Towards Sustainable Forest Management: A Comparative Analysis between Canada, Brazil and China.

Aryamik Sharma, Jai Hanjrah and Jett Tokiwa

Forests are essential ecosystems that provide numerous ecosystem services, support human livelihoods, and maintain biodiversity. Recognizing their significance, countries have established forest regulations to guide sustainable forest management (SFM) practices. However, challenges persist in achieving effective and efficient forest management, leading to deforestation and unsustainable practices. This paper examines the current state of forest regulations and their effectiveness, focusing on the regulatory frameworks in Canada, Brazil, and China. Through a case study analysis, including a comparison of regulatory frameworks and enforcement mechanisms, the study evaluates their effectiveness in promoting SFM. The role of various sectors involved in forest management is explored, and policy recommendations are provided based on the analysis. Findings suggest that a "one size fits all" approach is not feasible, emphasizing the importance of proactive sustainability-oriented policies, stakeholder collaboration, and continuous adaptation. The paper concludes by summarizing key arguments, findings, and implications, as well as outlining potential next steps for promoting SFM in the studied countries while considering the contextual needs of each region. Balancing economic and environmental considerations is crucial to avoid regulatory failures driven by revenue generation.

1 Introduction

Forests are vital ecosystems that cover nearly 31% of the Earth's land area and play a crucial role in supporting human livelihoods and maintaining biodiversity (Food and Agriculture Organization of the United Nations, 2020; Ritchie Roser, 2021). They provide a wide range of ecosystem services, including carbon sequestration, water purification, soil stabilization, timber and non-timber forest products, habitat for wildlife, and recreational opportunities (Brockerhoff et al., 2017). Forests are also home to indigenous peoples and local communities who have deep cultural, spiritual, and economic connections to these lands (Zhiyanski et al., 2021).

Recognizing the importance of forests, many countries have established regulations and policies to govern their management (Lipschutz, 2000). Forest regulations are typically developed and enforced by public sector forest agencies and are intended to guide the utilization and conservation of forest resources in a sustainable manner (Smyle et al., 2016). The concept of sustainable forest management (SFM) has emerged as a key principle in forest regulations, which seeks to balance the economic, social, and environmental aspects of forest management to ensure that forests can meet the needs of present and future generations (Von Gadow et al., 2001).

SFM encompasses a wide range of principles and practices that aim to maintain the health, productivity, and resilience of forest ecosystems while also supporting the social and economic well-being of local communities (Siry et al., 2005). This includes measures

such as forest planning, monitoring, and enforcement, as well as promoting sustainable logging practices, protecting biodiversity, conserving forest soils and water resources, and respecting the rights and knowledge of indigenous peoples and local communities (Baumgartner, 2019; Von Gadow et al., 2001).

However, despite the existence of forest regulations and the concept of SFM, challenges persist in achieving effective and efficient forest management (Smyle et al., 2016). Issues such as illegal logging, encroachment on forest lands, inadequate enforcement of regulations, conflicting policies, weak governance, and lack of capacity and resources for monitoring and enforcement continue to contribute to deforestation, forest degradation, and unsustainable forest management practices in many parts of the world (Lipschutz, 2000).

In recent years, there has been growing recognition of the need to address these challenges and improve the effectiveness and efficiency of forest regulations and SFM practices.

This paper seeks to examine the current state of forest regulations and their effectiveness. It starts with a brief overview of the underlying purposes of regulation followed by a section that is specific to the regulations in forest management and examines the literature on the different regulatory frameworks that govern forestry practices and sustainable forest management.

This is followed by a case study analysis that highlights the forestry laws and practices in Canada, Brazil, and China, including a comparison of their regulatory frameworks and enforcement mechanisms, as well as an evaluation of their effectiveness in promoting SFM in each country. Since forest management involves coordination and collaboration among multiple actors, a section exploring the role of these sectors is included.

Based on the analysis of the regulatory frameworks and the factors contributing to deforestation and forest management, the discussion section will include policy recommendations for promoting SFM. Finally, the summary section will provide an overview of the key arguments and findings presented in the study. It will highlight the main conclusions drawn from the analysis of regulatory frameworks, policy recommendations, challenges, and opportunities for implementation. Potential next steps for further policies, considering the implications of the study's findings and the potential for promoting SFM in the studied countries.

