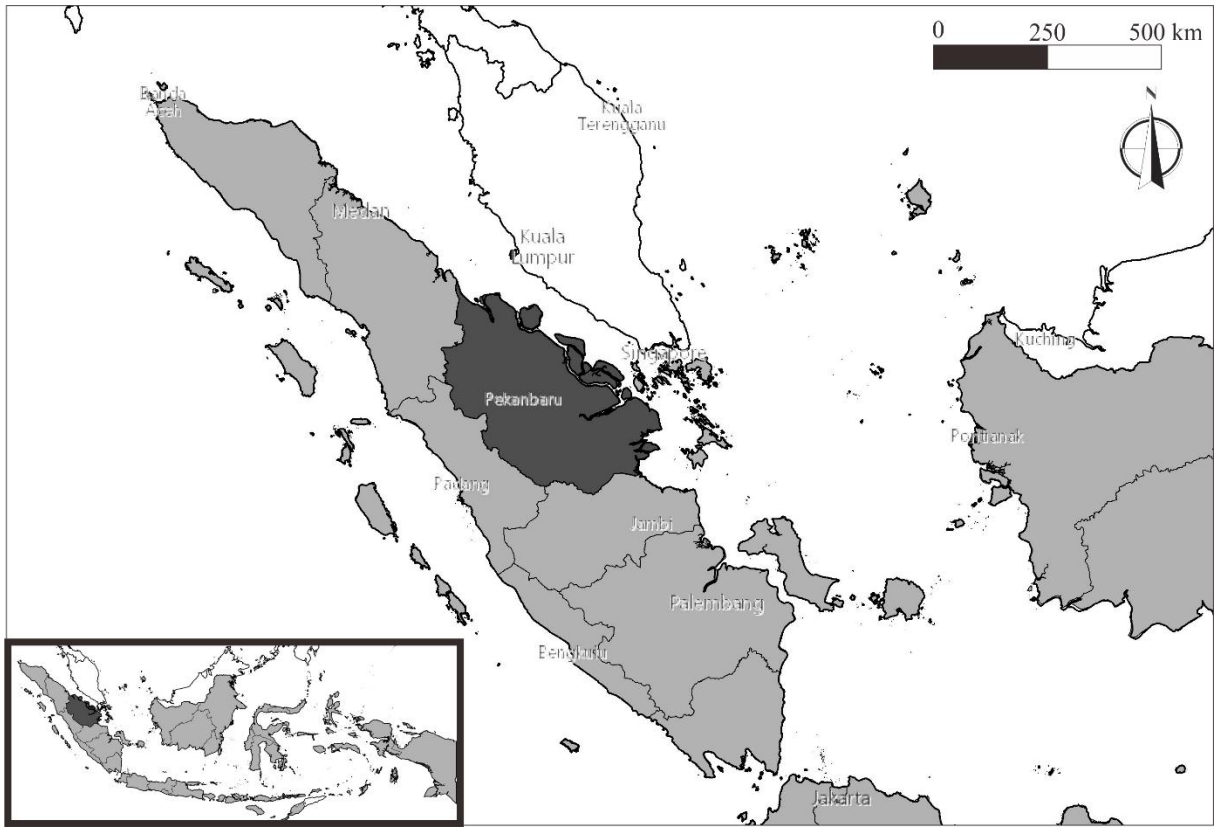


Figure 3.2. Location of Riau, Indonesia

Data source: (GADM, 2016)

3.2. Historical background

A resource rich country with vast fertile tropical rainforests hosts both great opportunities and risks. The ongoing deforestation and land conversion have threatened the intact primary forests in Indonesia, ever since the country's independence. From a historical perspective, numerous arguments can be made to support various theories as to why rapid deforestation has become such a pressing issue for the country in recent decades. Based on a report compiled by the Directorate General of Climate Change of the Ministry of Environment and Forestry in 2015, the author processed the periodic data regarding the average deforestation rate in Indonesia from 1990 to 2012, as shown in **Figure 3.3** below.

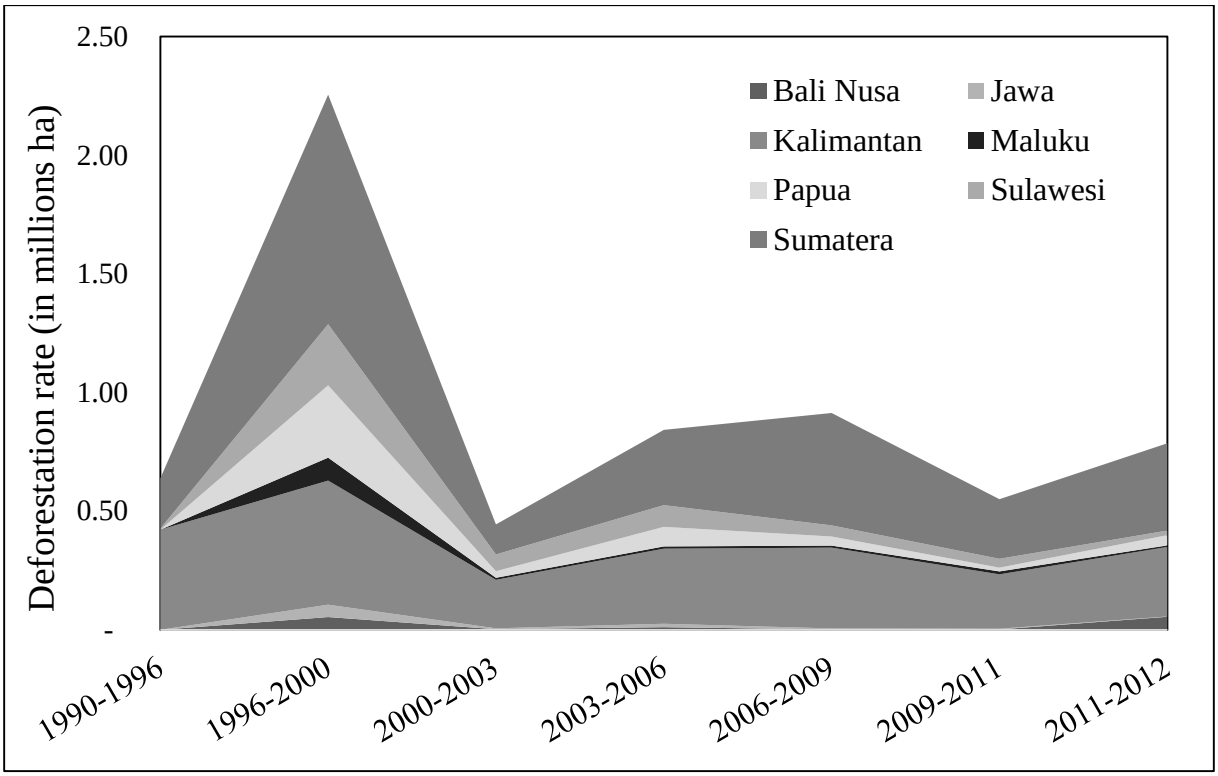


Figure 3.3. Deforestation rate in Indonesia

(Data source: MOEF 2015)

The data indicates that deforestation peaked around early 2000, when Indonesia shifted from a 32 years of authoritarian tyranny to local autonomy. As several scholars have discussed and noted, multiple drivers of deforestation were identified in Indonesia during the tyranny, which were principally related to the entrenched authoritarian system that did not promote accountability in protecting and conserving natural capital (Casson and Obidzinski, 2002; Holmes, 2000; Obidzinski, 2004; Palmer and Engel, 2007; Resosudarmo, 2004). To add to the discourse, 20 years post-decentralisation, this section attempts to concisely lay out both internal and external drivers related to the continuation of deforestation, with deeper discussions on the issues that matter in Riau, Indonesia.

3.2.1. Transmigration policy

Agricultural, geographic and economic conditions in a particular province indicate the drivers of deforestation. After independence, Indonesian forest policy predominantly focused on

dispersing the national population and initiating agricultural expansion in many areas, particularly in the outer islands, such as Sumatra, Kalimantan, Sulawesi and Papua (Hardjono, 1991; Resosudarmo *et al.*, 2012). Hence, via the transmigration policy, agricultural cultivation went alongside certain types of rural development on those islands. Transmigration encouraged the immigration of people from high density islands to underpopulated areas. **Table 3.1** shows the inflow of people to Sumatra and Riau especially. Recent migration indicates that the data include only those who migrate into the province or island during the time of census. Over time, the economic opportunities in Riau have attracted people from the other islands.

Table 3.1. Recent migration to Riau and Sumatra (1980-2010)

Year	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**
Riau	98,652	91,881	245,465	147,518	358,815	213,867	294,957
	(8%)	(16%)	(21%)	(19%)	(26%)	(25%)	(24%)
Sumatra	1,241,706	582,704	1,182,444	783,012	1,356,916	860,513	1,251,726

Data source: (Statistics Indonesia, 2016)

In 1973, to disperse the population while ensuring food security and support, a conversion programme of one million hectares of peatlands was launched to provide housing and agricultural land in Sumatra and Kalimantan (Dauvergne, 1998; Hardjono, 1988; Cribb, 1998). Additionally, joint ministerial programmes centred on supporting transmigration projects. After the construction of arterial roads, a number of connections to villages and forests were built and lengthened. International loans to fund the re-settlement programme were received from the Asian Development Bank (ADB) and the World Bank (Dauvergne, 1998). The transmigration projects and extended support given to maintain the livelihood of people who had migrated to Riau had a temporary impact on forest-clearing; however, this did not accelerate forest

conversion in the long term (Miyamoto, 2006). Meanwhile, private businesses in the transmigration destination areas persistently developed and demanded more logging permits from the central authority.

3.2.2. Timber logging

Intensification of forest policies in favour of boosting the national economy became more visible in the latter part of the authoritarian administration. In 1970, the presidential decree on commercial logging concessions PP 21/1970 was enforced (Kartodihardjo and Supriono, 2000); since then, permits to conduct forest exploitation have been easily released. On the side of endorsing industrial logging activities, roads are constructed to ease access and reduce the travel cost of timber products from the forests (Jepson *et al.* 2001). Furthermore, the log export boom in Indonesia was the centre of rural development, especially on the outer islands and was largely driven by the ambition of the national authority, the external needs of other countries, in addition to the dynamics of international economic regimes (Manning 1971, Resosudarmo and Yusuf 2006). The International Monetary Fund (IMF), amidst their own claim of addressing the twin goals of conservation and economic development, regulated the amount of timber exports by imposing and lifting the timber export ban on Indonesia (Resosudarmo and Yusuf 2006).

3.2.3. Rubber plantation

Subsequent to the rising demand for timber, non-forest timber products (NFTPs) were came in the spotlight. The earliest NFTP to attract national authorities' attention was rubber (*Heveabrasiliensis*) at the beginning of 1990s, when Indonesia dominated the global rubber market. Additionally, rubber plantations strongly influenced the rate of peat and forest clearance in Indonesia, including villages in Sumatra. To support the development of the rubber industry,

more roads were constructed and the amount of land rent consequently increased (Miyamoto, 2006). The development trend inevitably created trade-offs between rubber production and the maintenance of biodiversity. Moreover, the presence of rubber within a small-holder's garden in Indonesia negatively correlated to the number of morphotypes discovered in the area (Lawrence, 1996). Thus, low tree diversity can be expected to be a limiting factor in the potential productivity of rubber agroforestry. In recent years, competition with other progressive agricultural products on the market, for instance palm oil, has dissuaded many self-employed rubber farmers from focusing predominantly on palm oil plantations (Feintrenie *et al.*, 2010). However, the trend has not prevented the central authority from maintaining rubber as a priority with respect to national commodities. From 2015 to 2019, the annual target for rubber production in Riau Province is expected to be more than 300,000 tons, which implies further expansion of rubber plantations (MoA, 2015).

3.2.4. Palm oil plantations

In the late 2010s, Indonesia was the largest palm oil exporter in the world, with a 44% share of the global market (Potts *et al.*, 2014). Palm oil expansion has been encouraged by the central government since the 1970s, and is consistently treated as one of the country's principal national commodities. **Figure 3.4** depicts the dramatic increase in palm oil plantations over two decades. As vegetable oil serves multiple purposes, land expansion in relation to palm oil cultivation offers commercial food, chemicals, cosmetics, pharmaceuticals, feedstock for biofuel, and products from many other industries. Following the ever-rising global demand for palm oil, establishments of large-scale plantations and processing units are formally encouraged and land is still being converted, even though the business sector and authorities are aware of the risks (Budidarsono *et al.*, 2013). With the most recent production of 29 million tons of crude palm oil in 2014 and 7.7% annual growth in production, there is still a tendency towards

expanding palm oil plantations (MoA, 2015). Releasing forest areas for plantations regarding private proposals brings additional economic benefits to the authorities, in the form of timber from the cut down and agricultural plants. Such an expansive trend can be observed in **Figure 3.4**.

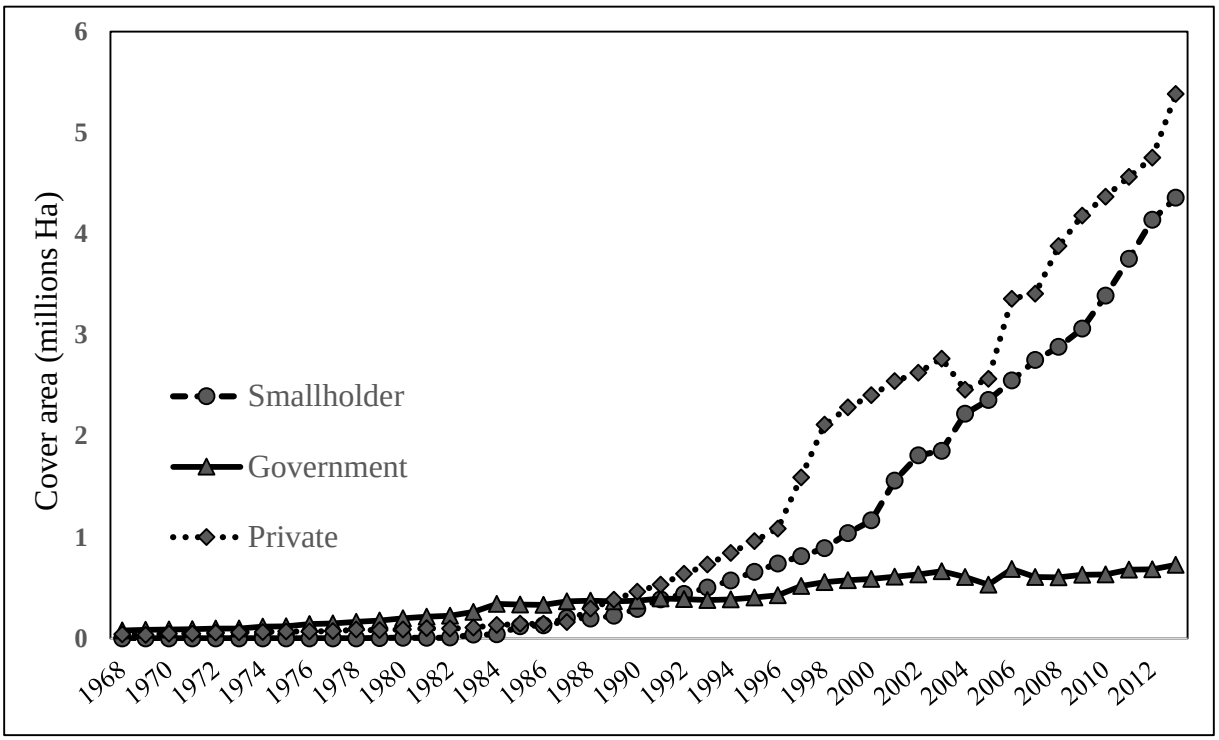


Figure 3.4. Oil palm plantations area by ownership

Data source: (MoA, 2014)

3.3. Peat and forest fires

The current quality of the environment reflects the status of Indonesian forestry, land-use allocation policy and the use of fire to clear areas in many provinces, including Riau. By nature, the tropical forest in Riau has a limited capacity to absorb the magnitude of disturbance, including climatic factors (Herawati and Susanto, 2011). Stressing the forest beyond its resilience triggers large fires to occur simply because of the abundant sources of ignition and supporting weather. Furthermore, quasi-open combustion fuelled by non-fossilised vegetation

is utilised to prepare land for, in particular, for plantation development on peat soils (Applegate *et al.*, 2001).

Loss of ecosystem services catered by the peatlands and tropical rainforests poses threats to the complex SESs. Man-made fires to clear areas of forest and peatland conversion also easily induce wildfires caused by the abundant source of fuel and drought periods experienced in this tropical climate (Herawati and Santoso, 2011). The pattern of peatland and forest fires is increasing in intensity and frequency because of the recurrent El-Nino-Southern Oscillation (ENSO) phenomenon, which has become even more unpredictable due to climate change. Haze and smoke persistently exist, and this problem is exacerbated during the drought period that induces forest fires to occur in October, and moreover, during the dry season from June to November. Now that climate change is prolonging the dry period in Indonesia (Akagi *et al.*, 2011) temperatures continue to rise and the number of forest fires are increasing annually.

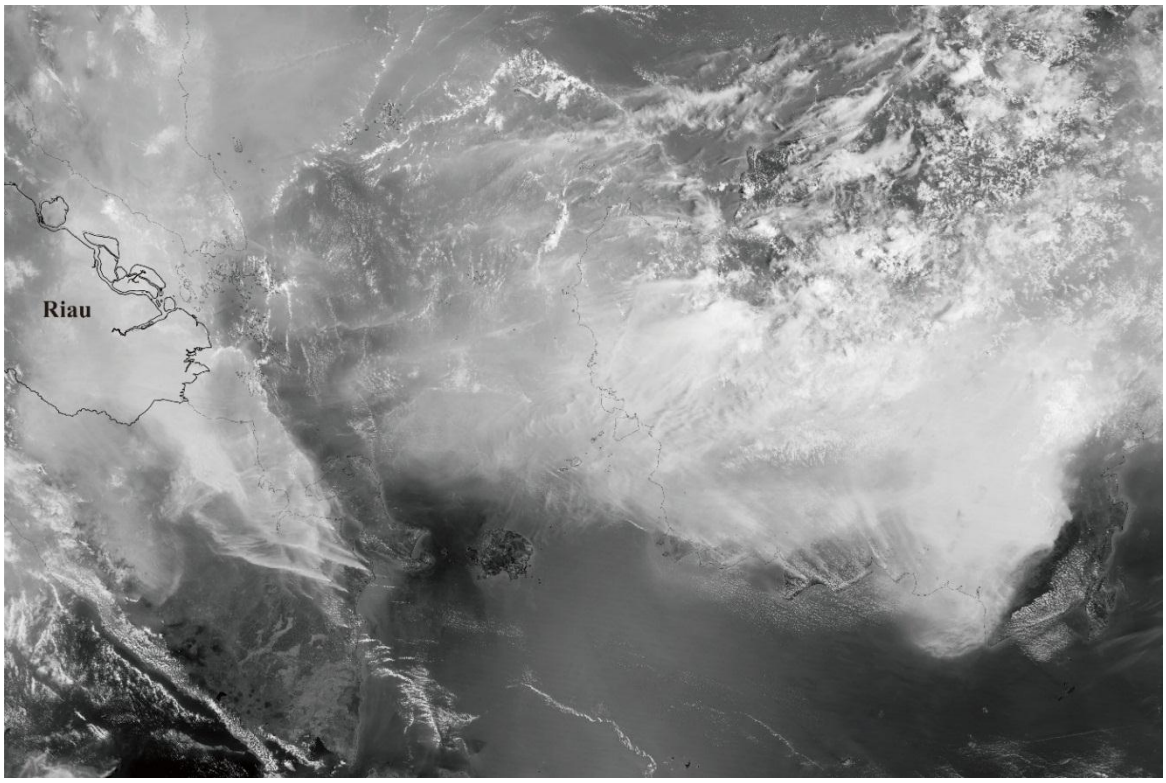


Figure 3.5. Satellite image from September 24, 2015 of Southeast Asia blanketed with haze
Source: (MODIS on NASA Terra Satellite)

The impact of smoke and haze produced by massive forest and peat fires in Riau is evident. **Figure 3.5** illustrates the coverage of the haze originating from Riau, which is located close to numerous Southeast Asian countries. The long-standing trans-boundary haze problem has become an annual occurrence in Southeast Asia following the forest and peat fires in Riau. Therefore, a thick haze from Indonesia and Malaysia blankets neighbouring countries, such as Singapore, Brunei Darussalam, the Philippines and Thailand. The impact has been seriously damaging to public health, while it has also disturbed essential sectors that support the regional economy, for instance business mobility, the supply chain system and aviation. Air pollution also leads to reduced income in the tourism industry and idle agricultural activity due to the unfavourable environment in both source and neighbouring countries (Quah and Johnston, 2001; Quah, 2002; Madiyarso *et al.*, 2004).

The fires and all of the consequences directly affect indigenous people who make their living from practicing traditional agriculture and forest management (Wiersum, 1997). Although burning trees, as a tool in farming and land preparation were initiated by indigenous people in Sumatra and Kalimantan (Dennis *et al.*, 2005), the practice was officially banned in 1984, although it was renewed in 1997, as evidenced by the large forest fires in that particular year. Long before the regulation was passed, private companies that had official permits over a piece of land, mimicked the use of fire by indigenous people, as a way to proceed with land allocation and drive the local communities whose land they occupied, away from their homes (Suyanto *et al.*, 2000).

Conversely, fire is also used by local communities to discourage large plantation companies from planting and harvesting (Tomich *et al.*, 1998). The long-established conflicts between private companies and local communities over land tenure is not the only reason why forest and peat fires still take place. The feeling of entitlement by the citizens and landowners in Riau concerning the tropical rainforests is growing together with the vested national interests in

economic gain and rural development. Such a pattern matches with the entitlement theory, which predicts that once a community feels entitled of welfare from a seemingly promising source, it will abuse the totality of rights to continue profiting for their own benefit (Pretty, 2003; Sen, 1984).

Through several interviews with key informants from the local authority, it was confirmed that both the smallholders and large corporations in agricultural industries agree that using fire as mentioned is the most advantageous technique. The reasons are mainly that burning creates space in the most efficient way, while the ash from the burnt peat and vegetation can act as fertilizer that improves soil structure and allows seedlings to grow (Ketterings *et al.*, 1999). The farmers also believe that fire reduces weed competition and the occurrence of pests (Ketterings *et al.*, 1999). Such convictions still exist amidst the vast numbers of mechanical techniques in opening the forests. The content and how it is being organised in the memory of agricultural society that is passed over generations, accentuates the repetitive nature of daily life, as the main reason for inertia in changing the practice (Kahneman et al., 2004; Mar, 2004; Russell and Hanna, 2012). Moreover, the economic rationale as part of their strategy in market competition may also play a role in the persisting forest and peat fires, as burning is believed to be inexpensive and effective.

Ilegal conversions of natural rainforest and peatlands using fire can still be observed throughout the province. **Table 3.2** gives the number of hotspots recorded in Riau and other provinces in Sumatra—as an island producing the largest amount of haze from forest and peat fires, in conjunction with Kalimantan. Spikes in forest and peat fires at the end of 2015, pushed Indonesia to move from being the world's sixth-largest producer of hazardous emissions to the fourth-largest (Harris et *al.*, 2015).

Table 3.2. Number of monitored hotspot areas in Riau and other provinces in Sumatra

Province	2011	2012	2013	2014	2015	Grand Total
Aceh	878	1,199	1,081	1,713	325	5,196
Bangka-Belitung	452	793	308	910	1,943	4,406
Bengkulu	328	262	133	162	399	1,284
Jambi	1,950	2,800	1,262	1,588	6,853	14,453
Kepulauan Riau	99	166	140	474	155	1,034
Lampung	998	904	236	911	1,539	4,588
Riau	**6,842**	**7,833**	**15,099**	**21,601**	**7,307**	**58,682**
Sumatra Barat	575	731	331	282	442	2,361
Sumatra Selatan	7,273	8,324	1,659	9,455	27,668	54,379
Sumatra Utara	899	846	1,053	2,398	839	6,035

Data Source: (NASA, 2016)

3.4. Theoretical underpinning of a selected collection of regimes

Not only do the discussions above describe the background of the issue that this research attempts to address, but they also shed light on the key drivers and pressures regarding the problem. To summarise the case study, there are motivating issues, which have been determined to exacerbate the intensity and severity of forest fires in Riau, Indonesia. **Figure 3.6** shows the time line of major policies and changes in land-use patterns. It demonstrates that interests from international and national communities may have an influence on local forest governance. The figure reveals interests that are leveraged by ruling policies and actors. Besides loans from international development banks for the transmigration programme in 1973, another example of international influence on local forest governance is via the log export quota, ban and approval. The International Monetary Fund (IMF) which removed the Indonesian log export ban in 1998, account for the patterns of development and transformation in tropical rainforests (Sahide *et al.*, 2015).

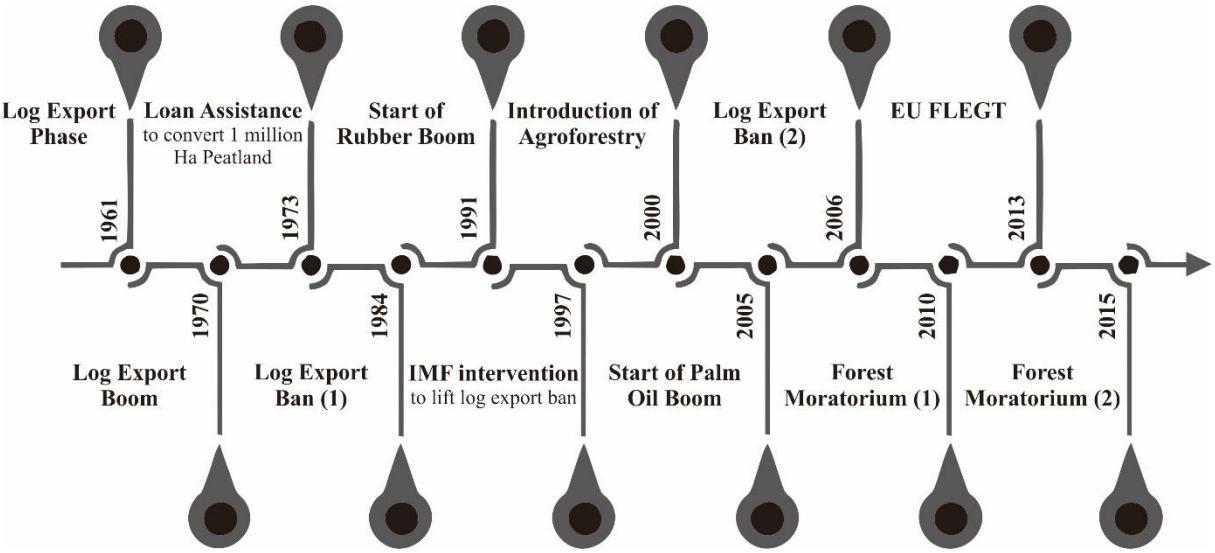


Figure 3.6. Timeline of dynamic interests on conversion of Indonesian tropical rainforests
Data Source: (Dauvergne, 1998; MoA, 2012; Sahide *et al.*, 2015)

To emphasise the impact of the national dynamic in forest governance, particularly on the potential of forest and peat fires in Riau, one can examine the spatial data portrayed in **Figure 3.7**, which exhibits hotspots in Riau during 2015 that are located primarily on concessions areas. The figure also confirms that Indonesia has three primary commodities export booms that are facilitated by means of given plantation concessions and agroforestry land tenure: palm oil, rubber and timber. The interests in commodity trades are guarded by international environmental regimes, e.g. roundtable sustainable palm oil (RSPO). Amidst economic interest, there should be a strategic move in bringing positive environmental change beyond law enforcement and legal sanctions. Hence, it is essential to measure the possible influence of environmental regimes on local forest governance in Riau, Indonesia.

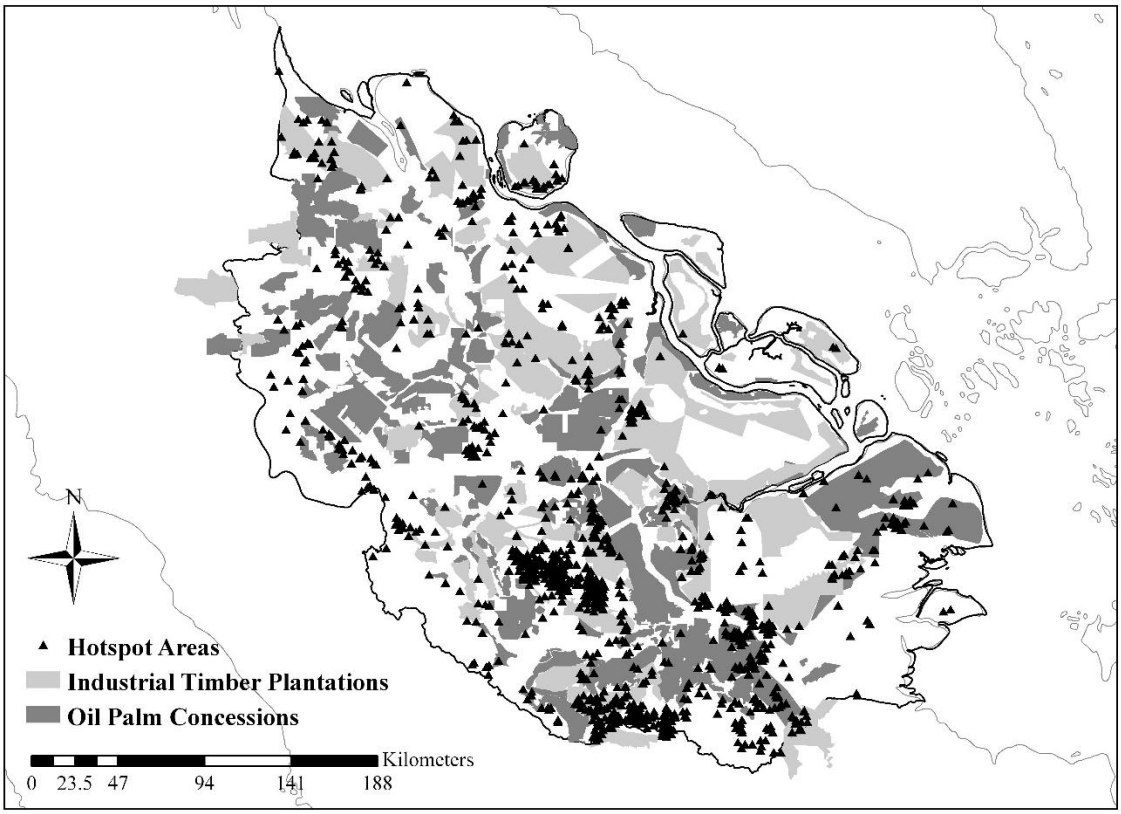


Figure 3.7. Monitored hotspot areas on timber and oil palm concessions in Riau

Data Source: (WRI, 2016)

The characteristics of regime complexes are apparent in the case of international environmental regimes in Riau, Indonesia. Tropical rainforests are subject to multiple policy fields, including inter-sectoral interactions among forests, agriculture, biodiversity, rural development, and poverty (Hogl *et al.*, 2009; Giessen and Krott, 2009; Humphreys, 2009; Krott and Hasanagas, 2006, Rayner *et al.*, 2010). Despite opportunities to strengthen local forest governance by having various supporting regimes, there is no clear structure concerning cooperation among environmental regimes. After a careful content analysis with regards to each MEA, which act as the basis for all the observed regimes in this research, a list is provided below of documented regimes that exist in Indonesia with relevance to tropical rainforests governance in Riau. The regimes mentioned below are intended to counterbalance the interests that have been shaping the intensity of forest and peat fires in Riau. Each of the regime will be discussed in the result and discussion chapter (Chapter 5). The proceeding in-depth interviews with stakeholders in

Riau to gain insight on environmental regime influence on local forest governance, are not limited to the given list. It rather functions as a basic coverage that the adjacent methodological approach should cover.

1. ASEAN Agreement on Transboundary Haze Pollution (AATHP)
2. Forest-product certification regime (FSC)
3. Regime that combat desertification (UNCCD)
4. Biological diversity regime (CBD)
5. Climate change regime (UNFCCC)
6. Endangered species trade regime (CITES)
7. International rubber trade regime (INRA)
8. International tropical timber production and trade regime (ITTO and FLEGT)
9. Palm oil certification regime (RSPO)
10. Wetlands (including swamp and peatlands) regime (Ramsar Convention)

4. Research Methodology

Regimes and regime complexes, recognized phenomena that occur as social institutions make differences in international society, from a national context and even more in a local setting (Miles *et al.*, 2002; Young 1999). In spite of assorted arguments on whether regimes matter, this research commences with the major consensus —that regimes matter— to see the influence they bring to the local governance. It attempts to explore and describe the way international environmental regimes have influence on the local political landscape and planning agenda. In order to break the myth of abstract, unstructured concept and theory of regimes and bring meaning into a growing number of MEA at a local level, this chapter elaborates the steps of studying the forest governance issue from the perspective of international regimes, in a reproducible manner. The methods have been designed to address the research objectives as indicated in every section. First, it focused on analysing documents and processing spatial and historical data to understand the pressures on tropical rainforests in Riau. Next, it carried out in-depth interviews to gain insight on the influence of each regime on local forest governance using a rating system. Finally, it mapped all relevant environmental regimes with forest and peat fires mitigation to see the potential of joint strategies.

4.1. Research design and approach

This research applies both deductive and inductive approaches. **Figure 4.1** depicts the dynamic of deductive and inductive approaches that are applied in this research. I acknowledge the contribution of both methods in investigating how regimes can shape local governance and provide a thorough understanding of the influence of regimes on local forest governance. This combination is relatively common in many grounded theory research designs and is appropriate for testing as well as developing a theory on samples and population (Creswell, 2012). Creswell,

(2012) added that this combination occurs because as many of the theories may be present, nevertheless incomplete due to several unexplored potential valuable variables.

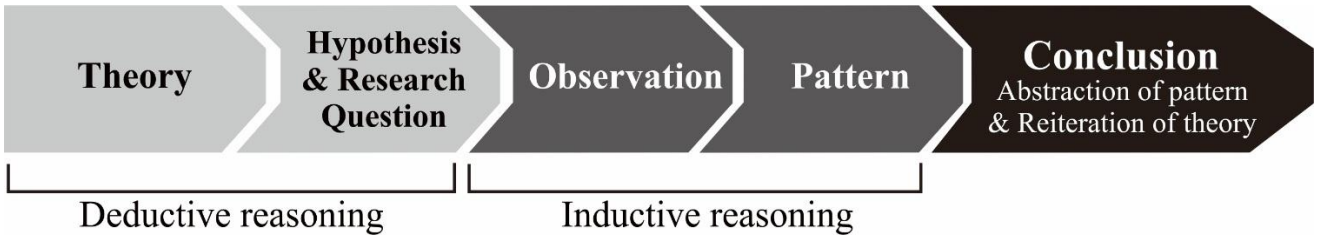


Figure 4.1. Summary of research approach

Deductively, the prepositions of regime theory are investigated through framework analysis (Royse, 2007) that is also built from principles elaborated upon in Chapter 2. It proposes that international environmental regimes have different influences in contrast to local forest governance, depending on the problem relevance to local forest governance and actor's interests in allowing a regime to make a difference. The hypothesis further suggests that a regime can influence local forest governance individually and moreover, that it can also be significant as a network. Furthermore, the relations among international environmental regimes themselves can influence the local forest governance.

To establish what forces potentially shape local forest and what relevant regimes have the potential to influence the selected local setting, an initial literature review was conducted. The review of the literature and documents from from both international organisations and national ministries, in addition to analysis on historical and spatial data are the means to examine every relevant international environmental regime that is effect in Indonesia. The pre-selection of regimes that are likely to have influence does not mean to be a strict rule the research must only follow; the research is designed to be exploratory when it comes to placing the established concept formation and causal inference on the selected setting. Thus, this when the inductive approach comes in.

The results of the research are also based on interviews and observations with key informants in the field of forest governance in Riau, Indonesia. Inductively, through the case of forest and peat fires mitigation as an urgent issue that local forest governance has to actively undertake (Krott and Giessen, 2014), this research explores a variety of ways, in which individual and collective regimes are shaping local forest governance. There is no further theory or hypothesis imposed on the type of relevancies each regime is bringing on the political landscape and the overall local forest governance. Instead, the network analysis part of this research requires detailed observation of naturally occurring relations among regimes. In other words, the identification of regimes' attributes and preliminary relationships as the objectives of this research are inducted from the established proposition.

This research also seek for a balance of individual characteristics and collective conceptualization of environmental regimes. It affirms the centrality of social and political influences in both individual and systemic regime outcomes. Brandes *et al.* (2013) and Robins (2015) argue that there is an apparent shift in social research studies from only an experimental research design to network-based observation, as it is inadequate to obtain the ongoing social processes. Undeniably, there is a cyclic chain of influence that constructs social systems and affects individual variables. On that account, this research pursues intact comprehension on the way international environmental regimes are approached, and are substantive to the improvement of local forest governance from individual and network observation.

The rest of this chapter will procced by taking in to consideration the dichotomy of individual attributes and network analysis that hasten the point of development regarding both the research technique and the object of this research: roles and influences of international environmental regimes at a local context. To explore the influence of each regime, this study adopted a social research method that is descriptive based on qualitative research. To explore the potential

significance of international environmental regime networks on mitigating forest and peat fires', this research applied network analysis.

4.2. Pressures on tropical rainforests that shape forest governance in Riau, Indonesia

The identification of forces and pressures on tropical rainforests in Riau was organised in a historical and descriptive manner. There are two basic techniques used to examine the case of forest fires in Riau, Indonesia. Firstly, analysis was conducted of documents and literatures so as to approach the research question. Academic communities and international organisations have made several attempts to document the patterns of forest fires that have been occurring in Southeast Asia for decades (references have been indicated in Chapter 3). In pursuit of the first research question data, I consulted literatures and documents to not only gain information, but also locate gaps in data, the approach and the conclusion. Hence, as introduced in Chapter 3, this thesis offers another insight with regards to data, methodology and the analysis of examining the pressures surrounding forest governance in Riau, Indonesia. It also explores the spatial data relationship and observe possibilities behind spatial patterns of pressures for predicting intensity of forest fires, this research adopts Geographically Weighted Regression (GWR).

4.2.1. Geographically Weighted Regression

4.2.1.1. Conceptual ground

The concept of regression analysis has been extensively used to understand the relationship between a dependent variable and a set of one or more independent variables (Charlton and Brunsdon, 2009). The simplest formula to allow for an understanding of GWR in the context of this research can be presented as follows:

$$y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \varepsilon$$ (1) General regression equation

where *y* (dependent variable) is a variable that we are attempting to model, in this research the dependent variable that we would like to model is the intensity of forest and peat fires. $X_{1, 2, \ldots n}$ are the independent variables denoting multiple variables that are believed to help explain the intensity of forest fires. β_0 and β_n (coefficients) are values that are going to be the results of regression calculation, reflecting the relationship of strength between independent variables and the intensity of forest fires. Furthermore, ε (residuals) is any portion of the dependent variable that is not explained by the model (Johnston *et al.*, 2001).

In this research, the more advanced version of regression analysis, GWR was used to identify the most influential factors involved in the intensity of forest and peat fires in Riau. Simple regression analysis describes the relationships amongst quantitative variables with an assumption that the regression coefficient (β) remains fixed over space i.e., it assumes that the unit of analysis is spatially homogeneous. Whereas GWR captures the relationship amongst multiple influential factors of a specific outcome that are varied across areas, yet measured within a single modelling framework (Brundson *et al.*, 1998). Instead of taking forest fires as a stationary outcome, this research takes into account intercepted coordinate locations of where explanatory variables and the forest fires occur over a certain period of time. The final GWR model can be expressed as:

$$y = \beta_0(u_i, v_i) + \sum_{j=1}^{n} \beta_j (u_i, v_i) X_{ij} + \varepsilon_i$$ (2) GWR equation

Tailored to this research, y represents the outcome of forest fires intensity at the coordinate locations *i* (u, v), while β_0 and β_j are the estimated intercept of the pressures on forests and the density of forest fires. *j* stands for the location, and *n* is number of observations. The spatial data enable varying parameter estimates to be easily mapped. The results of GWR presented in

this research are predominantly the values of coefficients that determine how each explanatory independent variable contributes to the intensity of forest and peat fires in Riau.

4.2.1.2. Data collection

Temporal and spatial trends in relation to the intensity of forest and peat fires from 2011 – 2015 were analysed using collected data from WRI (WRI, 2016). The collected data focused on the historical analysis that is elaborated upon Chapter 3, primarily: immigration rate, rubber plantation areas, timber and non-timber agro-forestries, palm oil plantations concessions and peatlands. The selection of the period of time (2011 – 2015) hinged upon the aspiration to make us of the latest information on local forest governance, so that the discussion on how environmental regimes influence forest governance is positioned within the same temporal framework throughout this thesis. Comprehensive and accessible data collection that covers all the aforementioned pressures on tropical rainforests in Riau is very limited. Anticipating dissimilar techniques of collecting and processing the raw data by each institution, this thesis employs data from only one solitary source.

4.2.1.3. Data analysis

Moving forward with the assumptions of pressures on local tropical rainforests in Riau, the data gathered were verified using simple linear regression to establish if all the five pressures proposed are statistically contributing to the intensity of forest and peat fires from 2011 to 2015. The trends of each of the pressures were assessed using the ordinary least squares regression (OLS) function under Spatial Statistics Tools in ArcGIS 10.2 software (ESRI, 2016). The null hypothesis is that explanatory variables contributing to the intensity of forest fires over the same particular area are not dependent by default, whilst the alternative hypothesis proposes that there is no correlation between explanatory variables and the intensity of forest fires over the specified area.

The result of OLS informed whether the model is statistically significant to be run, by assessing Pearson correlation coefficients to evaluate if there are correlations between the explanatory variables and dependent variable. At this stage, several variables may not be included further in the calculation, thus permitting other suitable biophysical or sociocultural explanatory variables to fill in. A correlation coefficient threshold between explanatory variables of $|r| > 0.5$ ($p < 0.05$) was considered to be relevant indicator, where collinearity begins to distort the model estimation (Dormann *et al.*, 2013). To verify that the prediction of the dependent variable is not dominated merely by one explanatory variable, the Spatial Autocorrelation tool was run. The result of the test indicated that the relationship between explanatory variables and the dependent variable is randomly distributed, as shown by the distribution of the residual (ε) (Johnston *et al.*, 2001).

Once all statistical indicators of OLS were fulfilled, GWR could subsequently be run using the same dependent and explanatory variables. However, unlike OLS that considers the influence of explanatory variables in an area to be the same, the feature of GWR would specify the influences on a more local definite area. GWR calibrated each local regression using its local neighbours (other districts), to yield optimal results with regard to minimising bias and maximising the model fit (Wheeler, 2014).