Findings indicate that adopting a "one size fits all" policy for forest regulation is not feasible and may be counterproductive. Instead, forest regulations should focus on proactive sustainability-oriented policies, incorporating education, stakeholder collaboration, and continuous adaptation. It is important to strike a balance between economic and environmental considerations, taking into account the context and needs of each country while avoiding regulatory failures driven by revenue generation.

2 Overview of Regulations

Regulations, in their simplest form, aim to exercise some sort of social control through the imposition of responsibilities and limitations on individuals, groups and other entities (Gunningham Holley, 2016; McManus, 2020). Modern day regulations in form of state-mandated legal restrictions, contractual obligations, social regulations, market regulations, third-party regulations, certifications and accreditations all seek to modify conduct, identify incentives or change preferences which might not occur otherwise (Mendoza, 2015). Regulation can cover a wide range of areas, including public health, safety, financial markets, business practices, consumer protection, and more (Orbach, 2012).

As an integral part of public governance, effective regulations help in shaping up the relationship between the state, the private sector and civil society (Levi-Faur, 2010). In democratic societies, one would assume that there are sufficient mechanisms in place to eliminate or at the very least minimize the societal harms while at the same time promote the societal benefits (May, 2005). However, in reality, these mechanisms either do not exist or are insufficient in nature (Orbach, 2012). This is where regulations help fill in the void by governing how any entity or individual carries out its activities and seek to address the 'market failures' (Pinotti, 2012). Market failures happen when individuals or entities do not take into consideration the costs associated with their activities on third parties (Mitchell, 2021). These costs could manifest in the form of negative externalities which may cause harm to third parties (Mitchell, 2021). For example, an unattended oil and gas production plant may spew harmful chemicals into the surrounding environment which could be determinantal to the local populations. Regulators may address this problem by setting standards for those harmful chemicals. In essence, regulations seek to minimize harm (Sterner et al., 2019).

Over the past few decades, environmental regulations have emerged as an approach to protect the environment (Gunningham Holley, 2016). Early environmental regulations were hierarchical and progressive in nature and often followed a 'command and control' approach (McManus, 2020). Cunningham Holley (2016) note that '[traditional] state-centered approaches to law were relatively effective, achieving several gains in halting and reducing environmental degradation.' In many industries, direct state law approaches were the most important driver of improved environmental performance. (Gunningham et al. 2003, KPMG 1996). Starting in the late twentieth century, there has been a gradual shift in the underlying focus of regulations towards restructuring of the regulatory state and new governance (McManus, 2020). These approaches tend to be more collaborative and participatory in nature (McManus, 2020).

This emergence of 'smart regulation' that com-

bine complementary instrument mixes, prioritize less-interventionist measures, escalate response up an instrument pyramid for regulatory responsiveness and dependable outcomes, empower third parties as surrogate regulators, and maximize opportunities for win-win outcomes have addressed some of the shortcomings of traditional regulatory approaches (Gunningham Holley, 2016). However, despite all these developments, global environmental resources and systems continue to face serious peril (UNEP 2012). This creates a new set of challenges including addressing the issue of regulatory capture, the complexities associated with regulating transnational corporations operating across different regulatory jurisdictions, concerns about legitimacy of environmental regulation due to clauses in international trade agreements, the growing importance of indigenous issues, and debates about the legitimacy and jurisdiction of environmental regulation by governments and most importantly enforcing these regulations (McManus, 2020).

Addressing these challenges in the age of increasing environmental uncertainty will, therefore, require states and other actors to determine the unique combinations of law, regulation, and new governance that are adaptable in a system that is constantly evolving (Gunningham Holley, 2016; McManus, 2020).

3 Regulating For Sustainable Forests

In modern literature, various schools of thought and perspectives exist when it comes to forestry laws. However, there tends to be a general consensus that the primary purpose of forestry laws is to safeguard natural resources and prevent detrimental activities such as forest clearing, logging, hunting, and vegetation collection (Enters, 2022).