4.3. Individual environmental regime attribute in Riau, Indonesia

Proceeding with the second research question, to reveal the influence of a regime, a typical social science research approach was adopted. I sampled individual perspectives on the way they think about the use of international environmental regime on local forest governance based on several indicators. This stage of the research does not automatically assume that every regime is dependent on another. Each regime has its own characteristics that define its influence and eventually collective presence on local forest governance.

4.3.1. Analytical framework

Based on the principles in Chapter 2, there are two dimensions concerning the influence of international environmental regimes on local forest governance: **problem relevance** and **actors' interests and capacities**. The choice of these two indicators are important to know if an environmental regime has the capacity to make a different in local forest governance i.e., some may have the relevance but is not of actors' interests and capacities, or vice versa. To give structure to the interviews and data collection the following indicators for both dimensions are compiled based on adapted methodological framework to assess the application of various international regimes (Underdal and Young, 2004; Young 1999), particularly on forest governance (Arts *et al.*, 2012; Krott. 2005; Sahide *et al.*, 2015; Secco *et al.*, 2014). **Table 4.1** lists the minimum indicators for both of the dimensions that should be covered during data collection and in-depth interviews.

The problem dimension of an international environmental regime may or may not be relevant to the mitigation of forest and peat fires—as a measure of local forest governance. Relevance can be reflected from the objectives of a MEA regulating the principles and norms of an environmental regime. The contribution of an environmental regime in influencing the intensity and severity of forest and peat fires is also an additional important indicator that demonstrates the problem relevance in actual practice.

International environmental regimes are placed differently in a local context depending on problem structures, actors and institutional settings (Bernstein and Cashore, 2012). This occurs not only due to problem relevance, but also several actors from private, public or international non-state parties that allow a certain regime to make a difference with respect to local forest governance according to their interests (Arts *et al.*, 2012). Krott (2005), in his book, further argues that bureaucratic interests are the most important determinant in political processes that

succumb to major impact regarding the shape of local forest governance. Therefore, actors' interests and capacities in utilising an environmental regime are indicated via structure, budget, legal support and coordination, as shown in **Table 4.1**.

Table 4.1. Indicators to assess regime influence

Dimension	Indicator	Description	Scale of Measurement
Problem Relevance	**Objective** (P1)	Forest and peat fire issues formally fit in with the regime's coverage and aim	High match Medium match No match
	Contribution (P2)	If the intensity and severity of forest and peat fires are controlled by a regime	Great contribution Medium-to-little contribution No contribution
Actors' Interest and Capacities	**Structure** (A1)	Bureaucratic structures reflecting responsibility for a regime's operationalisation	Specific autonomous bureaucracy Special unit to deal with the issue via a focal point No match
	Budget (A2)	Budget allocations for a regime	Substantial Marginal No budget
	Legal Support (A3)	Legal mandate to implement a regime	High support, e.g. national mandate and regional instruction Medium support, e.g. regional instruction only No formal mandate
	Coordination (A4)	Promotion of a regime by broadening coalition during implementation	State bureaucracy coalition Coalition with non-state actors to promote the issue No successful coalition building in support of a regime

Adapted from: (Arts *et al.*, 2012; Krott. 2005; Sahide *et al.*, 2015; Secco *et al.*, 2014)

4.3.2. Data collection

4.3.2.1. Research contributors

Studies on the current influence of regimes on local forest governance involved in-depth interviews with stakeholders and experts. To identify the all-embracing regime influence domestically, this research also engaged with non-bureaucratic key informants, whose organisations and institutions have social obligations and managerial relationships (Krueger, 2012) with the SESs of the tropical rainforests in Riau, Indonesia. This includes business entities, NGOs who actively advocate the rights of the citizen for enhanced environmental quality, and experts of the aforementioned sectors in Chapter 3 that affect the forest governance significantly (Donaldson and Preston, 1995; Driscoll and Starik, 2004). Such incorporation is in accordance with stakeholder theory concerned with the relationship of organisations, which have the power to affect the processes and outcomes of the respective governance system (Driscoll and Starik, 2004).

Even though the perspective of the business sectors are valued equally to enrich the substance of this research, no response was obtained from eight companies engaged in rubber, paper, timber and palm oil production regarding my inquiry to interview any of their public and governmental affairs staff. To cover the absence of responses from those companies, I maximised the interviews with experts in gaining insights on the practice and position business sectors. Here, I use a broad definition of experts owing to the extent and depth of their experience in relation to international environmental regimes (Faze *et al.*, 2006), based on the period of their involvement in the adoption of international environmental regimes, project-based contributions, in addition to local and national forest governance.

In total, 9 people contributed to this study, ranging from the provincial House of Representative who deals with ratification of local environmental regulations, to the director general of forestry

planning and environment. The list of interviewees' occupational backgrounds are attached in **Empirical references** section.

4.3.2.2. In-depth interviews

The individual in-depth interviews conducted with nine key informants were aimed at exploring the influence that each of the international environmental regimes has in helping to mitigate the forest and peat fires. In addition, the interviews became a means to understand the way environmental regimes interact among each other, as a network, according to the current practice in Riau, Indonesia. To that extent, I will describe the additional set of questions in the next section that specifically discusses the method of conducting network analysis.

It is ethically important to gain a consent from all the key informants, in order to record and note down the discussion throughout the interview. Moreover, even though the correspondents had already stated their willingness to share their expertise and experience, when the interview times were being arranged, oral consent was obtained from them prior to the interviews taking place, after they had read over and signed the consent form. The consent form was written in Bahasa Indonesia, which is the native language of the author and informants; the English translation of the form is attached in **Appendix A**. The informants have an option to withdraw from the study at anytime or to refuse any questions without prejudice and consequences. They were all informed of all potential risks. I do not anticipate any consequences related to being a research contributor for this thesis other than those the informants encounter in their daily work and life. Additionally, the informants are guaranteed to remain anonymity. The information provided by the informants during the interviews will not be personally identified in any written material, presentations or published work.

The nine in-depth interviews were conducted individually in Bahasa Indonesia. They all began with a re-introduction to the research topic and objectives. The interviews on individual regime

influence consisted of two different types of questions: closed and open questions. The closed type of questions were designed to assess how the ten different regimes affect local forest governance and the process of forest fire mitigation, based on 6 general indicators (**Appendix B**). The open questions were followed up by the perception of the real actors on Riau forest governance, which is written in the interview guide (**Appendix C**), and was given to the informants to read at their convenience. The interviews lasted for approximately 120-150 minutes, and concluded with a review of the principal arguments discussed in the interview.

4.3.3. Data verification

The use of multiple techniques to collect data is typical in a grounded theory approach (Creswell, 2012). Data collection of the current status of each indicator, as described in the scale of measurement in **Table 4.1** was primarily organised by means of in-depth interviews with key informants. It was also supported by examination of related documents ranging from reports from international organisations, presidential decrees, ministerial documents and provincial archives in relation to the adoption of a certain MEA. In addition, as it was impossible to conduct a data verification workshop due to the diverse schedules of the highly respected research contributors, simple statistical analysis was utilised to manage minor differences that occurred in describing the influence of regimes on local forest governance. **Figure 4.2** illustrates how data corresponding to research questions were verified through triangulation.

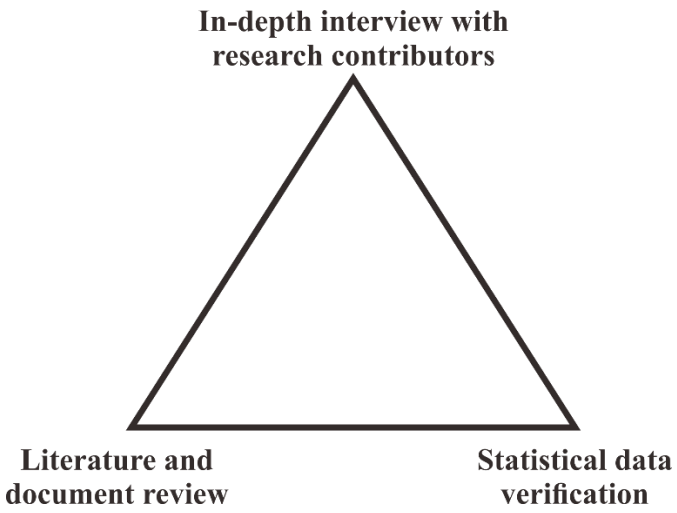


Figure 4.2. Data verification through triangulation

Such data verification is intended to ensure the data collected in this research from nine different experts and practitioners have consistency and validity, while reducing bias that may unconsciously reflect on the way I reach a conclusion at the end of the study. Consequently, this addition requires further simple quantitative analysis, in which uncertainties regarding results can be mathematically shown, rather than assumed implicitly. Hence, although the sample size is very small, I will employ basic descriptive statistics. There are two statistical characteristics that will summarise the consistency of this small sample size data set: centre (mean and modus) and shape (skewness) (Doane and Seward, 2011). Additionally, basic statistical calculations were chosen as they can inform whether the data are spread out over a wide range, and if all the collected data are of symmetric distribution (Altman and Bland, 1996). All the statistical calculations were undertaken using basic functions in Microsoft Excel (2010) based on the scores given in **Table 4.2**.

4.3.4. Data analysis

Despite the feature of in-depth interviews being filled with qualitative reasoning, I attempted to characterise the basis of qualitative expert system, where description are given in terms of

directions of change or orders of magnitude instead of real values as suggested by Krueger *et al.* (Krueger *et al.*, 2010). The closed types of questions in this research require straightforward answers that can be quantified directly by both the author and informant during the interview. In answering each of the closed types of questions, there is a full disclosure of what each rating indicates. **Table 4.2** unequivocally states the quantification behind the scale of measurement for each factors contributing to regime influence. This quantification helps to summarise and visualise the results of the research in the next chapter.

Table 4.2 Score for each scale of measurement

Indicator	**Description**	**Scale of Measurement**	**Score**
Objective (P1)	Forest and peat fire issues formally fit in with the regime's coverage and aim	High match Medium match No match	2 1 0
Contribution (P2)	If the forest fire's intensity and severity are controlled by the regime	Great contribution Medium- to-little contribution No contribution	2 1 0
Structure (A1)	Bureaucratic structures reflecting responsibility for a regime	Specific autonomous bureaucracy Special unit to deal with the issue via a focal point No match	2 1 0
Budget (A2)	Budget allocations for a regime	Substantial Marginal No budget	2 1 0
Legal Support (A3)	Legal mandate to implement a regime	High support, e.g. national mandate and regional instruction Medium support, e.g. regional instruction only No formal mandate	2 1 0
Coordination (A4)	Promotion of a regime by broadening coalition during implementation	State bureaucracy coalition Coordination with non-state actors No successful coordination building in support of a regime	2 1 0

Besides, the qualitative reasoning obtained through responses to the open questions will be thoroughly elaborated upon in the following chapter. The dialogue regarding the issue according to any practice that each of the correspondents imbues reality with meaning (Ruiz, 2009) provides the tool to explore the meaning attached to their perspectives. To do so, firstly I transcribed the interviews and matched the point highlighted during the interview with the

field notes. To develop a thorough understanding of influence of the discussed for each regime(s), thematic content analysis was conducted descriptively and analytically using ATLAS.ti 7.1. The analysis was guided by the aim and objectives of the research, while literature and document reviews frame the context of analysis that result in the identification of each regime, as presented in Chapter 5.

4.4. Network analysis of environmental regimes in Riau, Indonesia

The third research question has a major implication for the research design and the type of data that was collected. Network analysis exposes the relational ties that occur among actors attributes (Kadushin 2002). It views the observed international environmental regime "as one realization from a set of possible networks with similar characteristics"—(Brandes *et al.*, 2009), which is the result of some unidentified causal processes. This research is particularly interested in analysing the ties that bind the international environmental regimes into a network. The network structure that has been formed possess the potential to influence the current local forest governance in Riau, Indonesia. That being said, an exploratory approach was directed to examine a possible deep connection for strengthening the current influence of a set of international environmental regimes. The following subsections elaborate the step of conducting network analysis for this research.

4.4.1. Data collection

4.4.1.1. In-depth interviews

Within a well-defined network boundary—a network of international environmental regimes that potentially influence local forest governance in Riau—I interviewed the same experts, practitioners and bureaucrats who shared their perspectives related to the previous research question on regime influence. Those interviewees were presented with the list of international

environmental regimes which they think have an effect upon forest governance in Riau. Following what McCarty *et al.* have to say on the subject of sampling in network science, I applied sampling with common names (McCarty *et al.*, 1997) to avoid interviewees nominating only partners with strong network connections.

With the aforementioned responses for *n* different environmental regimes can produce *n(n-1)/2* possible ties; in this case I can expect 45 possible ties from 10 international environmental regimes. This seems mundane, but is very important to disentangle the potential relations among environmental regimes (Kadushin, 2002). Simultaneously, it is understandable that during the 120-150 minutes interview, the interviewees may experience fatigue. Thus, instead of asking the respondents to examine the degree of the relationship of the 45 possible network ties among 10 environmental regimes in detail, I asked them to provide information in a simple binary scale: "close" or "distant". The choice of binary scale was based on the common use of language and semantics behind the language used by the respondents, native Indonesian people, (Larasati and Manurung, 2007) in describing quality of intensity.

For more detailed references, **Appendix D** is provided to clarify the precise wording I used in delivering the question to the participants. The nine in-depth interviews were conducted in conjunction with the interviews related to the individual attributes of the regime influence. Finally, after the long interviews, again I concluded with a review of positive indication on the existing connection among environmental regimes according to the respondents, as well as a debriefing thanking the informants for sharing the time, experiences and perspectives.

4.4.1.2. Documents review

In line with the in-depth interviews, I enchanced the data collection procedure by means of the non-respondents method. This is suggested by Huisman (2009) to enhance the collected cross-sectional network data, where data on the intensity of the ties may be missing at random or

appear to be only one-dimensional (Huisman, 2009; Little and Rubin, 1987). The absence of information can occur out of choice by not responding to certain network ties, unfamiliarity with one particular regime, or any other possible reason established.

As a perfect response rate is uncommon, the absence of several types of network data in this research was complemented with in-depth literature and document reviews. Rather than pretending that the absence of information in terms of density of network ties does not exist, the literature and document review focuses on further examining the fundamental principles of a particular regime based on the insights given by the interviewees. The basis for reviewing documents is a particularity of each environmental regime that is observed via the fundamental principles and/or basic criteria written in the MEA ratified and adopted by the Government of Indonesia (GOI).

4.4.2. Data analysis

The data collected from interviewees was reviewed and transcribed onto an adjacency matrix. With information given from the respondents about each relational tie, the ordinal scale that was given to the description of network ties of international environmental regimes is also included in the matrix. **Appendix E** depicts the adjacency matrix used to analyse the discussions on relational ties among regimes in addressing the forest fires in Riau, Indonesia. Not every interviewee has an insight to be shared in connection with all relational network ties; some are not familiar with this aspect; hence, they refrained from commenting any further. The responses given by the respondents were divided into three: close, distant and not available.

The information obtained from the research contributors, who actually encounter, utilise and become part of the regimes is important input that is used to improve the quality of network analysis output by advancing the document review. The basis for the document review connecting every fundamental principle and basic criteria related to the environmental regimes

are shown in **Table 5.3** in Chapter 5. To use an example, the principle that requires authority to "Establish strategies to minimise risks to human health and environment", occur in the ASEAN Agreement on Transboundary Haze Pollution (AATHP) and biological diversity regime (CBD). Despite the difference in wording, such a principle is supposed to be the normative feature that should emerge, as the above mentioned regimes are being practiced (Lester, 2013; Nahapiet and Goshal, 1998; Tsai and Goshal, 1998).

The reason why the fundamental principle of MEAs and basic criteria for the certification regimes become significant relational ties in this research is by virtue of the social capital that is embedded in different environmental regimes. Social capital is a long-established concept that fundamentally represents a value that is expected to occur as a return in social relations (Lin, 1999). Once adopted, environmental regimes can potentially convey social credentials, a flow of information and influence to the policy-making process in the field of forest governance (Borgatti, 2009; Lin, 1999). Structuring the network of international environmental regimes enables a production of knowledge to better address the forest fires that happen in Riau, Indonesia.

When all data were collected and prepared for analysis, the matrix was imported from comma separated value format (.csv) into Gephi (.gephi). Gephi is a software package for network analysis and visualisation that is written in Java (Bastian *et al.*, 2009). The software allows any type of dynamic networks and complex systems to be analysed and visualised at the same time. Gephi offers powerful data exploration tool with a high quality layout algorithm, data filtering, clustering, and statistics (Bastian *et al.*, 2009). All of them are combined with a flexible and user-friendly interface. Thus, the software appeals to many experts as well as non-experts.

After the data was imported into Gephi, the software allowed setting identities for nodes, ties, and attributes. Once the network components are set and ran, the graph visualisation could be

viewed and explored. The analysis of the model was then advanced by adding network conceptualisations: network connectivity, centrality, density, and reciprocity. Statistical tab in Gephi supports data calculation and analysis; several things I did for instance were calculating average path length to get network density and computing the eigenvector centrality that permits size alteration of network node based on the attributes.

4.5. Limitations

Some difficulties were encountered when arranging the in-depth interviews with some of the participants and the institutions. As touched upon in the earlier section of this chapter, none of the representatives from business responded to the interview inquiry. The lack of responses reduces the number of interviewees in this research, which in turn affects the robustness of data. To deal with the issue of data reliability and validity, this research used several prior to the interviews, during the interviews and post hoc:

1. The sample were chosen and analysed appropriately, as suggested by Morse *et al.*, (2002). It is essential to select research contributors who best represent the research topic and scope/
2. At the end of every interview, I always confirmed the results with the participants by summarising the principal arguments established up to that particular research stage — after several earlier interviews. Considering the hectic schedule of the experts and bureaucrats, the immediate debriefing right after the interview was meant to establish the availability and unavailability of the respondents to engage with another round of interviews designed for data validation.
3. In addition to the confirmation of the result, data verification was took place also through statistical analysis. Although it is not very common in qualitative research, the quantification of the results of in-depth interviews permits me to display data

consistency across nine different leading figures by using descriptive and inferential statistics to demonstrate data saturation and replication (Morse, 1991).

The unavailability of business sectors to the interview requests simultaneously impacts upon the combination of viewpoints in the collected data. This is when the role of experts as observers and presumably non-biased sources of data collection are crucial. This is for the reason that had I stayed in Riau, longer than the original plan, I would still have been unable to obtain responses from any of the eight companies in agroforestry, timber and pulp & paper productions, even up until the point of writing this thesis.

With respect to network analysis, the limitations are due to the poor response rate from the interviewees**.** The core concept of network analysis, that is relational ties between individuals instead of focusing only on the individual characteristics, was unfamiliar to many correspondents. Notwithstanding the rephrased, simplified question, many of the experts and bureaucrats restrained from commenting on the connections among international environmental regimes, due to the lack of familiarity concerning the issue. Therefore, some of the questions remained unanswered. This prevented statistical analysis, particularly Cronbach's alpha[1], to be conducted on the collected data from different interviewees. To compensate for the missing information, an in-depth document review was conducted with regard to establishing answers to a similar question: if the principles and basic criteria of two international environmental regimes go hand in hand in mitigating forest fires.

While seemingly clear-cut, this method is subject to diverse interpretations of the wording of principles and basic criteria. In order to maintain reliability I followed what Le Blanc, (2015)

[1]Cronbach's alpha is a common numerical coefficient of internal data reliability. This is commonly used to inspect reliability associated with the variation accounted for the true score behind underlying construct (Cortina, 1993). In this research, Cronbach's alpha can be used to verify whether every research contributor means the same thing when rating "close", "distant", and "not available" on the relations among international environmental regimes.

had undertaken to ensure the validity of the proposed network model by coding a few of the "borderline" vague cases to determine whether the addition or omission distort the network structure I propose, in a significant manner. Had I been in contact with a group of people who are familiar with network analysis and its practice in environmental policy, I could have advanced the result of the document review work by means of a peer-review.

5. Results and Discussions

This chapter aims to answer the research questions and pursue the overarching aim stated at the beginning of the thesis. Throughout the thesis, theoretical insights, results of literature reviews and indicators of international environmental regimes' assessments have already been discussed. This chapter is especially dedicated to explaining the results of the investigation related to each research question and discusses the analysis regarding the research aim. Disentangling influences of a network of international environmental regimes concerning local tropical rainforests governance requires many research and perspectives. This chapter aims to demonstrate the contributions of the methodologies applied in this discourse, while eventually drawing the limitations regarding generalisation of the results.

5.1. Forest fires intensity in Riau, Indonesia

5.1.1. Statistical result and discussion of pressures on tropical rainforests in Riau, Indonesia

Economic and political forces that embody local forest governance in Riau have been identified in Chapter 3. The findings in Chapter 3 are separated with the results of other research questions, as they can provide more structure to the development of thesis arguments through a case study. The historical timeline and descriptive spatial information included in Chapter 3 were provided with the hope of introducing the case study for this research. It was also meant to prepare readers for the next research stage that applies the methodological approach to trace the influences concerning environmental regimes' influence. This section tailors the results regarding economic and political forces that have been laid out in Chapter 3 with further discussions on the actual spatial and temporal pressures on tropical rainforest.

Tables, figures and results in Chapter 3 outline the topography, migration rate, agro-industries and construction of infrastructures in support of businesses, which are occurring in the tropical rainforests in Riau favour the cyclical pattern of forests and peat fires. To go deeper into the

analysis of the relationship between the pressures and the intensity of forest and peat fires from 2011 up to 2015, GWR was performed. As a result of the regression analysis on the assumed pressures, the variables that are significantly contributing to the intensity of forest fires are identified in **Table 5.1**. The full disclosure related to data screening and statistical analysis is shown in **Appendix G.**

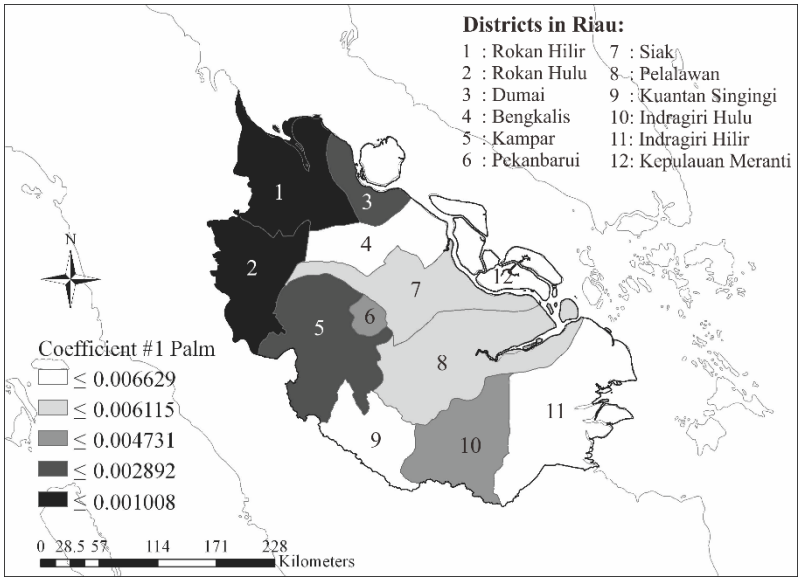
Table 5.1 Forest fire intensity and explanatory variables

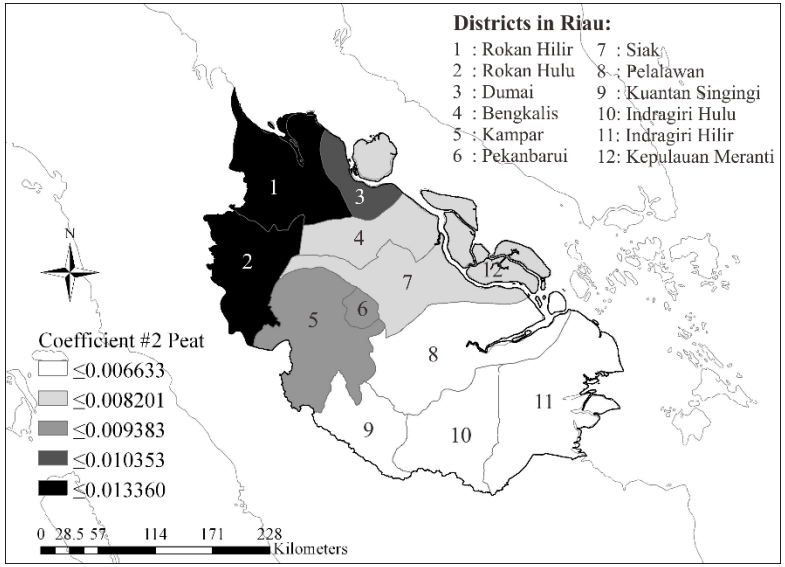
Dependent variable : Forest fires' intensity		
Explanatory variables	GWR R^2 adjusted	Coefficient ranges
Palm oil plantations	0.57	0.0011-0.0067
Timber and non-timber agro-forests	0.79	0.0058-0.0134
Human ignition of peatlands	0.61	0.0025-0.0153

GWR R^2 is a statistical measure that indicates the fitness of predicted mode, in other words, how close the data are to the fitted regression line; 1 exhibits perfect prediction of the model, whilst 0 shows no statistical correlation between the model and data. Coefficient ranges reflect the strength between individual explanatory variables in causing the intensity of forest fires. The coefficient of each explanatory variable is varied across districts in Riau. Additionally, **Figure 5.1** displays particular relevant contributing factors in different districts in Riau.

The figure leads us to a better understanding of specific pressures on the tropical rainforest. The results obtained suggest an overall positive relationship of pressures contribute to forest and peat fires. In the spatial context, the southern districts (Kuantan Singingi, Indragiri Hilir, Indragiri Hulu and Pelalawan district) have suffered from forest fires mainly because of ignition on the peatlands, whilst palm oil concessions play a major role in intensifying forest fires in Indragiri Hilir, Kuantan Singingi and Bengkalis. In Rokan Hulu, Rokan Hilir, and Kuatan Singingi the major determinant of forest fires are the timber and non-timber agro-forests. Such continuous human ignition of peatlands on the tropical rainforests potentially put the SESs in an even more vulnerable stake. As temporal and spatial fire patterns interact with the

characteristics of the landscape, fires can make the burnt area more susceptible to fires, the next time there is a fire (Niklasson and Granstrom, 2000).





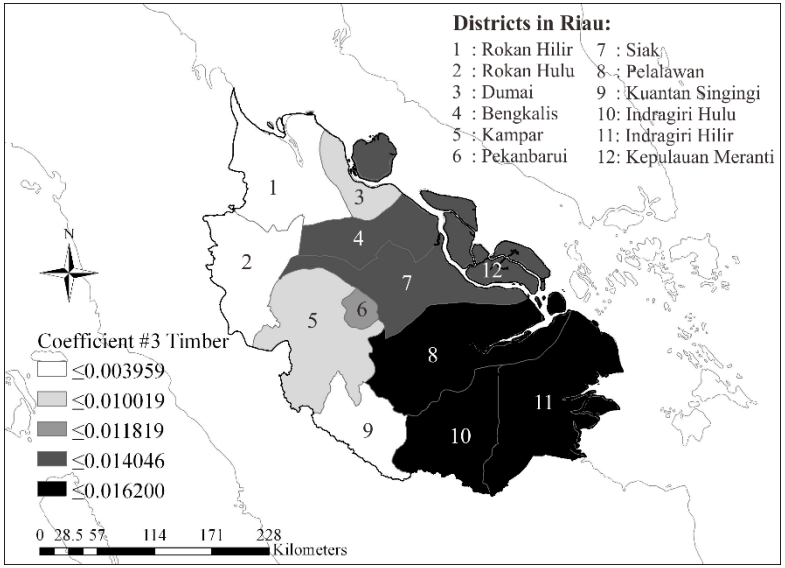


Figure 5.1 Coefficient distributions of each influencing pressures on every district in Riau

The forest and peat fires occurring on tropical rainforests in Riau confirms the conflict between economic development and environmental quality that has been taking place globally. As the historical timeline of major policy and development measures (refer to **Figure 3.6**) illustrates, the awareness of pervasive negative environmental externalities coming late to the tropical rainforests in Indonesia. It was only in 2013 that there was an agreement between Indonesia and the European Union regarding sustainable forest governance principally to halt illegal logging timber and improve forest management (EU FLEGT, 2016). The majority of interviewees indicated that a prompt response in relation to ratification and immediate adoption of some regimes were due to the trade and economic elements of an agreement, for instance the FLEGT agreement. This arguably signifies that there are many economic interests beyond the environmental quality for international environmental regimes to influence regular forest governance and practices.

Furthermore, stakeholders also benefit from incentives that encourage the conservation or use of the rainforest. Interests also grant a sense of orientation on the outcome of governance (Interview 1, 2016; Interview 4, 2016). Interests may also help explain the results of governance. Thus, it may appear to be straightforward to focus on short-term capital gain instead of thinking in the long term. The diversity in valuing benefit above and beyond the forest products is also likely to be affected by interests held by the stakeholders. In addition, interests in burning forests and peatland also span the entire social and economic sphere. As several interviewees remarked during the interviews, "some prioritise the low expense to clear out as much land as possible for their agricultural business, several set fires as a form of protest against the large agro-corporations, while some others prefer to increase their social status by being forest owners who can decide the management of their land".

The interest in economic gain is important to be investigated, understood and considered in the design of policy responses to ensure that environmental regimes stand a chance of effectively counteracting the illegal and destructive use of forest ecosystems in the name of economic development. Understanding the drivers and pressures on tropical rainforests in the lowest possible level of governance helps to determine which of the environmental regimes are relevant to safeguard the forest governance and management.

5.2. Influence of international environmental regimes

5.2.1. Evaluation of the influence of international environmental regimes in Riau, Indonesia

Proceeding to a more definitive discourse of ending man-made forest and peat fires through international environmental regimes, the influence of each regime on local forest governance is investigated. International environmental regimes that are discussed in this research are essentially the ones that are considered to have the power, in principle, to tackle the interests shaping the governance and use of tropical rainforest. This thesis acknowledges that, in Indonesian political landscape, many international environmental regimes are not fully integrated into the policy architecture, despite their signature and ratification or adoption of MEA. Dimensions of regime influence that are posited in the methodology section of this thesis comprise two aspects: problem relevance and actors' interests and capacities. Based on the in-depth interviews to develop a causal and empirical explanation for the propounded theory, the following are the results of the investigation.

Table 5.2 Evaluation result of international environmental regime influence in Riau, Indonesia

International Environmental Regimes	Score per indicator of regime influence					
	P1	P2	A1	A2	A3	A4
ASEAN Agreement on Transboundary Haze Pollution	2	2	1	1	2	2
Forest-product certification regime	2	1	0	0	0	1
Regime that combats desertification	0	0	1	2	2	1
Biological diversity regime	2	2	2	2	2	2
Climate change regime	2	2	2	2	2	2
Endangered species trade regime	0	1	1	0	0	1
International rubber trade regime	0	0	1	0	0	1
International tropical timber production and trade regime	1	1	1	0	0	2
Palm oil certification regime	2	2	1	1	2	2
Wetlands (including swamp and peatlands) regime	2	2	2	2	2	2

Table 5.2. is a summary of in-depth interviews and literature analysis on regimes' influence that will help to characterise different arrays and degrees of regimes' relevance in mitigating forest and peat fires in Riau, Indonesia. The simple additions of each indicator can distinguish the position of each regime and how they have been used in forest governance. Descriptive analysis of the results gained from the in-depth interviews for each indicator can be noted in **Appendix F**. In support of the results depicted in **Table 5.2**, there are ten subsections explaining how each of the international environmental regimes influences local forest governance in Riau, Indonesia. The concise syntheses are presented in the same manner by indicators shown in the results of the in-depth interviews and document analysis.

5.2.1.1. ASEAN Agreement on Transboundary Haze Pollution (AATHP)

The twelve year wait for all the signatory states to the AATHP finally ended in 2014. Indonesia was the last country to ratify the agreement under Law 26 of 2014. The agreement is extremely

relevant to the problem of man-made forest and peat fires especially in Riau, Indonesia where the province geographically faces several ASEAN member state. The late ratification was primarily due to national concerns over potential breaches of sovereignty in sharing information even for the sake of mitigating the sources of regional haze (The Jakarta Post, 2014; Interview 6, 2016; Interview 7, 2016). Currently, Indonesia's National Disaster Mitigation Agency (BNPB) is working together with ASEAN Coordinating Centre for Transboundary Haze Pollution (ACC) in monitoring and implementing measures to prevent and act upon regional haze pollution. The fund to enforce the regime is channelled through BNPB.

5.2.1.2. Forest-product certification regime (FSC)

The analysis of pressures on the tropical rainforests in Riau presented in Chapter 3 and 5.1, attempts to ensure that the forest products, both timber and non-timber, either taken from the forest or agroforest are not the result of man-made fires is worth investigating. Amongst the certification regime for forest products that exist in Indonesia are Forest Stewardship Council (FSC) and Lembaga Ekolabel Indonesia (LEI). LEI was a national version of FSC to support more affordable certification for more enterprises in Indonesia (Interview 3, 2016). All of the interviewees asserted that although the voluntary certification schemes have been around for sometime in Indonesia, they have the potential to cover the reduction of forest-fires via sustainable practice of agro-forestries. However, they do not attract much interest from the stakeholders, especially business sector, in fighting against man-made forest fires.

5.2.1.3. Regime that combat desertification (UNCCD)

The regime was established under the United Nations Convention to Combat Desertification (UNCCD) and concerned with improving research and approaches to overcome land degradation (UNCCD, 2001). All the interviewees agreed that due to the pressures on the forest and peatland, land degradation in Indonesia is salient, but still does not cause any land desertification. The convention was ratified under Presidential Decree 135 of 1998.

Nevertheless, up to now, there are no further plans to combat the desertification issue in both local and national forestry plan. Regarding land and forest degradation, a massive budget is allocated by MoEF annually. In 2014, IDR 61.85 billion was channelled to assist the rehabilitation programme that was written as part of national report presented at UNCCD convention (Giessen and Sahide, 2015). The support given to local authority in Riau in the form of rehabilitation budget does not count towards the effort in reducing man-made forest and peat fires. Several interviewees asserted that it may arguably motivate weak enforcement of forest management as they secure the rehabilitation fund, instead of operational fund. Additionally, the majority of the interviewees were all questioning the fact that Indonesia ratified the UNCCD convention, which is particularly designed for countries in Africa, the Mediterranean, and South America, as it states in the annexes.

5.2.1.4. Biological diversity regime (CBD)

The regime is practiced based on the ratification of Convention on the Biological Diversity (CBD) under national Law 5 on 1994. Pursuant to the supplementary commitment of CBD agreed in Rotterdam and Nagoya, there are ratifications under Law 10 and 11 of 2013. At the local level, the Department of Environment and Forestry (DoEF) in Riau is responsible for implementing the laws. Even though there is no CBD secretariat in Indonesia, there are local and international non-state actors executing projects together with DoEF in Riau to halt forests and peats fires based on the principles of Biological diversity regime. Furthermore, partnership and cooperation specifically under the CBD can also be observed through the Memoranda of Cooperation and Joint Work Programmes (CBD, 2016) and MoEF Decree 390 of 2003. For biodiversity and habitat conservation alone, the National Ministry of Environment and Forestry (MoEF) allocated IDR 1355.53 billions (stated in Strategic Plan of MoEF 2010-2014 and MoEF Regulation 51 of 2010). However, there is no specific budget to mitigate forest and peat fires under Biological diversity regime so far.

The problem that is covered by the scope of the regime is, however, seen to be relevant by all of the interviewees. They argue that the regime has become the centre-piece of tropical rainforests conservation. Hosting the second largest tropical rainforests in the world (UNEP, 2009), it is a valid argument to allow influence brought by the regime on local forest governance. Biological diversity regime is regarded as a strategic move to anticipate forest transformations into plantations that have been causing serious biological diversity loss in Riau, particularly in light of endangered species living in the tropical rainforests of Riau. The GOI aims to provide 26,819,383 ha of conservation area to include biological diversity protection from any harmful habitat destruction under MoEF Regulation 45 of 2011, including the threats of man-made forest fires.

5.2.1.5. Climate change regime (UNFCCC)

Climate change is a constant menace to an archipelago country such as Indonesia, as the consequences of climate change are catastrophic to thousands of islands (Allison *et al*., 2009). Changes in the weather, like the El Nino oscillation, also cause damage to crops from plantations surrounded by peatland and forests, in addition to the intensification and exacerbation of forest fires. These are several reasons why mitigating the source of greenhouse gases and adapting to the climate change under United Nations Framework Convention on Climate Change (UNFCCC) is relevant to the biophysical setting of Indonesia. Hence, addressing the cause of climate change including man-made forest and peat fires, has become one of the principal priorities for MoEF. Additionally, the latest study by the World Resource Institute (WRI) published in 2015, revealed that due to these widespread and destructive fires, Indonesia accounted for the fourth largest emissions in the world (WRI, 2015).

The problem relevance of climate change was elevated by national interest in the contribution of Indonesia to reduce 26% of its greenhouse gases against the business as usual scenario by 2020 (UNFCCC, 2015). Henceforth, the Riau planning agenda also incorporated changes to

enable the target to be achieved, principally through emission reduction from land-use, land-use change and forestry (LULUFC) (Interview 4, 2016). In addition, a special budget worth of IDR 4.5 billion was also circulated to help achieve the target by financing a shift in local forest governance and practice in 2014 (MoF, 2015). Furthermore, to better coordinate the international actions and programme, such as REDD+ (Reducing emissions from deforestation, forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries), an international body, UNORCID (United Nations Office for REDD+ Coordination in Indonesia) was established in 2014. However, amidst the support shown by the current government, both the REDD+ Agency and the Council on Climate Change (NCCC), which was led directly by the former president and was powerful in terms of integrating programmes across ministries, were disbanded and subsequently merged under MoEF (Jakarta Globe, 2015). This has created mixed responses from many interviewees, as some suggest that such a manoeuvre has weakened the influence and effectiveness of Climate change regime (Interview 3, 2016; Interview 6, 2016; Interview 7, 2016; Interview 8, 2016).

5.2.1.6. Endangered species trade regime (CITES)

Endangered species trade regime has a long history to examine. Ratification of Convention on International Trade in Endangered Species of Wild Fauna and Flora in Indonesia was achieved in 1978 (Presidential Decision 43 of 1978), and further advocated by the Biodiversity Conservation and its Ecosystem Law of 1990 (Law 5 of 1990). Several ministries and Indonesian research institutions (MoEF, MoMF and LIPI) were granted the authority and funds to ensure the regime is equipped to manage the protection of flora and fauna (Interview 5, 2016; Interview 6, 2016). In addition, several partnerships were initiated with NGOs and private actors to campaign the regime (Interview 4, 2016; Interview 6, 2016). The active use of the regime and the regime's mission in ensuring the habitat for protected flora and fauna, in addition

to legal and financial support given to the regime may, to some extent, contribute to the betterment of local forest governance in Riau. However, there is no apparent tendency to use the regime as a tool to mitigate man-made forest and peat fires, despite the burnt forest area ultimately also impacting upon the flora and fauna of Riau's natural ecosystem. Interviewees agreed that in pursuance of a reduction in man-made forest and peat fires, the endangered species trade regime does not contribute to the reduction of the risk and occurrence of fire.

5.2.1.7. International rubber trade regime (INRA)

In 1979, the International Natural Rubber Agreement (INRA) was agreed to regulate international rubber trade. This regime aims to stabilise the prices of natural rubber on the international market in order to balance supply and demand for rubber growth (Khan, 1980). It claims to be an economic tool to control land-use change for mid-/long term development (Khan, 1980), hence the inclusion in the regimes I am investigating. In spite of the absence of implementing organisation and legal support in Indonesia, active consultation between Indonesia rubber entrepreneur association with the Ministry of Agriculture (MoA) and Ministry of Trade (MoT) are ongoing (Interview 3, 2016; Interview 6, 2016; Interview 7, 2016; Interview 8, 2016). Hence, it is no surprise that amidst the declining price and interest amongst farmers to produce rubber in Riau, the national government has imposed a rubber replanting programme worth IDR 104 billion (CNN Indonesia, 2016). The majority of interviewees agreed that International rubber trade regime makes no positive contribution in the attempt to reduce the intensity and severity of the man-made forest fires; and even promotes man-made fires for rubber plantations.

5.2.1.8. International tropical timber production and trade regime (ITTO and FLEGT)

The constant demand for tropical timber production creates an international environmental regime that aims to sustainably manage and harvest the forests. The argument given by

proponents of the regime insists that the trade regime positively contributes to forest governance in Riau (Interview 2, 2016; Interview 4, 2016; Interview 5, 2016). Indonesia as one of the signatories of the European Union Forest Law Enforcement, Governance and Trade (EU FLEGT) and International Tropical Timber Trade Agreement (ITTO) is bound to promote diversification of international timber export products, while halting illegal logging (Murniningtyas *et al.*, 2007). Furthermore, the EU FLEGT continues to be monitored by national and local government alongside the European Union (EU), since its early adoption, unlike the ITTO that is losing its influence due to the export ban concerning logging (Interview 2, 2016; Interview 4, 2016). In fact, Indonesia was the first Asian country, which signed the voluntary partnership agreement of EU FLEGT to receive the FLEGT licence in 2016 (EU FLGT, 2016). While the result of the regime based on the EU FLEGT has an impact on curbing illegal logging, all the interviewees agreed that it has no further influence on reducing man-made forest fires.

5.2.1.9. Palm oil certification regime (RSPO)

Palm oil was chosen to be the principal commodity of Indonesia (MoNP, 2011). To guarantee that the agricultural operations are not degrading the quality of the environment, GOI has expressed the importance of palm oil certification in agricultural development (MoF, 2016). Currently, there are two international palm oil certification systems: the Roundtable on Sustainable Palm Oil (RSPO) and International Sustainability and Carbon Certification (ISCC). ISCC is a German certification system that provides assurance regarding biofuel processing methods, and has been adopted by several large agro-industrial companies in Indonesia that produce palm oil-based biofuels (ISCC, 2016). Holding an ISCC certification allows the biofuel to enter the European market, as the product is considered to demonstrate compliance with EU Renewable Energy Directives. According to the in-depth interviews, however, the ISCC exerts little influence on the fight against man-made fires, as the number of companies to have attained

the certification remains low; regardless that the certification scheme is attempting to implement positive change in the field of agro-industry.

Primarily, the RSPO as a global multi-stakeholders initiative pertaining to sustainable palm oil is a more common measure in the field of agriculture, as well as forestry. The certification grants the producers and sellers a seal of approval that ensures the volumes of palm oil sold are traceable to the sustainable practice of growing, harvesting and land management (RSPO, 2013). This is exceedingly relevant to the drivers and Indonesia as the biggest producer and exporter of palm oil has been actively promoting the regime of palm oil certification. The promotion of regime is heightened by the creation of a similar national certification scheme, known as the Indonesian Sustainable Palm Oil (ISPO) in order to reach even more small and medium palm oil enterprises. The ISPO system was established in 2011 under ministerial regulation (MoA regulation 19 of 2011) (ISPO, n.d.). Although the nature of ISCC, RSPO and ISPO are voluntary, MoA is attempting to broaden the coalition and collaboration in support of the regime via various joint studies, researches and projects under United Nations programmes and initiatives (UNDP, 2014).