Broadly speaking, forest regulations can be categorized into hard law mechanisms and soft law mechanisms (Hickey Innes, 2003). Hard law mechanisms for improved monitoring in the forestry sector involve the use of legally binding regulations and legislation (Kirton Trebilcock, 2017). These hard law norms are often considered necessary to establish order and regulate social behaviour in forestry practices (Hickey Innes, 2003). They are typically developed at the national or regional level and are expected to be enforced effectively to achieve forest policy goals such as development, protection, and sustainability (Kirton Trebilcock, 2017). However, it is acknowledged that the effectiveness of hard law mechanisms depends on their enforcement, and that law is only as good as its enforcement (Hickey Innes, 2003).

On the other hand, soft law mechanisms in forestry involve non-binding and voluntary instruments that are not legally enforceable (Coglianese, 2020). Examples of soft law mechanisms include third-party certification, non-binding international treaties, and industry-led initiatives (Hickey Innes, 2003). These mechanisms are often used by non-state stakeholders to promote new standards and represent their values in the forestry sector (Kirton Trebilcock, 2017). Soft law norms can be more general or more specific, depending on the instrument (Coglianese, 2020). For instance, forest certification standards such as the Forest Stewardship Council (FSC) are often more specific than monitoring requirements outlined in international treaties or industry-led initiatives (Coglianese, 2020). Soft law mechanisms, including forest certification, have emerged as important market-based policy instruments in the forestry sector at an international scale (Hickey Innes, 2003). Although these initiatives are well-intentioned and have received widespread support, they ultimately depend on existing regulatory frameworks that have been proven ineffective (Smyle et al., 2016). Moreover, these initiatives may introduce new layers of complexity, which could lead to unintended consequences and associated risks (Smyle et al., 2016).

Over the course of the 20th century, forest regulations have evolved from being “timber” and “forest-centric” to the values that forests provide to the society, cultures and ecosystems (Smyle et al., 2016). Modern forestry regulations acknowledge the multifunctional role of forests as wildlife habitats, grazing and agricultural resources, and contributors to water and soil conservation (Lipschutz, 2000). More recently, environmental law principles and the values of biological diversity have gained increased visibility within forest law (Siry et al., 2005). As a result, forest regulations have evolved from simply focusing on stopping deforestation to adopting a more holistic approach, such as sustainable forest management (SFM). Modern regulations are largely based on a rights-based perspective and serve as a means of defining the relationship between the state and its citizens, as well as the rights granted for managing forests and natural resources (Smyle et al., 2016). Essentially, these regulations establish the framework for how individuals can interact with and utilize forest lands which now includes all forests: public, private and communal (Sikor Stahl, 2012). In this rights-based approach, collaboration between the government and its citizens in the establishment and enforcement of regulations is paramount (Smyle et al., 2016).

Despite, the widespread recognition of principles of SFM and its significance in achieving social, economic, and environmental objectives ever since the 1992 Rio Earth Summit, it leaves a lot to be desired (Smyle et al., 2016). A recent analysis of global progress towards SFM conducted by Food and Agriculture Organization of the United Nations (2020) indicated that ‘enabling conditions’ (which includes legal framework, stakeholder involvement, data availability and reporting and management planning) for successful implementation of SFM are missing from most of the global forest

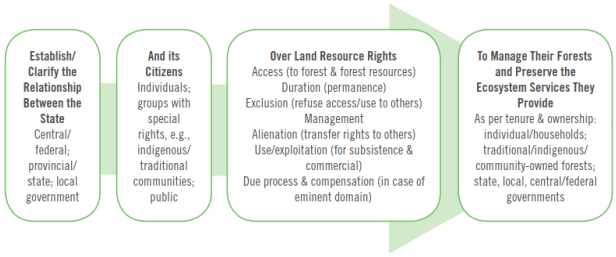

Figure 1: *A Rights Based Approach to Regulating Forests (Adapted from Smyle et al., 2016).*

areas.

Before understanding the failures of forestry laws, it is important to put into context the complexities associated with forestry laws. The following case studies illustrate the different regulatory approaches taken by countries to manage their forest resources.