The problem relevance and actors' interests and capacities in utilising the regime as a tool to reduce man-made forest and peat fires are observed. The regime scope matches the drivers of the problem appropriately, while a number of the interviewees argued that Palm oil certification regime obtains full support from the authorities due to high concordance with national and palm producers' interests (Interview 3, 2016; Interview 5, 2016; Interview 8, 2016). Several of the interviewees argued that amidst the potential use of the regime, it does not mitigate the main driving forces in relation to the tropical rainforests in Riau. Therefore, the regime can only slow down the development of new palm oil plantations, coupled with smallholders expanding their farms to meet rising demand for palm oil.

5.2.1.10. Wetlands (including swamp and peatlands) regime (Ramsar Convention)

The Convention of Wetlands of International Importance, also known as the RAMSAR convention, has been highlighting the issue of wetland, swamp and peatland preservation since 1971 (Matthews, 1993). There are seven wetland conservation sites in Indonesia (Ramsar, 2014) which are still considered low in comparison with the total 20.6 million ha peatland area. Examining the SESs context, the problem relevance covered by the regime is high. Rich in organic matter, highly flammable peatlands and swamps are integrated features of the tropical rainforests in Riau (Murdiyarso *et al.*, 2010). Subsequently, the combination of common biomass burning and drainage of the peatland for land-use conversion set vast fires on the carbon-rich land (Miettinen *et al.*, 2012; Murdiyarso *et al.*, 2010). The trend is exacerbated by the need to drain the converted land to serve another purpose regarding land-use, such as plantations, rice paddy field, housing, etc.

The RAMSAR convention was ratified in 1991 under Presidential Decree 48 of 1991. The MoEF, under MoEF decree 22 of 2007, started the collaboration with international organisations regarding the protection of peatlands, which included Riau. In addition, the initiation of a joint project worth of AUD 37 million to monitor peatland management performance in Kalimantan Island was conducted by the Indonesian and Australian governments (Atmadja *et al.*, 2014). The former president also issued the peatland moratorium in until 2015 (President Decree 6 of 2013). Nevertheless, it was only in 2016 that the GOI, under the current presidency, took the regime even more seriously. Presidential Decree 1 of 2016 stated the establishment of Peat Restoration Agency under the direct supervision of the President. Specific budget allocation to support the new agency has not yet been disclosed, but respondents in the interviews said that the Agency attracts donors from other countries that

originally channelled their financial support by means of the disbanded REDD+ Agency (Interview 8, 2018; Interview 9, 2016).

5.2.2. Result analysis: Matrix of regime influence in Riau, Indonesia

Principles that international environmental regime influence is determined by the problem relevance and actors' interests and capacities can possibly characterise the types of influence international environmental regimes have on local forest governance. Using a matrix depicted by **Figure 5.2**, we can conceptualise regimes concerning their attributes. The x-axis of a matrix describes the interests and capacities of actors in using a regime, while the y-axis labels the suitability of the regime to address the problem of man-made forest and peat fires, which is a proxy for relevance in the present case. Based on the composite indicators laid out as the analytical framework in Chapter 4.3.1, each score for a given indicator must be added together to specify the magnitude of problem relevance and actor dimensions (refer to **Table 4.2**). Below is the conceptual matrix to assess the regime influence of local forest governance.

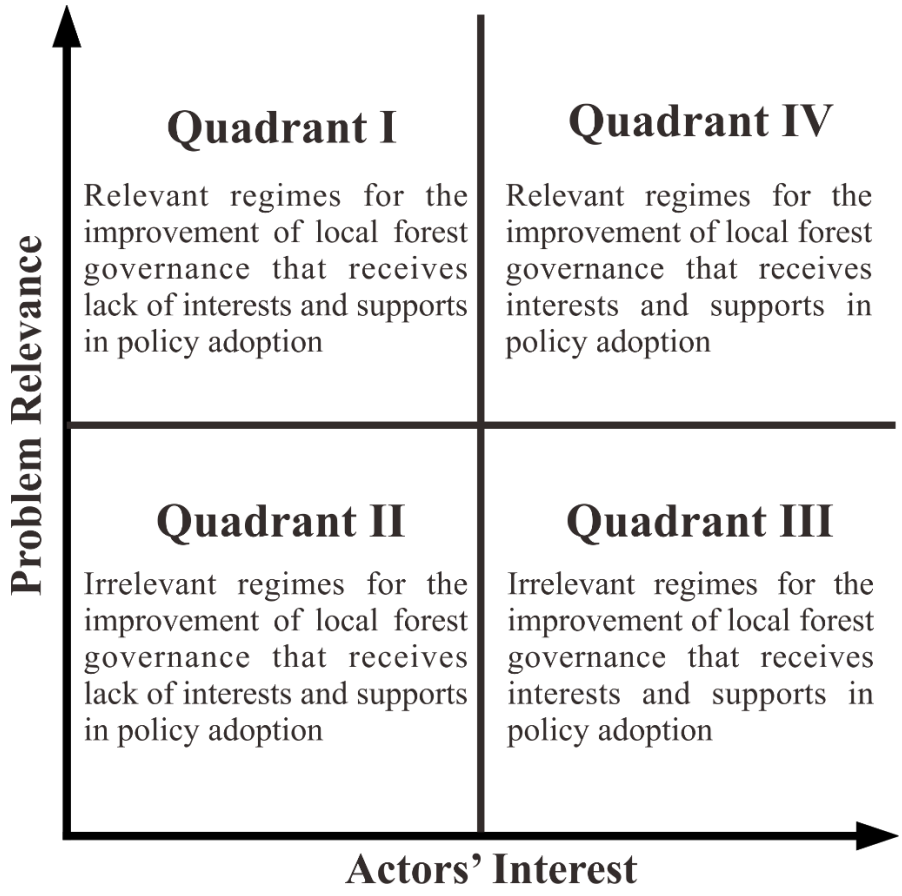


Figure 5.2 Regime influence matrix of environmental regimes on local forest governance

The use of four quadrants is to demonstrate the characteristics of influence that a regime can bring to local forest governance. Quadrant I illustrates a regime that has relevance only in the problem dimension and has not been used extensively by stakeholders in local forest governance. The regimes in Quadrant II have little relevance for the problem and represent low interest to stakeholders. Quadrant III displays regimes that are of stakeholders' interest; however, they are unrelated to forest and peat fires mitigation. Quadrant IV exhibits regimes that are of the stakeholders' interest in relation to mitigating the forest and peat fires. By quantifying the influence of each environmental regime according to the indicators, the regime influence matrix can be utilised to map regime influence on local forest governance, principally to mitigate man-made forest and peat fires. The range of actor dimension (x-axis) is from 0 to 8; a value that is lower than 4 is considered insignificant with regards to the actor dimension.

As for the problem dimension (y-axis), the range of axis is between 0 and 4. A value that is less than or equal to 2 is irrelevant for problem dimension. The detailed calculation for regime quadrant noted in **Appendix H**.

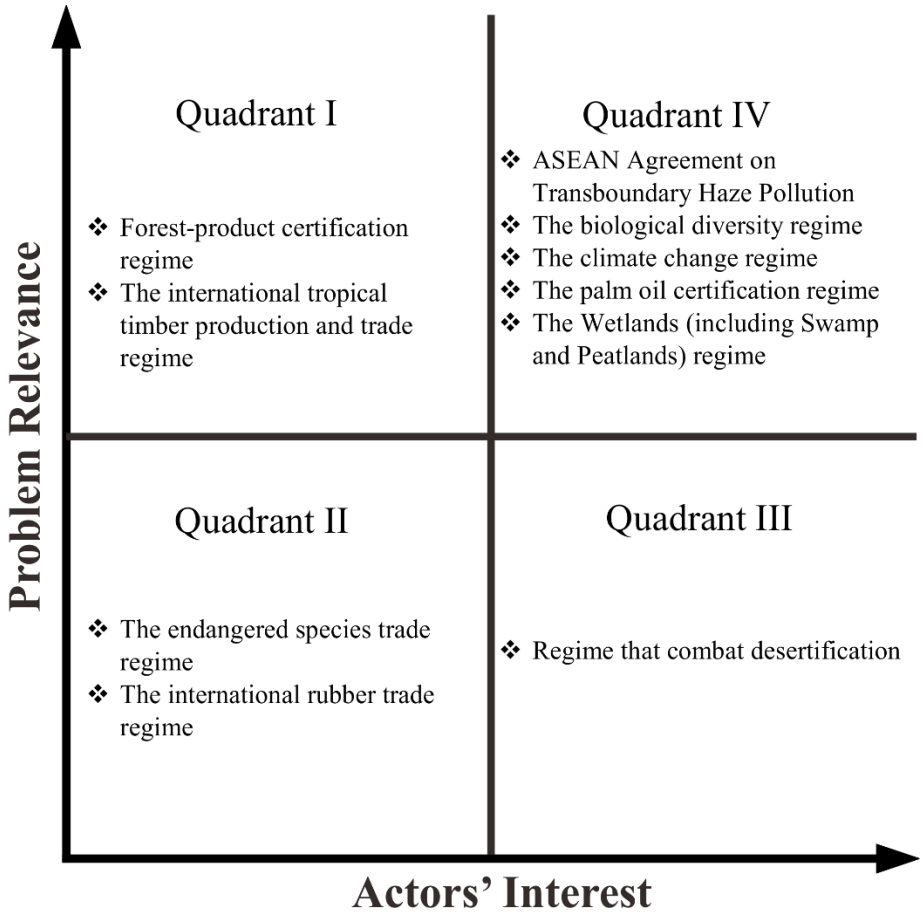


Figure 5.3 Regime influence matrix of environmental regimes on local forest governance in Riau, Indonesia

The construction of the matrix that accommodates the dimensions of regime influence enables us to map and characterise the existing regimes concerning tropical rainforests governance in Riau. There are basically four characteristics of international regime influence. **Figure 5.3** classifies AATHP, Biological diversity regime, Climate change regime, Palm oil certification regime and Wetlands regime have influenced the local forest governance in Riau, although the degree of influence is not within this research scope, and would require further investigation. As the supporting subsections have detailed the dynamic of each regime, we can conclude that problem relevance alone is insufficient to allow a regime functioning on its own.

Regardless the relevance of the scope of a regime with the urgent issue of forest and peat fires, a regime can only make a difference the local governance when stakeholders have an interest and capacity to allow the influence. The AATHP is an example. Indonesia was the last ASEAN member state to ratify AATHP. Ironically, as a major source of haze across the region, Indonesia could benefit greatly from the agreement without waiting for twelve years to ratify the treaty since the regional commitment. Due to the reluctance to share information on the source of transboundary air pollution under the pretense of national security, the environmental benefits of the regime were belittled (Interview 3, 2016; Interview 5, 2016). Another example is the influence of Climate change regime that has to be held back by disbanding NCCC and national REDD+ agency, notwithstanding the relevance and financial support the regime potentially brings to many pressing challenges that are not sectoral in nature.

On the other hand, a regime that has low problem relevance can influence local forest governance. The regime that combats desertification (UNCCD) for instance has nothing to do with the problem of critical forest and peat fires in Riau, or any problem that is currently experienced by tropical rainforests in Indonesia. The UNCCD convention itself has already indicated the parts of the world where the convention is particularly pertinent. Nevertheless, the regime receives financial support for implementing the convention. Without any problem justification, the political benefit of adopting the regime may not be able to last for an extended period of time.

The International tropical timber production and trade regime (ITTO and FLEGT) is identified to be relevant for mitigating forest fires from land conversion into agro-forests. Yet, it only makes little difference due to inadequate support and attention from stakeholders. Although it has potential to make a difference in mitigating forest and peat fires, a regime that is not on the political agenda will not be able to influence forest governance.

Identification of international environmental regimes' influence on local forest governance based on problem relevance and actors' interests and capacities can be one way to understand the dynamic of the adopting of international policies at the national or subnational level. Indicators of regime influence were defined to analyse the basic characteristics of regime complexes. As shown through the assessment results, several regimes have legal support, focal points and implementing bodies, funding backing, and coalitions with state or non-state actors. Nonetheless, there are some that do not have those basic operational conditions to influence forest governance. This is related to the interest of stakeholders' interests and capacities, and if the scope of regime covers the problem area. The framework and characterisations offered in this thesis can hopefully clarify the gap between the need for regimes and underlying practical policies that work and the political willingness to adopt regimes that are irrelevant for both the problem and for stakeholders.

According to the result, the field of environment and forestry are subject to political polarisation. The way in which domestic authorities select regimes and make their interests in the regimes relevant can possibly leave the rest of the actors in the governance system with little choice. Regimes adopted by governments are loosely connected and either compete or collaborate to address issues where effective action would actually require regimes, or those who implement them, to closely work together. It is occasionally difficult to distinguish alternative ways to conduct local forest governance by the influence of international environmental regimes. Rather than following the narrative that has been set as the discourse on the issue, the next answer to the third research question will discuss the way in which the collective result of the existing environmental regimes can potentially contribute.

5.3. Network analysis on international environmental regimes

Based on data-driven methodology, to answer the first research question (1. In order to focus on the pertinent environmental regimes that are possible in mitigating forest and peat fires, what are the main pressures on tropical rainforests in Riau, Indonesia?), I have identified pressures on tropical rainforests that contribute to the massive and frequent forest and peat fires in Riau. Selected international environmental regimes—with several additions of trade regimes that arguably have environmental aims and principles—that are directed at mitigating the pressures on the forests and reduce the intensity of forest fires were examined to answer the second research question (2. How do local authorities, experts and civil society make use of individual international environmental regimes to guide policies and mitigate the issue of forest and peat fires in Riau, Indonesia?). In conjunction with local stakeholders, individual regimes' influences were discussed using a set of indicators. The next research question on how the structural pattern of environmental regimes can potentially contribute to mitigating the risk of forest and peat fires remains. This section attempts to make use of network analysis to explore the third research question (3. What insight can be gained from the implementation of various international environmental regimes to mitigate forest and peat fires in Riau, Indonesia?).

5.3.1. Results features of network structure

As indicated by the majority of the interviewees, both local and national stakeholders are aware of the threats to SESs in Riau. The stakeholders also recognise impacts of international environmental regimes on forest management and governance. Yet divergent concerns and interests related to tropical rainforests outweigh the potential of environmental regimes in mitigating forest and peat fires. Furthermore, the lack of coordination mechanism, insufficient capacity and contradictory objectives lead to weakened coherence and, by proxy, weaken collective impact of environmental regimes to positively affect local forest governance.

A network of social institutions, in this case international environmental regimes, has the ability to affect how actors behave (Bodin and Crona, 2009; Scholz and Wang, 2006). Stakeholders involved and collaborating through a network and involvement in creating joint strategies are pivotal to the actors' capacities for advocating environmental challenges. Such dependency is commonly observed on account of,

> "*Policy actors seek network contacts to improve individual payoffs in the institutional collective action dilemmas endemic to fragmented policy arenas.*" (Berardo *et al.*, 2010).

To date, there is still hardly any empirical analysis of networks in environmental and forestry governance. Analysing the existing network of environmental regimes on local forest governance helps to straighten out the pattern of relations among the regimes that can help enhance or hinder the social capital and regime's influence of each regime. Therefore, this last part of the research explores the above mentioned hypothesis by further exploring the network of environmental regimes.

The analysis began with a question on potential linkages amongst environmental regimes that interviewees think can contribute to the reduction of forest and peat fires. **Figure 5.4** is the summary of the interviews. The use of a binary system ('Close' or 'Distant') to rate the connection amongst environmental regimes (ERs) was determined to be effective given the limited time for interviews. Based on interviewees' considerations, I carried out the examination by analysing the primary documents for each MEA and certification regimes, focusing on principles and basic criteria. The use of such a methodology is common in the field of network analysis (Le Blanc, 2015). The result of the document analysis is shown in **Table 5.3**. Moreover, ratings were derived from interviewees' responses and the results of document assessment.

International Environmental Regimes										
ASEAN Agreement on Transboundary Haze Pollution (ER1)										
Forest-product certification regime (ER2)	C									
Regime that combat desertification (ER3)	NA	NA								
Biological diversity regime (ER4)	C	C	NA							
Climate change regime (ER5)	C	C	NA	C						
Endangered species trade regime (ER6)	NA	NA	NA	D	D					
International rubber trade regime (ER7)	NA	D	D	D	D	D				
International tropical timber production and trade regime (ER8)	NA	C	NA	D	C	D	D			
Palm oil certification regime (ER9)	C	C	NA	D	C	D	D	D		
Wetlands (including swamp and peatlands) regime (ER10)	NA	D	C	C	C	D	D	D	C	
International Environmental Regimes	ER1	ER2	ER3	ER4	ER5	ER6	ER7	ER8	ER9	ER10

Figure 5.4 Adjacency matrix of summary on the potential links of cooperation among environmental regimes according to interviewees in combating forest and peat fires in Riau, Indonesia

Binary system of rating: C = 'close'; D = 'distant'; NA = not available (if the interviewees are unsure with the quality of connection).

Table 5.3 Links between environmental regimes in an attempt to reduce the intensity of forest and peat fires

Principles, aims, and basic criteria of environmental regimes	Converging principles, aims, and basic criteria observed in MEA and certification documents
Ensure no activity threatens tropical rainforests's quality and intactness	AATHP-3.1; CBD-3
Take precautionary measures to anticipate, prevent and monitor forest fires	AATHP-3.3; CBD-7c; FSC-8.2
Use natural resources following sustainable development principles	AATHP -3.4; CBD-8e; CBD-10c; UNFCCC-2.iii; FSC-5.2
Use natural resources in an environmentally sound manner	AATHP -3.4; CBD-8e; UNFCCC-2.iv; FSC-7.1
Develop and implement measures to control sources of fires	AATHP -4.1; CBD-14a; FSC-6.2; RSPO-5.1
Assess and record condition of all fire-prone areas	AATHP -7.1; FSC-9.2
Develop and implement regulatory measures to promote zero burning policy	AATHP -9a; CBD-8k
Develop appropriate policies to curb activity that potentially lead to forest fires	AATHP -9b; UNFCCC-2.vi
Promote public education and raise awareness to prevent forest fires	AATHP -9e; CBD-13b; FSC-4.5
Promote and utilise indigenous knowledge and practices in fire prevention and management	AATHP -9f; CBD-8j; FSC-3.6
Develop strategies to identify, manage and control risks to human health and environment	AATHP -10.1; CBD-6a; CBD-8g
Identify components of biological diversity for habitat conservation and sustainable use	CBD-7a; FSC-9.1
Implement strategies to limit or reduce greenhouse gas emissions	UNFCCC-2.vii; RSPO-5.6

(Author's elaboration, based on AATHP, 2002; CBD, 1992; CITES, 1973; CWI, 1971; EU FLGT, 2014; FSC, 2012; INRA, 1979; ITTO, 2006; RSPO, 2013; UNCCD, 1994; UNFCCC, 1997)

For the purpose of readability, the principles, aims and criteria in the right column of **Table 5.3** are labelled according to their (parent MEA/certification scheme)-(numbers/points) as written in the original documents. For instance, if it is based on agreement of CBD point 7a, it is written CBD-7a. **Table 5.3** and **Figure 5.5** present aggregate pictures of the ties amongst environmental

regimes based on the similarities in the principles, aims and criteria within an encompassing goal to reduce the intensity of forest and peat fires. Similar principles, aims, and criteria of environmental regimes to reduce the intensity of forest and peat fires are from now on assumed as "converging strategies" that are offered by each environmental regime. Environmental regimes in **Figure 5.5** are represented as nodes, while straight lines that tie one node to another depend on the degree of convergence of strategies between two regimes.

Figure 5.5 is a 1-mode reduction of the initial bipartite network. The nodes in bipartite networks can be divided into two disjoint sets (Zhou *et al.*, 2007), in this research environmental regimes and its strategies. A One-mode reduction network, usually called as a parent network (Zhou *et al.*, 2007), has no ties to connect those two nodes (environmental regimes and its strategies), instead it is only represented by nodes of environmental regimes. For the purpose of this chapter, the parent network provides a perspective that I would like to focus on by showing the strengths of the links among the nodes. To seek for more information of the network, the complete bipartite network, as a representation of **Table 5.3**, is attached in **Appendix I**. The rest of the result section will be arranged based on the features of the network structure presented in **Figure 5.5**.

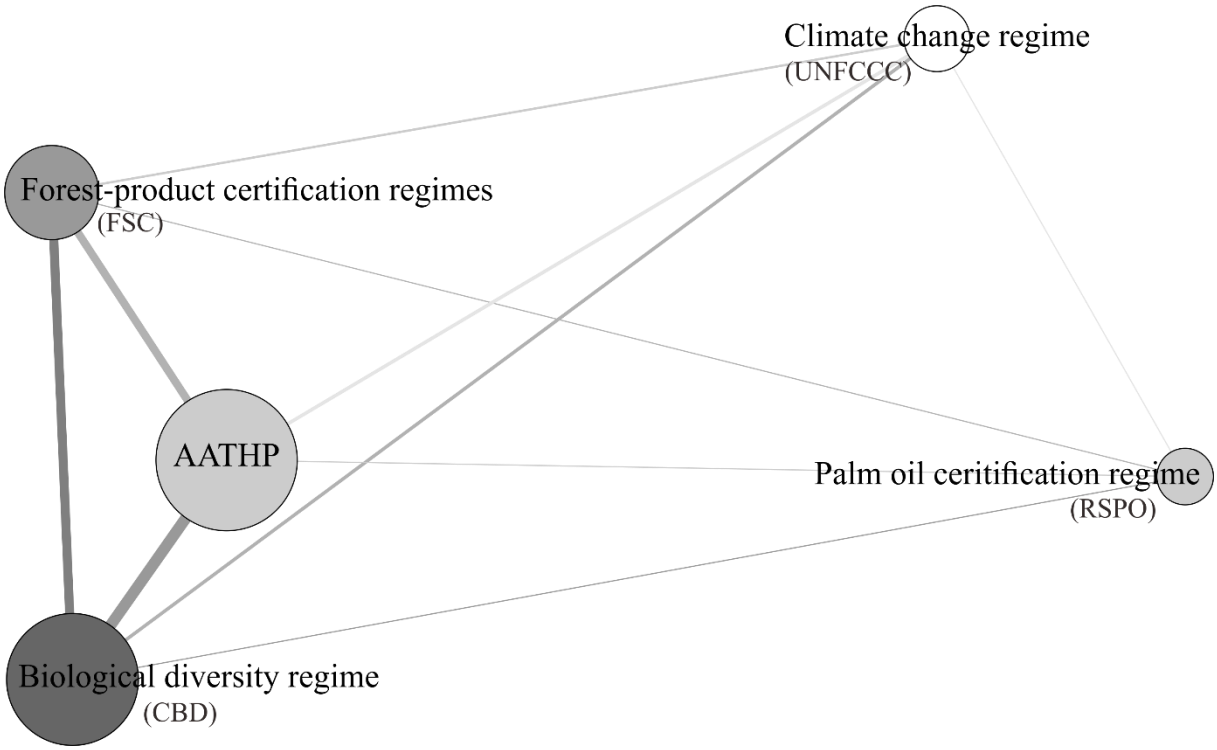


Figure 5.5 Parent network of environmental regimes and their strategies to mitigate forest and peat fires in Riau, Indonesia

Degree distribution

The ten environmental regimes studied have been narrowed down into five observed regimes due to the converging strategies related to reducing forest fires. The number of ties that an environmental regime has represents its degree of distribution. Based on the descriptive feature of network structure, we can decide if the data connected has a good measure of statistics. Examining **Figure 5.5**, all of the environmental regimes have an equal number of links. It appears like that until we delve into the network, shown in **Appendix I**. In a network that involves bipartite connections (nodes of the network are combinations of environmental regimes and strategies offered by an environmental regime), we should consider the strength of the connection. The strong and weak ties in this case are represented by the thickness of the connecting lines, based on the number of converging strategies between two regimes.

Reciprocity

Converging strategies induce reciprocity among environmental regimes that share the same link. For instance, according to **Table 5.3** and its detailed visualisation in **Appendix I**, when actors utilise indigenous knowledge in fire prevention and management, one of the objectives of the AATHP (AATHP-9f), the biological diversity regime (CBD-8j) and the forest-product certification regime (FSC-3.6) are overlapping simultaneously. This candidly means that actors are getting closer to achieving the social expectations embedded within particular environmental regimes, which in the example refers to the AATHP, the biological diversity regime and the forest-product certification regime and. In the sense of network theory, this means that without having to establish a formal agreement among environmental regimes, an execution of converging strategies in combating forest and peat fires will combine the effects of three regimes at a time.

Centrality

Examining the structures of the nodes and their ties, the network structure in **Figure 5.5** conveys a sense of unequal strength of ties; with a particular regime possessing stronger ties. Recognising such a characteristic of several major nodes is one of the main features of network analysis: *centrality*. Centrality, in our case, represents the prominence of an environmental regime with regard to the case of forest fire mitigation. Using statistical methods and network theory, there are two types of centrality shown by **Figure 5.5**. The first one is *betweenness centrality*, which is a statistical measure that accounts for the frequency of a node to link with other nodes (Borgatti, 2005). The more an environmental regime has connected strategies to combat forest and peat fires, the more central its role in mitigating forest and peat fires. Subsequently, there is an *eigenvector centrality*. A node that has high eigenvector centrality is connected to well-connected nodes (Borgatti, 2005). The thicker the link between two

environmental regimes on the map, the more likely they will be linked via joint projects. Based on **Figure 5.5**, the central environmental regimes are the AATHP and CBD.

5.3.2. Discussion on the practicality of information

In natural resource governance, where various stakeholders often need to collaborate to reconcile each others' vision, collective capacities of environmental regimes are easy to overlook. Moreover, inadequate understanding and accounting for possible synergetic ties amongst MEAs and adopted certification schemes can result in underused capacities and opportunities for joint projects and thus synergistic effects, or worse incoherent policies. Network analysis was conducted on the basis of unlocking the combined potential of environmental regimes in local forest governance, under contrasting national interests in agricultural and forest-based products, as shown in Section 5.1.

The influence of a group of environmental regimes on local forest governance, to mitigate pressing problems, such as forest and peat fires, should not be underrated due to several reasons. The results and features of network analysis shown in the previous section are in line with the hypothesis in Section 2.4, that the more the nodes (environmental regimes) are connected, the higher their collective impact on forest governance.

First, there are many potential policy integrations under similar social expectations regarding the MEAs and certification schemes as explained in **Table 5.3**. The results of the analysis add more accuracy to the hypothesis of network concepts and initial insights on social capital within environmental regimes. Secondly, because of the connections shown by the structure of environmental regimes that are considered to have the potential to mitigate forest and peat fires, connected regimes can optimise the budget and financial support given to address the forest fires. Under a limited budget, for example, the enforcement of several projects that are central to the problems are logical, as they have stronger impacts that help achieve the mitigation goal.

In this research, the AATHP and CBD can be the potential points of convergence. Finally, the optimised, or at least enhanced, structure of environmental regimes allow for the emergence of a collaborative governance process by facilitating information flow and exchange across the stakeholders for each environmental regime.

The insights from the environmental regimes' network structure goes hand in hand with the characteristics of regime influence in mitigating forest fires observed in Section 5.2. Several of the relevant environmental regimes are not or not adequately implemented due to the lack of legal and financial support, regardless of their potential role in mitigating the forest and peat fires. This can be recognised from the case of the forest-product certification regime that has pertinent social capital and expectations related to fire risk control. Yet, there is not much concern given to the forest-product certification regime by the national and local government. Even though it is a voluntary certification regime, the situation of the palm oil regime is just the opposite. The palm oil certification regime has an autonomous body that facilitates palm oil certification for all the companies. The decision to exclude a relevant environmental regime can be counter-productive regarding its individual benefits, but also with respect to the regimes' collective impact.

5.4. Generalisability and limitation of the results and discussions

The results of the research are applicable to a specific social-ecological context, primarily limited to a geographical aspect. Geographically, this research focuses on Riau, Indonesia. It narrows down the consideration of pressures on SESs, which leads to the selected environmental regimes to address those pressures. Were this research conducted in another province in another island, the list of environmental regimes under scrutiny may be downsized or expanded. Geographic scope also determines the selection of stakeholders to be interviewed about the influence of environmental regimes on forest governance in Riau. Hence, the results

of the regime influence matrix will be different. The network analysis subsequently will also be different with regard to the nodes, density of ties, degree of network centralisation, and so on. A further limitation is regarding the temporal frame of references for the case study, which affect actions and policies exerted by stakeholders. The regimes can move from one quadrant to another, depending on the treatments and practices at a certain point of time. It is hence important to keep track of the regimes in order to mitigate an environmental challenges.

Another limitation is that the result of the investigation into regime influence has the chance to be misconstrued in relation to the reasons behind the influence of a certain environmental regime. Despite the attempt to clarify that this is research on how environmental regimes can contribute to address forest and peat fires, an environmental regime is practiced not necessarily because of its influence on mitigating forest and peat fires. Although it was not found during the historical assessment, there is the possibility that an environmental regime is adopted and implemented in Riau because of some attribute other than the potential to reduce forest and peat fire risk. The stakeholders may adhere to an environmental regimes because of an additional action orientation. This may put an environmental regime in contrast to what is depicted in **Figure 5.3**, which only has two principal dimensions: problem relevance and actors' interest and capacities.

Despite the limitations, several aspects of the results can be generalised without the contrasints posed by the specific context of the case study. The methodology in general can be applied in tracking down the interests to any environmental and natural resource problem anywhere. The results also offer structure to the political issue that is exceedingly polarised, for example, by utilising the matrix of regime influence. They also contribute to the expansion of network science beyond mapping people and preferences with regard to environmental regimes. Furthermore, it can also be used to see the structure of social institutions, including environmental regimes.

6. Conclusion

The aim of this thesis was to disentangle the relationship between international environmental regimes and local forest governance in mitigating forest and peat fires by means of studying their influence and structure. The thesis sought to answer three research questions: (1) In order to focus on the pertinent environmental regimes that are possible in mitigating forest and peat fires, what are the main pressures on tropical rainforests in Riau, Indonesia? (2) How do local authorities, experts and civil society make use of individual international environmental regimes to guide policies and mitigate the issue of forest and peat fires in Riau, Indonesia? (3) What insight can be gained from the implementation of various international environmental regimes to mitigate forest and peat fires in Riau, Indonesia?

As explained in **Chapter 5**, pressures on tropical rainforest in Riau have primarily come from palm oil plantations, timber and non-timber agroforestry areas, and peatlands during the past 5 years (2011 – 2015). Historically, there were diverse reasons regarding land use under the façade of rural development. The biomass burning technique to clear land to support agricultural activities easily induces wildfires that cause transboundary haze pollution, shifting the nature of problem from a local to a global setting. Additionally, the economic driver behind gaining short-term economic benefit has exerted pressures on tropical rainforests in Riau, which requires urgent mitigation.

International environmental regimes provide several mitigation strategies that can be applied in local forest governance. Following the discussion of pressures on tropical rainforests in Riau, this thesis examined environmental regimes that have the potential to counteract the pressures. As a combination of empirical and analytical fields of research, this thesis investigated the second research question on regime influence based on a set of indicators in Chapter 2 building on in-depth interviews and extensive review of literature. Regime influence has been identified

to comprise two dimensions and several indicators for each: problem relevance (objective and contribution) and actors' interests and capacities (structure in the government body, financial support, legal support, and coordination). Based on these results, the thesis identified a list of environmental regimes which can positively influence forest governance, when applied by local governments and other actors. The results show that there are four possible degrees of regime influence on local forest governance:

(1) The forest-product certification regime (FSC, LEI) and the international tropical timber production and trade regime (ITTO and FLEGT) have an influence on forest governance due to problem relevance; nevertheless, there is inadequate support for implementation from the local and national governments;

(2) The endangered species trade regime and the international rubber trade regime (INRA) have very limited influence due to the irrelevant context and lack of support from government to allow influence to be exerted;

(3) The regime that combats desertification (UNCCD) is allowed to exert influence on forest governance in Riau, even without any problem relevance specifically for forest and peat fires;

(4) The AATHP, the biological diversity regime (CBD), the climate change regime (UNFCCC), palm oil certification regime (RSPO), and the wetlands (including swamp and peatlands) regime (Ramsar Convention) have the greatest positive influence in terms of relevance to the problem that needs to be addressed and the support given by the government.

The collective power of environmental regimes on local forest governance was subsequently analysed following the rules of network analysis. According to the potential converging

strategies to mitigate forest and peat fires, the collective action of environmental regimes can be focused via the forest-product certification regime (FSC), the palm oil certification regime (RSPO), the climate change regime (UNFCCC), with high network centrality in the biological diversity regime (CBD) and the AATHP. The network structure shows the possibility of taking advantage of synergies, maximising the potential in similar objectives, principles and the basic criteria of each regime by means of joint projects and activities**.** Network structure might not be the principal interest; however, the ties that connect similar regimes can reflect a possible way of integrating and coordinating policies, information and financial support more effectively.

Understanding pressures that shape forest governance in Riau, in other words narrowing down the interests surrounding local forest governance, helps to set the political stage for mitigating the urgent issue of forest and peat fires, and thus, further sustainable forest management. It preconditions stakeholders, international organisations, donors and bureaucrats to be more aware of what international environmental regimes can possibly do to counteract the drivers and pressures of man-made forest and peat fires in Riau. Therefore, the empirical study of political and economic players and moreover, the processes are generally of a descriptive value that can initiate a shift in support of evidence-based policies and forest management with minimum interest in forest and peat burning.

Following this research, there may possibly be several exciting possible directions for future research. As this research only focuses on environmental regimes, and few trade regimes that claim to have an environmental aspects, future research can broaden the field of study to other environmental themes. In this research, economic development has been identified as the primary driver of forest loss; hence, it is only logical to include trade regimes in future analysis. Indonesia is engaged with many international and regional trade agreements (Soesastro and Basri, 2005). Therefore, with palm oil and rubber being the primary national commodities

(MoA, 2014; MoNP 2011), the conversion of forests can be expected to continue, as long as the agreements with other countries in their current form.

Moreover, as one of the consequences of carrying out a cross sectional analysis, this thesis did not cover the details of any specific policy measures and practices of the various stakeholders. The influence of an environmental regime is the only way to gain cross-sectional insights on how national and local politics treat the adopted environmental regimes. A further recommendation in relation to future research is to obtain longitudinal measures on the effectiveness of each of the regimes over time. It is worth to investigate specific practices of specific actors when applying each environmental regime that would directly or indirectly result from the adoption of an international treaty.

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Appendices

Appendix A

Consent form for participation of individual interview

Dear Research Contributor,

This is a consent form, a copy of which will be left with you for your records. It should give you an idea of what the research is about and what your participation will involve. If you would like any more details, please feel free to ask.

The objective of this research is to analyse and harness the potential of international land-use treaties, agreements, and conventions to address forest fires that frequently happen in tropical rainforest in Riau, Indonesia. We shall spend some time together, during which I am going to ask you to kindly answer a set of questions and conduct a following interview to understand the way international regulations, agreements, and conventions surrounding land-use are being employed to mitigate and control forest fire events happen in Riau's tropical rainforests. All the answers to the questionnaire and information that you provide me will be confidential and you will not be personally identified in any of my written material, presentations, or published work. Only with your approval, I would also like to use my personal device to record our discussion, so I can fully focus on our conversation rather than taking note. After the interview, I will transcribe and translate our discussion and questionnaire results. I will check back with you to make sure that I am representing your contributions accurately. As a new field of research, it is likely that many of the quotes from the interview will appear in the published work, however only the group as a whole (public authority/private sector/NGO) will be identified, and your individual contributions to the discussion will remain confidential and anonymous.

This research project is part of thesis for the degree of Master of Sciences that has to be carried out within the university policy. All potential risks are assessed thoroughly. I do not anticipate that your participation in this research should expose you to any risks, other than those you encounter in the daily work and life. The benefit of participating in this research is the opportunity to share, discuss, and harness possible ways for multi-governmental agreements impact forest governance at the provincial and national level.

Your signature on this form indicates that you have understood the information regarding participation, and agree to participate as a contributor. In no way this interview and questionnaire waive your legal rights nor release the researches, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and/or to refrain any questions, without prejudice and consequences. If you have any questions and concerns about this study, please contact Zahra Zafira Mutiara at +447984628771 or zahra.mutiara@mespom.eu

"Hereby, I, the undersigned agree to participate in the research. In understand that the interview will be recorded and that the researcher may quote from my written or oral comments, but that my name will not be associated with any of these comments."

Respondent's name _____ Signature _____

Date _____

Appendix B

Questionnaire

Research Objective
The objective of this research is to analyze and harness the potential of international environmental treaties, agreements and conventions to address forest fires that frequently happen in tropical rainforest in Riau, Indonesia.

Instruction (follow the interview guide for a more complete explanation)
There are two parts of the interview questions:
I. Closed question

II. Open question

For ten different regimes below, please rate the question and statement according to the view of the institution that you represent:

1. Is the regime suitable to address forest and peat fires?

Regime \ Objective	Forest and peat fire issues formally fit in with the regime's coverage and aim		
	High match	Medium match	No match
ASEAN Agreement on Transboundary Haze Pollution			
Forest-product certification regime			
Regime that combats desertification			
Biological diversity regime			
Climate change regime			
Endangered species trade regime			
International rubber trade regime			
International tropical timber production and trade regime			
Palm oil certification regime			
Wetlands (including swamp and peatlands) regime			

2. How big is the contribution of the regime as a way to control the forest fire in terms of intensity and severity?

Regime \ Contribution	If the forest fire's intensity and severity are controlled by the regime (contribution)		
	Great contribution	Medium- to-little contribution	No contribution
ASEAN Agreement on Transboundary Haze Pollution			
Forest-product certification regime			
Regime that combats desertification			
Biological diversity regime			
Climate change regime			
Endangered species trade regime			
International rubber trade regime			
International tropical timber production and trade regime			
Palm oil certification regime			
Wetlands (including swamp and peatlands) regime			

3. Is there any bureaucratic structures that carries out the operationalization of the regime?

Regime \ Structure	Bureaucratic structures reflecting responsibility for a regime		
	Specific autonomous bureaucracy	Special unit to deal with the issue through a focal point	No match
ASEAN Agreement on Transboundary Haze Pollution			
Forest-product certification regime			
Regime that combats desertification			
Biological diversity regime			
Climate change regime			
Endangered species trade regime			
International rubber trade regime			
International tropical timber production and trade regime			
Palm oil certification regime			
Wetlands (including swamp and peatlands) regime			

4. Is there any budget allocations for regime's operations?

Regime \ Budget	Budget allocations for a regime		
	Substantial	Marginal	No budget
ASEAN Agreement on Transboundary Haze Pollution			
Forest-product certification regime			
Regime that combats desertification			
Biological diversity regime			
Climate change regime			
Endangered species trade regime			
International rubber trade regime			
International tropical timber production and trade regime			
Palm oil certification regime			
Wetlands (including swamp and peatlands) regime			

5. Is there any legal mandate to implement a regime?

Regime \ Legal Support	Legal mandate to implement a regime		
	High support, e.g. national mandate and regional instruction	Medium support, e.g. regional instruction only	No formal mandate
ASEAN Agreement on Transboundary Haze Pollution			
Forest-product certification regime			
Regime that combats desertification			
Biological diversity regime			
Climate change regime			
Endangered species trade regime			
International rubber trade regime			
International tropical timber production and trade regime			
Palm oil certification regime			
Wetlands (including swamp and peatlands) regime			

6. Is there any promotion of the regime by broadening coalition during implementation?

Coordination / Regime	Promotion of the regime by broadening coalition during implementation		
	State bureaucracy coalition	Coordination with non-state actors	No succesful coalition building in support of a regime
ASEAN Agreement on Transboundary Haze Pollution			
Forest-product certification regime			
Regime that combats desertification			
Biological diversity regime			
Climate change regime			
Endangered species trade regime			
International rubber trade regime			
International tropical timber production and trade regime			
Palm oil certification regime			
Wetlands (including swamp and peatlands) regime			

Appendix C

Interview Guide

Research aim

The objective of this research is to analyze and harness the potential of international environmental treaties, agreements and conventions to address forest fires that frequently happen in tropical rainforest in Riau, Indonesia. There are two parts of the interview questions: (1) A closed type of question (2) A follow-up open type of question.

Brief discussion on regime

Let me begin with an overview of the kind of regime that we are discussing in this research context. A regime is originally defined by Le Pestre as "*A set of interrelated norms, rules, and procedures that structure the behaviour and relations of sectors so as to reduce uncertainties they face and facilitate the pursuit of a common interest in a given issue area*" (Le Pestre, 2002)[2], such as forest and fire mitigation. The application of the aforementioned concept of regime has led to a phenomenon of regime complex, where there are multiple regulations and/or institutions that are trying to address similar issues within a governance domain.

Guide on the questions

The closed questions are designed to assess how ten international environmental regimes influence local forest governance, particularly in the attempt to mitigate forest and peat fires based on the perception of the real actors on local governance. Below are the list of regimes:

1. ASEAN Agreement on Transboundary Haze Pollution (AATHP)
2. Forest-product certification regime (FSC)
3. Regime that combat desertification (UNCCD)
4. Biological diversity regime (CBD)
5. Climate change regime (UNFCCC)
6. Endangered species trade regime (CITES)
7. International rubber trade regime (INRA)

[2] Le Prestre, P. 2002. Studying the Effectiveness of the CBD. *Le Prestre, P. Governing global biodiversity*, 57-90.

8. International tropical timber production and trade regime (ITTO and FLEGT)
9. Palm oil certification regime (RSPO)
10. Wetlands (including swamp and peatlands) regime (Ramsar Convention)

Each of the closed question will be followed by several open type of questions regarding the use, implementation, and obstacles of practicing the regime.

Themes	***Primary Question (close type of question)***	***Secondary Question (open type of question)***
Problem Relevance	Is the regime suitable to address forest and peat fires?	Is there any difference with or without the implementation of the regime?
	How significant is the regime's contribution to addressing the severity of forest fires?	How significant is the influence of the regime on the design of forest fire mitigation and plans?
Actor's Interest	Is there any bureaucratic structures that carries out the operationalization of the regime?	Does it have sufficient legitimacy? What is measure?
	Is there any budget allocations for regime's operations?	How they control and monitor the budget? Is there any issue with regards to institutional capacity?
	Is there any legal mandate to implement a regime?	What is the type of the legal mandate? How do the stakeholders show the political willingness?
	Is there any promotion of the regime by broadening coalition during implementation?	Who are the other actors involved? How are they brought into the process? How can they voice their interests?