3.1 Canada

Canada's forests cover 39% of the total landmass, and they are an essential source of natural resources and biodiversity (Government of Canada, 2023). Nearly 90% of the forest area in Canada is publicly owned and is jointly regulated by the federal, provincial and territorial governments (Government of Canada, 2023). Although forest regulations may vary from one region to another, the overarching goal is 'protecting the forests and ensuring that sustainable forest management practices are followed across the country' (Bullock et al., 2017). The laws, regulations, and policies that are focused on SFM address various aspects of forest management, including land-use planning, forest practices, forest regeneration, Aboriginal interests, public consultation, biodiversity, protected areas, natural disturbances, and more (Bullock et al., 2017).

On the other hand, only 6% of Canada's forests are privately owned and management of these lands is supported by various provincial and territorial guidelines and programs (Government of Canada, 2023). Private landowners often adopt forest management plans and take advantage of government programs to guide their harvesting and stewardship activities (Government of Canada, 2023). Some provinces have laws that establish standards for forest management practices on private lands (Bullock et al., 2017). Additionally, most provinces implement regulatory mechanisms to differentiate timber harvested from private lands from public timber, which requires payment of royalties (Government of Canada, 2023). These mechanisms include regulations for timber scaling, marking, and transportation (Bullock et al., 2017). To prevent illegal and unsustainable activities on private lands, landowners and nearby communities remain vigilant in monitoring forest activities (Cashore McDermott, 2004). In provinces without specific statutes governing forest harvesting on private lands, landowners can rely on general laws to safeguard their property from trespass or timber theft (Government of Canada, 2023).

Many consider Canada's forest management policies and practices among the most stringent in the world (Cashore McDermott, 2004). It is no coincidence that Canada has the lowest rates of deforestation in the world (Ritchie Roser, 2021).

However, despite Canada's efforts to manage its forest resources sustainably, certain regions across the country remain prone to wildfires and logging activities.

3.2 Brazil

Brazil is one of the five mega-forested countries, with nearly 310.5 million hectares acres of its territory covered by public forests and the Amazon rainforests accounting for almost 92% of these forests (Ritchie Roser, 2021; SFB, 2020).

Brazil has a comprehensive and robust legal framework for environmental protection, which has been shaped by the Federal Constitution of 1988 that recognizes the environment as a common good (Soares-Filho et al., 2014). Over the years, this legal framework has become more comprehensive, science-based, and punitive, as reflected in various legislations enacted between 1985 and 2012 (SFB, 2020). These include the Forest Code, Agrarian Reform Act, National System of Conservation Units, and Law of Environmental Crimes, among others, which have improved instruments for the protection of public forests, land rights, and legalization of private areas (Drummond and Barros-Platiau, 2006; Rajão et al., 2021).

These developments have partly contributed to the reduction of deforestation in the Amazon, and Brazil has been globally recognized for its efforts in reducing CO2 emissions by 80% from 2005 to 2014 (Carvalho et al., 2019). Several governance measures have played a role in this success, including law enforcement, remote monitoring systems, restrictions on public credit, and multi-stakeholder agreements such as beef and soy moratoria (Gibbs et al., 2015; Moutinho et al., 2016; Barreto et al., 2017).

However, some of these efforts have been hampered by a variety of reasons including – natural resource exploitation, access to land, presence of lobbying groups in agribusiness and political financing by private companies (Golden Kroner et al., 2019; Carvalho et al., 2019; Busch and Ferretti-Gallon, 2017; Brito et al., 2019; Fearnside, 2018; Abessa et al., 2019; Pereira et al., 2019). Some of these drivers became more pronounced following the 2018 Presidential elections and the government's anti-socio-environmental agenda (Escobar, 2018; Rothkopf, 2018; Tollefson, 2018).

3.3 China

According to Food and Agriculture Organization of the United Nations (2020), China has 219 million hectares

Figure 2: *Large acres of Amazon Rainforests have experienced deforestation over the past few years.*

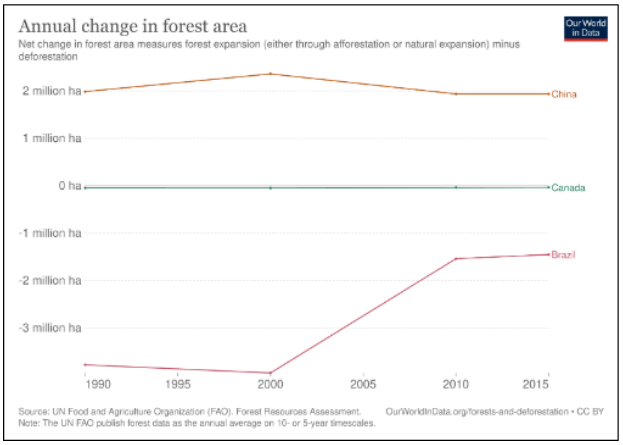

Figure 3: *Annual Change in Net Forest Area across Canada, Brazil and China since 1990 (Sourced from UN Food and Agriculture Organization)*

of forested land in total. Prior to the establishment of the People's Republic of China in 1949, the country had very few forests left (Wenhua, 2004). The significant reduction in both the quantity and quality of natural forests led to the loss and fragmentation of natural habitats (Chen Nakama, 2013).

Starting late twentieth century, the government started introducing a series of reforms and regulations. The Forest Law was enacted in 1998 'for the purposes of implementing the ideal that lucid waters and lush mountains are invaluable assets, protecting, cultivating, and rationally utilizing forest resources, accelerating land greening, safeguarding forest ecological security, constructing ecological civilization, and achieving the harmonious coexistence of human and nature.' (Chen Nakama, 2013).

As per China's Forest Law, the State is recognized as the owner of forests and forestland, unless otherwise specified by law for collective ownership (Dai et al., 2011). Given that China is one of the world's largest exporters, importers, and consumers of timber and timber products, a vast majority of regulations have been focused on addressing the deforestation caused by illegal logging and commercial activities (Dai et al., 2011). Over the course of the last decade, the amendments to the original law have included provisions for areas such as afforestation and restoration of forest ecosystems (Chen Nakama, 2013). This could partly explain why China has experienced a net positive change in forest areas since 2000.

However, despite efforts to tackle illegal logging and associated trade in recent years, forests in China remain susceptible to over-exploitation of forest resources, developments in agriculture, forest fires and other pests (Wenhua, 2004).

As illustrated above, different countries can have varying perspectives when it comes to regulating forests. Factors such as geographical location, sociocultural values, economic priorities, and political considerations can influence a country's approach to forest regulations. For instance, Canada has largely adopted its regulations based on principles of SFM. Brazil, on the other hand, being the home of Amazon, has based its regulations safeguarding these rainforests. Given China's history of degradation of forests in the early twentieth century, current developments indicate the regulations are focused on restoring the forests through large-scale afforestation and imposing restrictions on illegal logging.

The case studies illustrate why it is virtually impossible to have a universal forest law (Lipschutz, 2000). Many critics argue that adopting a universal forest law would only compound the existing problems that are prevalent in traditional top-down 'command and control' regulatory approaches such as:

- Too much focus on revenue generation and/or exerting control by governments and other actors over forest lands (Smyle et al., 2016);
- Incompatibility with property rights or customary practices (Kemp-Benedict et al., 2014);
- Insufficient institutional capacity or political will to effectively monitor and enforce regulations Christy, 2007);
- Overly prescriptive approaches that are heavily focused on enforcement processes rather than desired outcomes such as improved wildlife habitat and water quality, or reduced risk of catastrophic fires (Guariguata Brancalion, 2014);
- Poor adaptability to local conditions (Kaimowitz, 2012);
- Lack of political will to enforce rules and address issues such as corruption, cronyism, wealth concentration, and rent-seeking that can often thrive in the forest sector (Kemp-Benedict et al., 2014).
- Coming back to the topic of increasing rates of deforestation and forest degradation in many parts of the world; it is not the absence of regulation

by public forest agencies that is driving these unsustainable practices, but rather the inadequacy of the existing regulations in terms of their form and function (Guariguata Brancalion, 2014). One could even make the case that the forest sector has been over-regulated and not under-regulated (Smyle et al., 2016).

- Forest regulations serve as a primary tool employed by public sector forest agencies to achieve sustainable forest management (SFM) goals (Larson, Pulhin, 2012). However, when looking at the outcomes, it can be concluded that the application of these tools is not efficient or effective enough and they seem to be "missing the mark".