Appendix D

Instruction for network structure

Besides individual environmental regime influence, this research also aims at understanding the potential influence of a collection of environmental regimes in mitigating forest and peat fires in Riau, Indonesia. The result of this part of interview will become the basis for mapping the structure of a collection of environmental regimes. Each regime will be linked with another based on regimes' principle, objective and criteria how many common strategies they both share.

The next task is to describe the strength of relations between one environmental regime and another with respect to the potential it can bring to forest and peat fires mitigation. The rating system for this question is even more straightforward. There are only two possible answers: 'Close' or 'Distant'. Close and distant relations indicate how converging their strategies are.

The environmental regimes are listed below:

1. ASEAN Agreement on Transboundary Haze Pollution (AATHP)
2. Forest-product certification regime (FSC)
3. Regime that combat desertification (UNCCD)
4. Biological diversity regime (CBD)
5. Climate change regime (UNFCCC)
6. Endangered species trade regime (CITES)
7. International rubber trade regime (INRA)
8. International tropical timber production and trade regime (ITTO and FLEGT)
9. Palm oil certification regime (RSPO)
10. Wetlands (including swamp and peatlands) regime (Ramsar Convention)

Appendix E

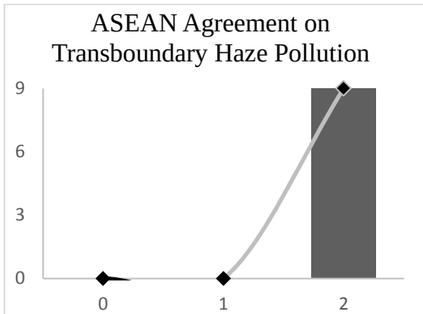
Adjacency matrix for transcribing interviews of international environmental regimes' relational ties

International Environmental Regimes										
ASEAN Agreement on Transboundary Haze Pollution (A)										
Forest-product certification regime (B)										
Regime that combat desertification (C)										
Biological diversity regime (D)										
Climate change regime (E)										
Endangered species trade regime (F)										
International rubber trade regime (G)										
International tropical timber production and trade regime (H)										
Palm oil certification regime (I)										
Wetlands (including swamp and peatlands) regime (J)										
International Environmental Regimes	A	B	C	D	E	F	G	H	I	J

Appendix F

Descriptive statistics of the interview results for each indicator

Indicator P1 (Objective)



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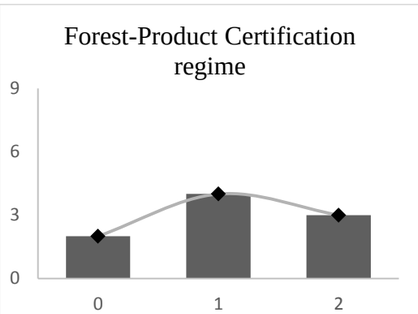

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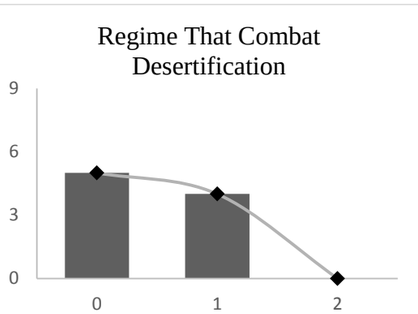

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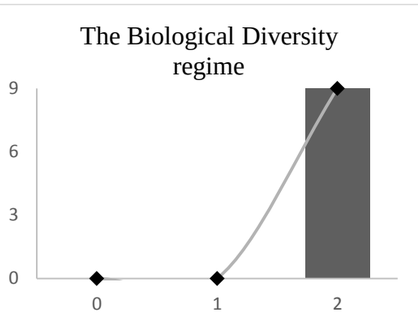

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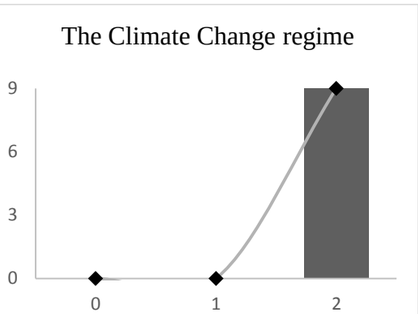

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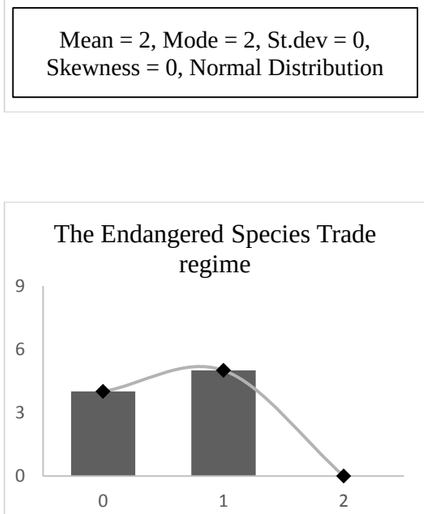

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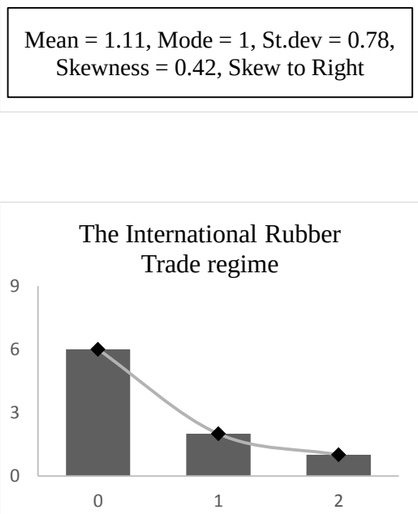

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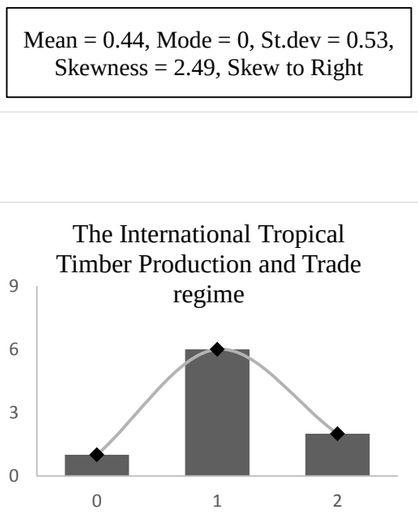

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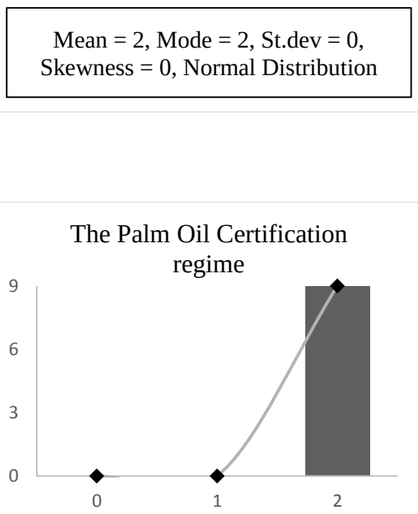

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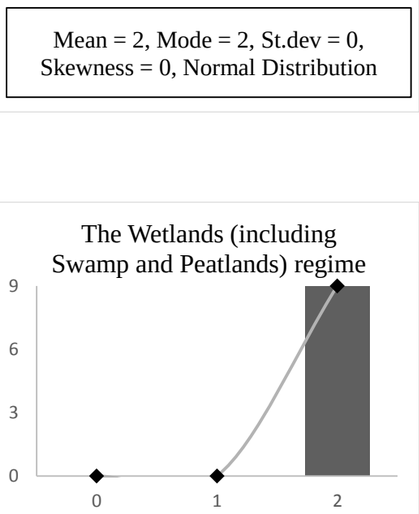

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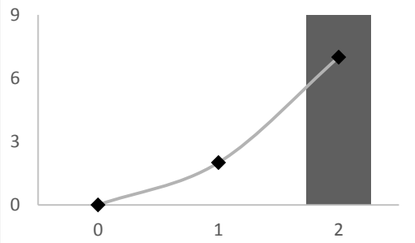
Indicator P2 (Contribution)

ASEAN Agreement on Transboundary Haze Pollution



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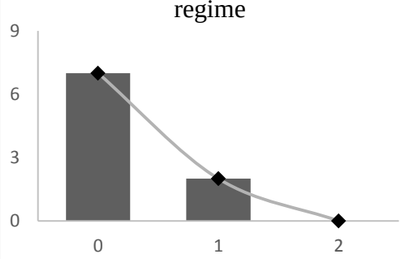
Forest-Product Certification regime



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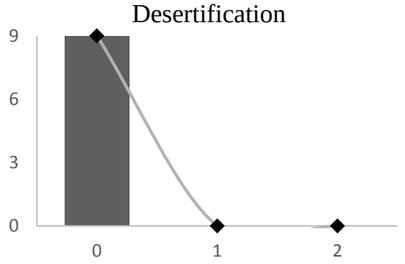
Regime that Combat Desertification



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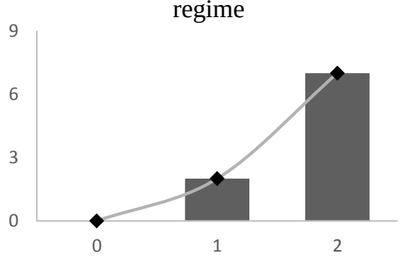
The Biological Diversity regime



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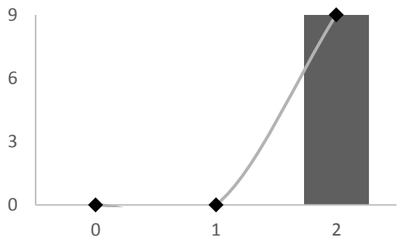
The Climate Change regime



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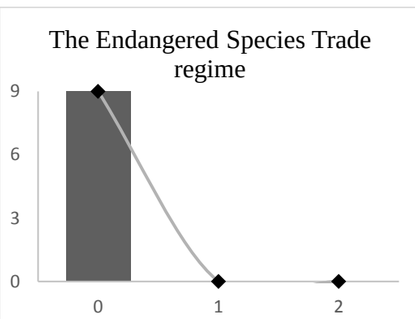
The Endangered Species Trade regime



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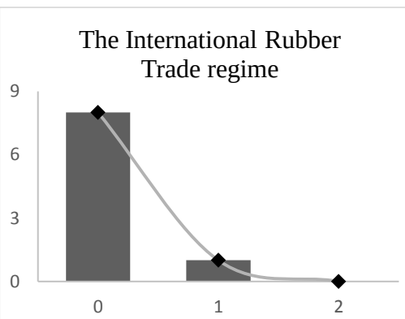
The International Rubber Trade regime



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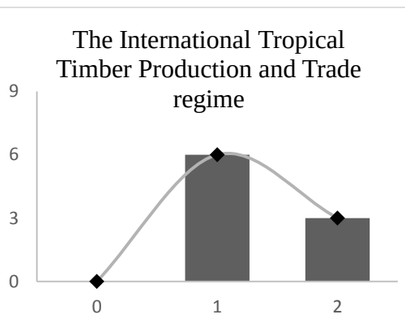
The International Tropical Timber Production and Trade regime



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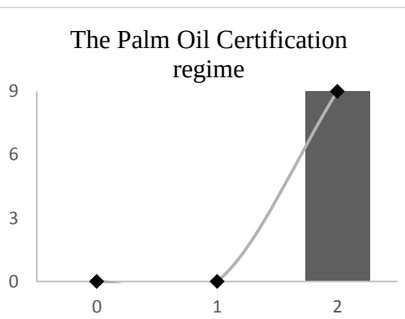
The Palm Oil Certification regime



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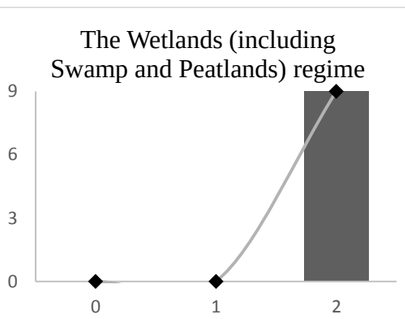
The Wetlands (including Swamp and Peatlands) regime



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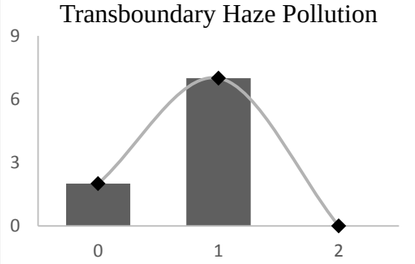
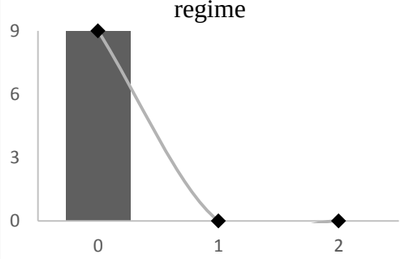
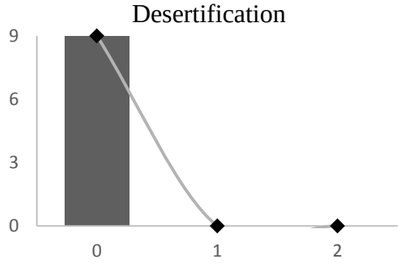
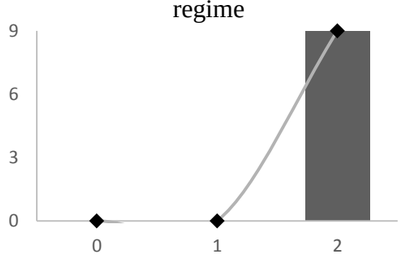
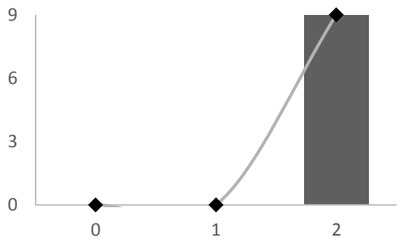
Indicator A1 (Structure)

ASEAN Agreement on Transboundary Haze Pollution	Forest-Product Certification regime	Regime That Combat Desertification	The Biological Diversity regime	The Climate Change regime
				
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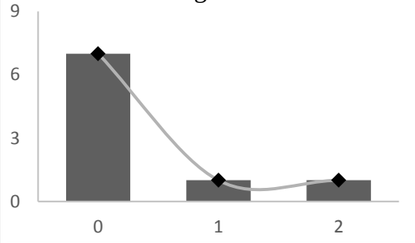
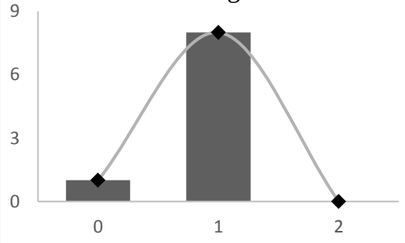
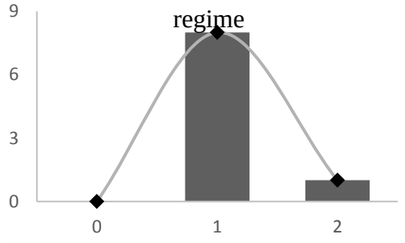
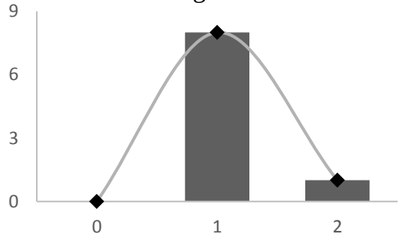
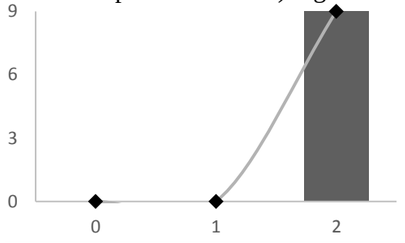
The Endangered Species Trade regime	The International Rubber Trade regime	The International Tropical Timber Production and Trade regime	The Palm Oil Certification regime	The Wetlands (including Swamp and Peatlands) regime
				
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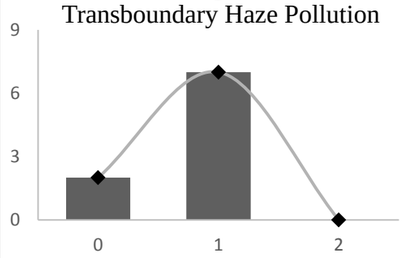
Indicator A2 (Budget)

ASEAN Agreement on Transboundary Haze Pollution



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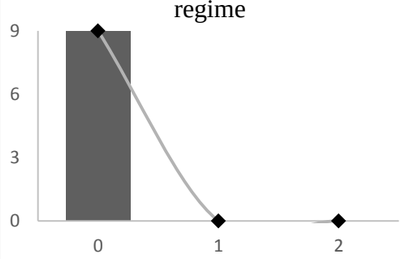
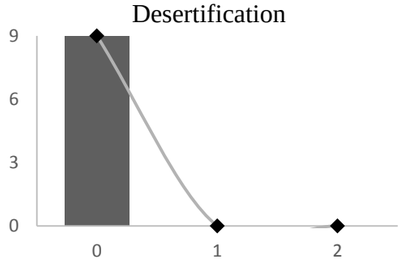
Forest-Product Certification regime



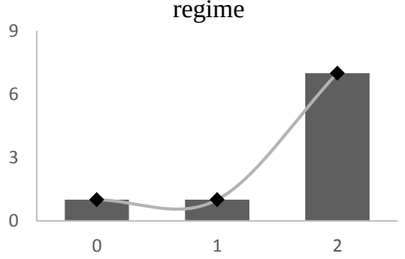
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

Regime That Combat Desertification



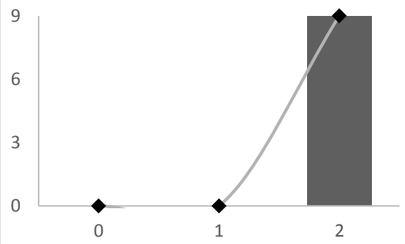
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

The Biological Diversity regime



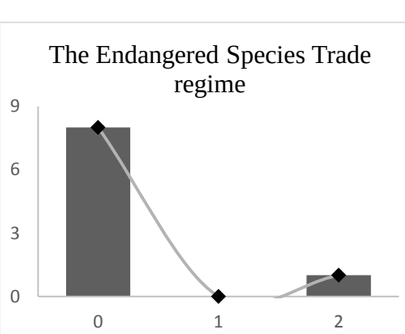
Mean = 1.67, Mode = 2, St.dev = 0.71, Skewness = -1.39, Skew to Left

The Climate Change regime



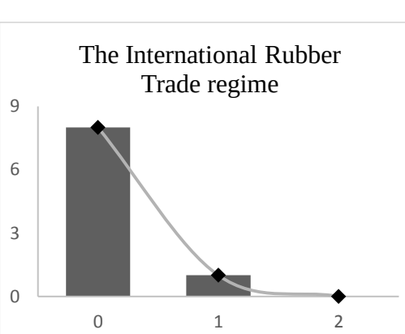
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

The Endangered Species Trade regime



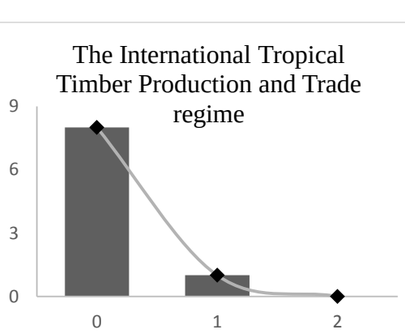
Mean = 0.22, Mode = 0, St.dev = 0.67, Skewness = 0.99, Skew to Right

The International Rubber Trade regime



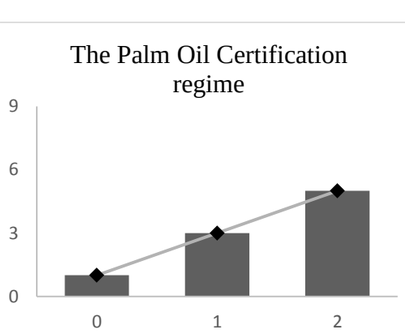
Mean = 0.11, Mode = 0, St.dev = 0.33, Skewness = 1, Skew to Right

The International Tropical Timber Production and Trade regime



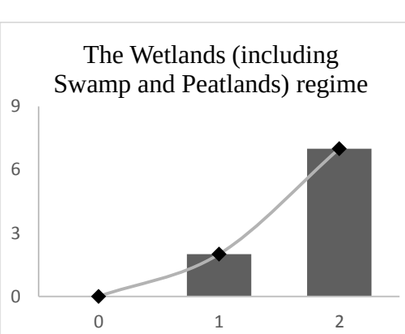
Mean = 0.11, Mode = 0, St.dev = 0.33, Skewness = 1, Skew to Right

The Palm Oil Certification regime



Mean = 1.44, Mode = 2, St.dev = 0.73, Skewness = -2.3, Skew to Left

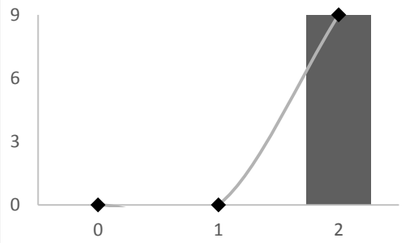
The Wetlands (including Swamp and Peatlands) regime



Mean = 1.78, Mode = 2, St.dev = 0.44, Skewness = -1.5, Skew to Left

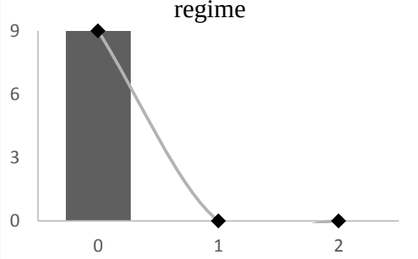
Indicator A3 (Legal Support)

ASEAN Agreement on Transboundary Haze Pollution



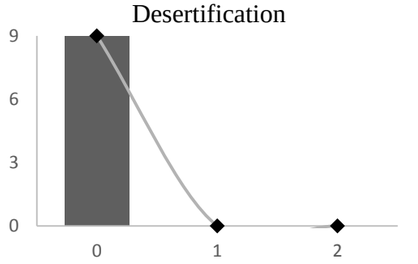
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

Forest-Product Certification regime



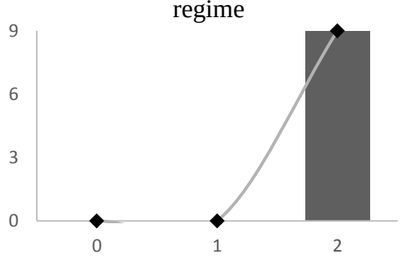
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

Regime That Combat Desertification



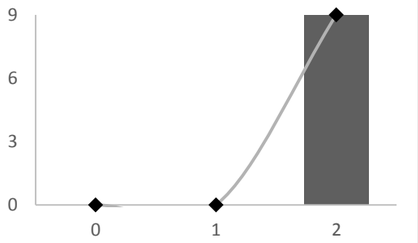
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

The Biological Diversity regime



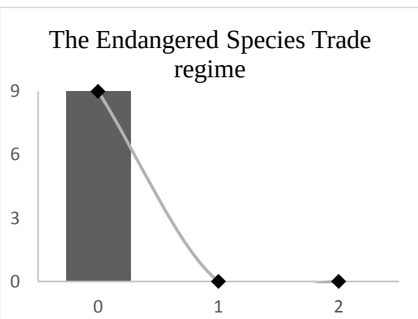
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

The Climate Change regime



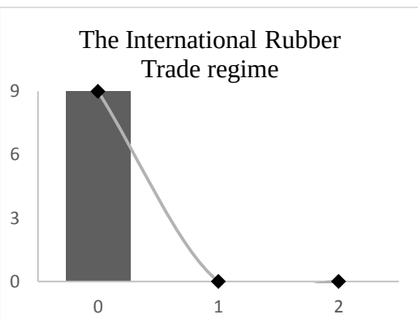
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

The Endangered Species Trade regime



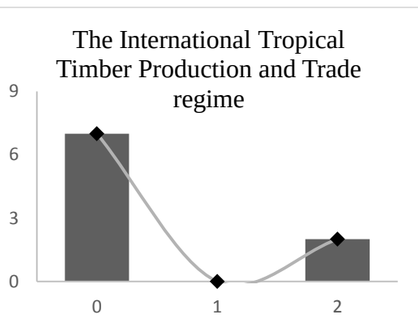
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

The International Rubber Trade regime



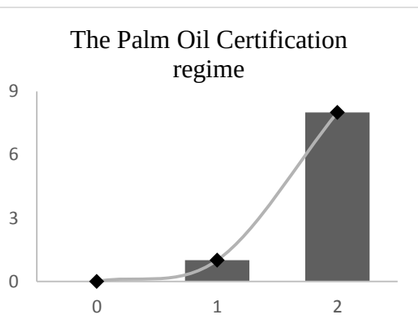
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

The International Tropical Timber Production and Trade regime



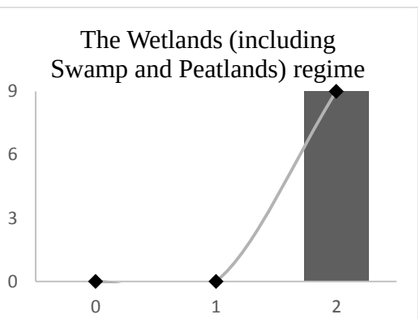
Mean = 0.44, Mode = 0, St.dev = 0.88, Skewness = 1.5, Skew to Right

The Palm Oil Certification regime



Mean = 1.89, Mode = 2, St.dev = 0.33, Skewness = -1, Skew to Left

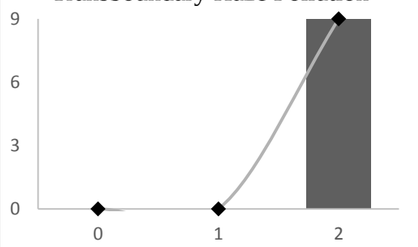
The Wetlands (including Swamp and Peatlands) regime



Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

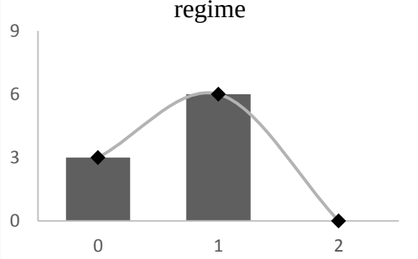
Indicator A4 (Coordination)

ASEAN Agreement on Transboundary Haze Pollution



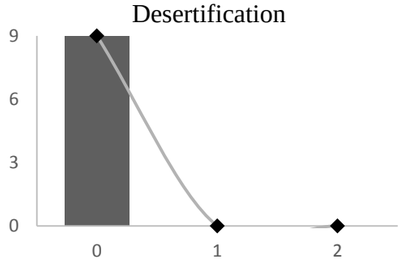
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

Forest-Product Certification regime



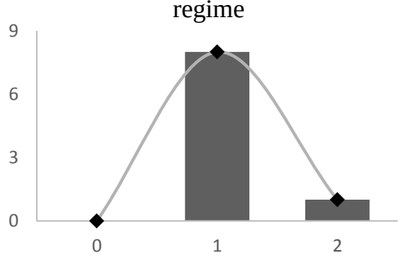
Mean = 0.67, Mode = 1, St.dev = 0.5, Skewness = -1.98, Skew to Left

Regime That Combat Desertification



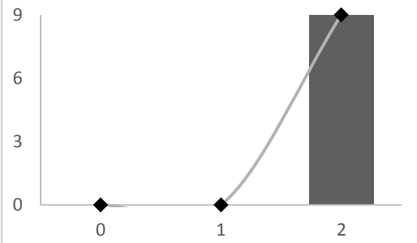
Mean = 0, Mode = 0, St.dev = 0, Skewness = 0, Normal Distribution

The Biological Diversity regime



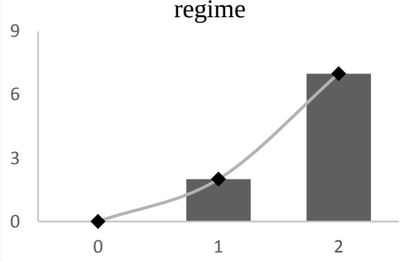
Mean = 1.11, Mode = 1, St.dev = 0.33, Skewness = 1, Skew to Right

The Climate Change regime



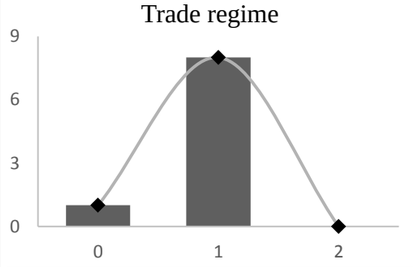
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

The Endangered Species Trade regime



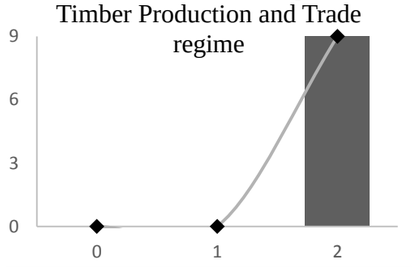
Mean = 1.78, Mode = 2, St.dev = 0.44, Skewness = -1.5, Skew to Left

The International Rubber Trade regime



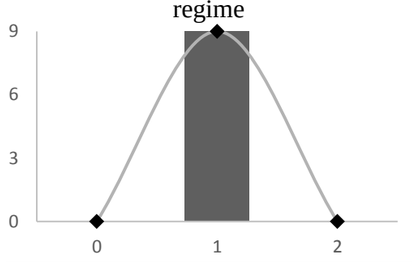
Mean = 0.89, Mode = 1, St.dev = 0.33, Skewness = -1, Skew to Left

The International Tropical Timber Production and Trade regime



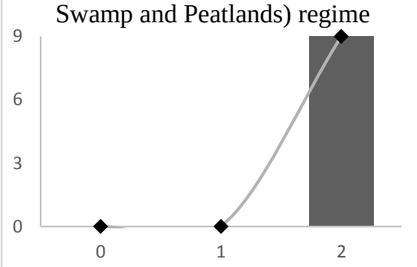
Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

The Palm Oil Certification regime



Mean = 1, Mode = 1, St.dev = 0, Skewness = 0, Normal Distribution

The Wetlands (including Swamp and Peatlands) regime



Mean = 2, Mode = 2, St.dev = 0, Skewness = 0, Normal Distribution

Appendix G

Summary of OLS results before proceeding to GWR

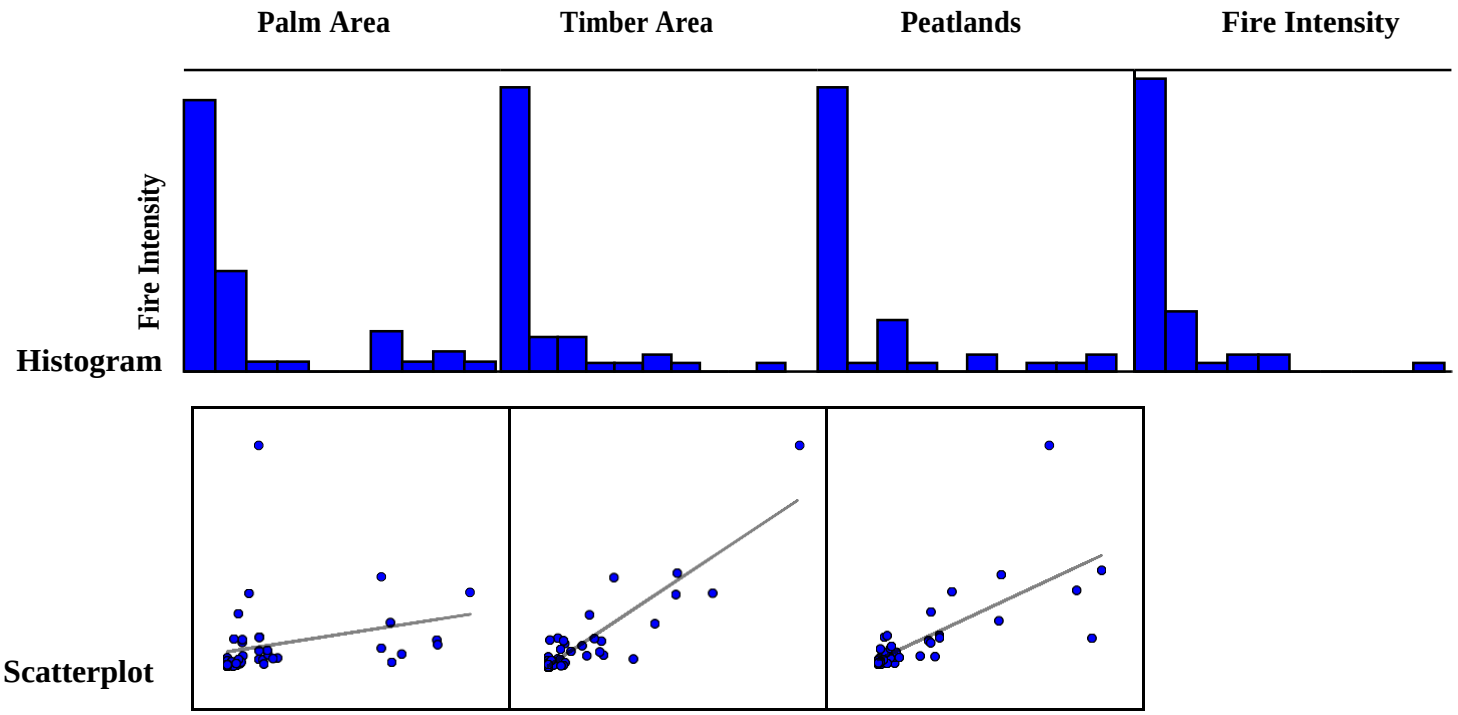
Model variables

Variable	Coefficient	StdError	t-Statistic	Probability	Robust_SE	Robust_t	Robust_Pr	VIF
Intercept	496.270698	402.213751	1.233848	0.223961	242.338226	2.047843	0.046715	--------
Palm Area	0.010844	0.004270	2.539449	0.014801	0.005315	2.040335	0.047489	1.582139
Timber Area	0.030993	0.003981	7.784918	0.000000	0.007737	4.005609	0.000241	2.508895
Peatlands	0.005322	0.002586	2.057677	0.045717	0.002633	2.021175	0.049516	3.238876

OLS Diagnostic

InputFeatures:	Regression_all	Dependent Variable:	Fire Intensity
Number of Observations:	47	Akaike's Information Criterion (AICc):	863.519517
Multiple R-Squared:	0.822425	Adjusted R-Squared:	0.810036
Joint F-Statistic:	66.383824	Prob(>F), (3,43) degrees of freedom:	0.000000
Joint Wald Statistic:	59.591435	Prob(>chi-squared), (3) degrees of freedom:	0.000000
Koenker (BP) Statistic:	21.098910	Prob(>chi-squared), (3) degrees of freedom:	0.000100
Jarque-Bera Statistic:	17.060491	Prob(>chi-squared), (2) degrees of freedom:	0.000197

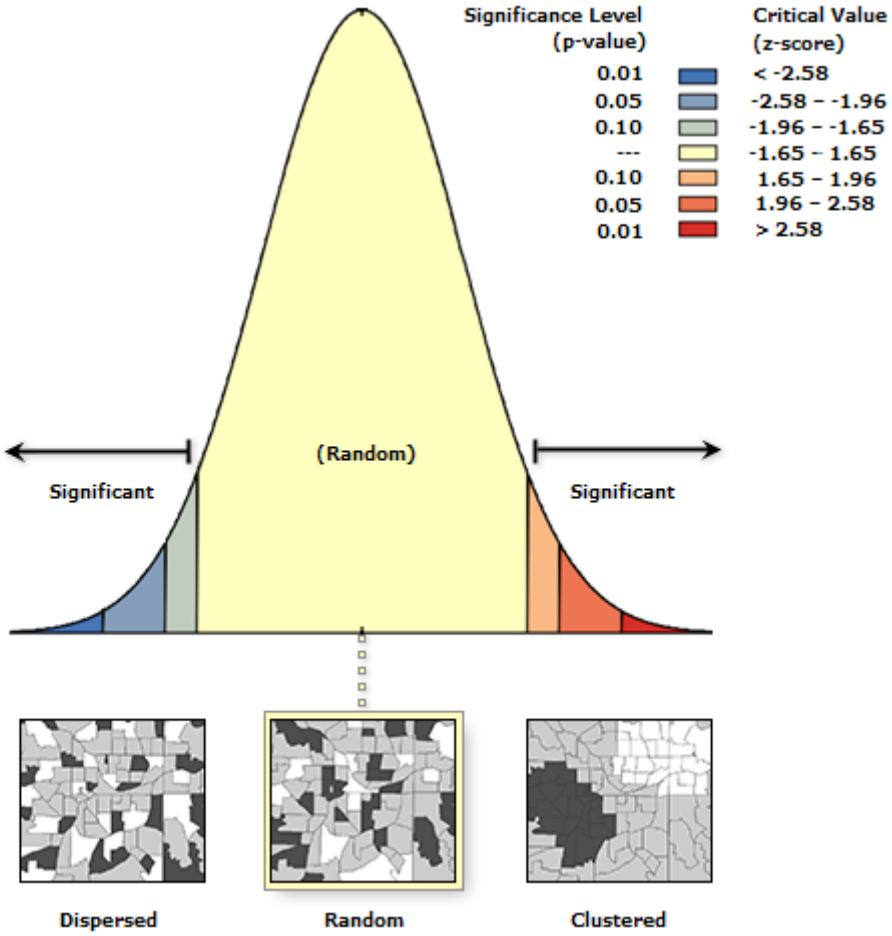
Variable distribution and relationships



The above graphs are Histograms and Scatterplots for each explanatory variable and the dependent variable. The histograms show how each variable is distributed. Each scatterplot depicts the relationship between an explanatory variable and the dependent variable. Strong relationships appear as diagonals and the direction of the slant indicates if the relationship is positive or negative.

Spatial autocorrelation report

Moran's Index: 0.245909
z-score: 1.218508
p-value: 0.223031



Given the z-score of 1.218508, the pattern does not appear to be significantly different than random.

Moran's Index:	0.245909
Expected Index:	-0.111111
Variance:	0.085848
z-score:	1.218508
p-value:	0.223031

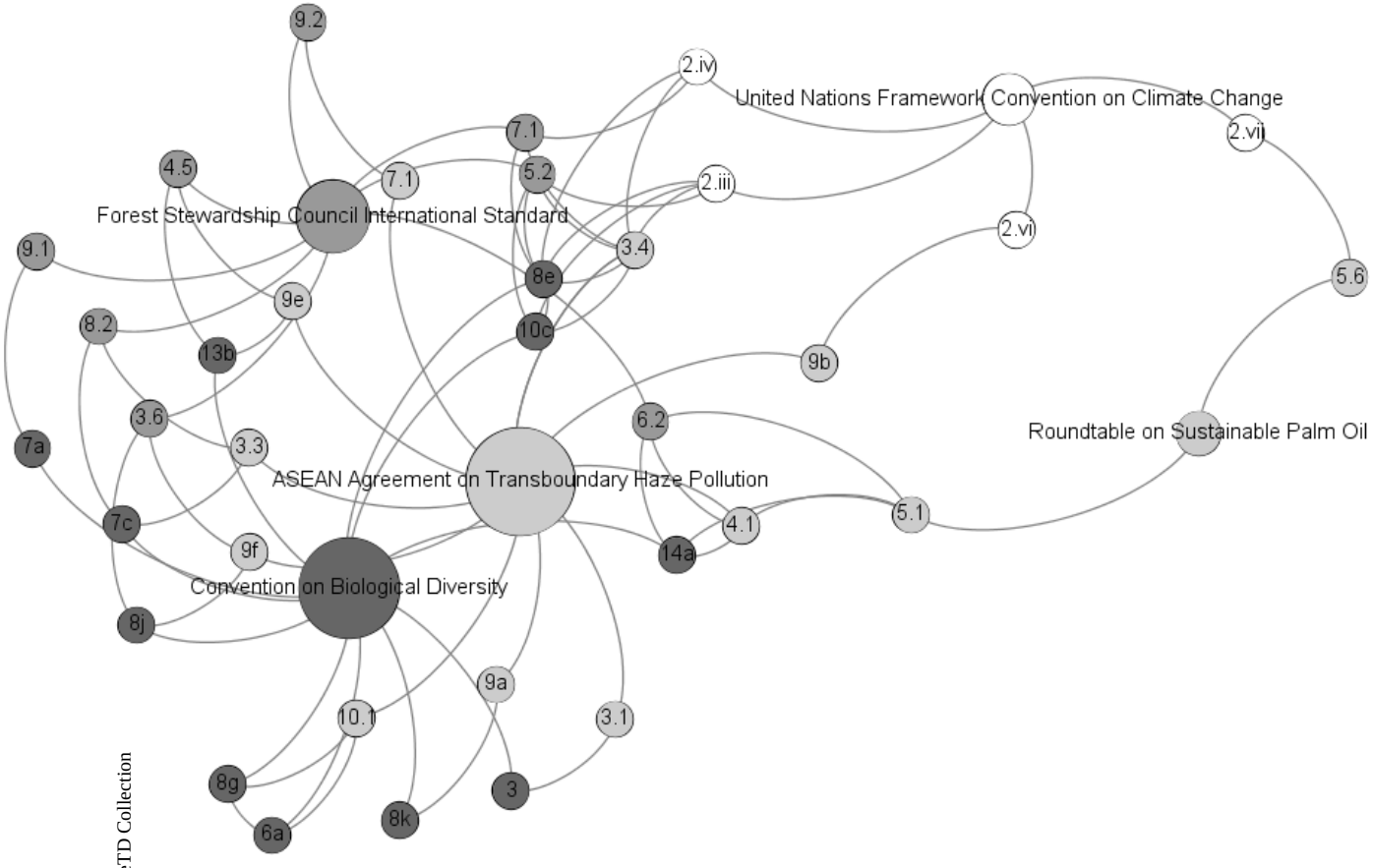
Appendix H

The analysis of regime influence on local forest governance in Riau, Indonesia

International Environmental Regimes (x, y)	x-axis (A1 + A2 + A3 + A4)	y-axis (P1 + P2)	**Quadrant**
ASEAN Agreement on Transboundary Haze Pollution	6	4	**4**
Forest-product certification regime	1	3	**1**
Regime that combat desertification	5	0	**3**
Biological diversity regime	8	4	**4**
Climate change regime	8	4	**4**
Endangered species trade regime	2	1	**2**
International rubber trade regime	0	2	**2**
International tropical timber production and trade regime	2	3	**1**
Palm oil certification regime	6	4	**4**
Wetlands (including swamp and peatlands) regime	8	4	**4**

Appendix I

Environmental regimes as a network of converging startegies to mitigate forest and peat fores based on similar principles, objectives and criteria



Author's elaboration, based on (AATHP, 2002; CBD, 1992; CITES, 1973; CWI, 1971; EU FLGT, 2014; FSC, 2012; INRA, 1979; ITTO, 2006; RSPO, 2013; UNCCD, 1994; UNFCCC, 1997)

Relational ties are labelled in numerical manner following the original documents for every regime (MEA and certification scheme)