4 The Role of Different Actors in Sustainable Forest Management

In the practice of sustainable forest management, multiple actors are typically involved to ensure that standards and performance indicators are identified in the process. Forests provide a wide range of economic, environmental, and social benefits, and managing them sustainably requires effective collaboration and contribution from all party frameworks. These actors come from all sectors and play a critical role which varies either in the policy creation, strategic planning, implementation and enforcement.

4.1 Governments

Governments play a significant role in the implementation and promotion of regulation in SFM. Due to most forestry regions being owned by the federal and provincial governments, they are responsible for its operations, protection and expansion across the country. In the process of forest preservation/regulation, governments are involved through the following practices.

Policy development: Governments at the provincial and federal levels are often responsible in the development of policies that protect forest management practices. This includes regulations and incentives to encourage reforestation, restriction of harvesting practices and intentionally create the foundation to promote conservation efforts. With the guidance of these management policies, the overall regulations then have the capacity to tackle issues such as timber harvesting, tree preservation, reforestation and wildlife management (Siry, 2003). Along with the creation of policies, governments may also create goals or targets that must be met by those operating within the industry. For example, they may set targets for levels of forestry that must be conserved or the rate at which forests must be regenerated. By governments setting targets and goals for SFM, corporations are then held accountable and have a general understanding of the limits that can operate within to protect forest preservation.

Enforcement: In addition to the creation of policies that regulate how forestry is managed, governments at the federal and provincial levels also have some responsibility in the enforcement of laws and regulations related to forest management. This often includes monitoring projects that take place on government properties and the penalization of illegal or unfavorable activities such as illegal logging or deforestation (Siry, 2003). While being restrictive in the policies and laws that regulate unsustainable forest behavior, the level of enforcement can be used to fund/incentivize sustainable harvesting practices. This may include financial incentives for forest conservation or reforestation, as well as funding for research and development of SFM practices.

Research and development: As technology evolves in favor of more sustainable management practices of natural resources, governments at the federal level have the capabilities to support research and development efforts through funding projects that help identify and implement new SFM practices (Benini, 2019). This can range from the development of new strategies for monitoring the health of forests, improving the technology to further improve forest restoration structures and even add to foundational factors that promote biodiversity.

Overall, the role that governments of all levels have is critical in implementing proper sustainable regulations to help protect and preserve the natural resources for future generations to come.

4.2 Indigenous Peoples and Local communities

The incorporation of local communities and indigenous peoples is crucial to SFM often due to how intertwined the local communities are within the forest region. As they have often been living within the region for extended periods of time, they are a major factor in forest preservation through the traditional knowledge and practices that have been passed down for generations, which become vital information to ensure forests are managed more effectively.

Community-Based Forest management systems: One way that the local communities and indigenous peoples are involved in the management of sustainable forests is through the development of community-based management systems. These systems make the local communities and surrounding native tribes the notable stakeholders in the decision-making processes related to the management of forests. These decisions include determining which areas should be protected, which areas can be harvested, and the methods used to harvest the areas of vegetation (Benini, 2019). In addition to the decision-making processes, they are also possibly involved in the monitoring and enforcement

efforts to keep forest preservation above sustainable standards. This can include participating and leading patrols that prevent wildlife poaching and illegal logging in surrounding regions.

Partnership Development: Another way indigenous communities and residents are involved is the management of sustainable forests is through the conjoining partnerships with government bodies, NGOs and other crucial stakeholders. These partnerships are helpful in bringing all parties together and provide local communities with access to valuable resources, such as funding and technical support, which can help them implement sustainable practices in the forest regions around them.

4.3 NGOs and Civil Society Organizations

Non-governmental organizations (NGOs) and civil society organizations play an important role in promoting SFM practices. They are crucial stakeholders through their efforts in providing advocacy, education, and technical assistance to governments, forest managers, and other stakeholders.

Advocacy and Awareness: NGOs and civil society organizations are helpful in the management of sustainable forests through their work to raise public awareness about the importance of SFM and preservation of the environment (Dobrynin, 2021). This influence on sustainable practices helps dictate decision-making processes of organizations on public policy and social efforts.

Monitoring and Reporting: Another way NGOs and civil society organizations are helpful to forestry regulation is through the monitoring of activities by governments and private companies involved in forest management and report any violations or environmental damage. Through the added enforcement by NGOs, this helps to hold all parties accountable for non-sustainable practices and promotes transparency in the forest management sector.

4.4 Private sector

The private sector, which includes companies involved in logging, pulp and paper production, and other forest-related industries, plays a role in SFM. Almost all policies and laws are related to logging companies and their limitations to forest harvesting. While economically incentivized to be as profitable as possible, they can adopt sustainable practices and certification schemes, and collaborate with governments, NGOs, and other stakeholders to promote sustainability.

Innovation: Private companies are often at the forefront of developing new technologies and practices that promote SFM. They are also more adaptable and responsive to changes in market conditions and regulations.

Market incentives: While private companies are significant investors in the harvesting of forestry, private companies can often create market incentives for SFM by demanding sustainably sourced materials and certifying their products as sustainable (Lawrence, 2013). This can encourage other companies to adopt sustainable practices and help to drive change across the industry.

5 Analysis

After determining the major stakeholders that are involved in the management of forest regulations, we can also look at different countries and how they each approach forest preservation with some actors playing a larger role than others.

5.1 Canada

Canada has strict forestry regulations that govern the management and harvesting of forests in the country. These regulations are designed to ensure that the country's forests are managed in a sustainable and environmentally responsible manner.

The government plays a significant role in the regulation of forestry in Canada, through laws that are determine at all levels (Federal, Provincial, Municipal) such as the Canadian Environmental Protection Act, the Species at Risk Act, and the Canadian Environmental Assessment Act (Government of Canada, 2020). In addition to the different acts by the federal government, lower-level governments are responsible for granting permits and regulation enforcement. Some of the key features of Canada's forestry laws that make them strict include:

Comprehensive regulatory framework: Canada's forestry laws are based on a comprehensive regulatory framework that encompasses federal, provincial, and territorial laws and regulations.

Large stakeholder involvement: Canada's forestry laws recognize all stakeholders involved in the process and make efforts to protect the rights of Indigenous peoples, local communities, including the right to participate in decision-making related to forestry activities on their traditional lands, along with involvement from NGOs, civil societies and environmental stakeholders.

Penalties for non-compliance: Canada's forestry laws provide for significant penalties for non-compliance, including fines, license suspensions, and legal action.

5.2 Brazil

Brazil's forestry regulations have been the subject of ongoing debates and major criticism over more recent years, with several stakeholders making statements that they are not strict enough on the laws surrounding the amazon forest regions (Earthworm, 2023). Some

of the reasons for this major criticism include several factors from limited government involvement in agricultural protection to more economic freedom for privatized corporations related to the forestry industry.

Loose historical and economic pressure: Brazil's forestry regulations have been considered loose by many of the country's outside stakeholders as the political pressure has been to prioritize economic development over environmental protection. Brazil is a country with a strong agricultural sector, and the forestry industry has played a significant role in the country's economic growth (Binswanger, 2002). As a result, there has been a long-standing tension between environmental protection and economic development, with some political actors advocating for looser regulations to facilitate economic growth.

Limited resources of regulatory agencies: In addition to the lack of government control, the enforcement of forestry regulations has been challenging due to the lack of resources from the regulatory agencies and NGOs aimed at forest conservation (Fearnside, 2017). Some forestry companies have also been accused of non-compliance and illegal activities, which have undermined the effectiveness of the existing regulations.

5.3 China

China's forestry laws have undergone significant revisions over the years, with the latest amendment to the Forestry Law being passed in 2018 (The Nature Conservancy, 2021). While previous revisions were subject to similar criticism of loose regulations toward forestry management, the current version of the law places greater emphasis on ecological conservation and sustainable management practices and includes provisions for the protection of biodiversity and wildlife habitat. The law also imposes harsher penalties for illegal logging and other forms of forest destruction.

Large government control: The rise in China's increased regulations have stemmed from a large contribution from the government control on forest management. China has established several regulations and policies to support the implementation of its forestry laws, including the National Forest Protection Program, the National Forest Certification Scheme, and the National Afforestation Program.

Limited private investment and influence: With the increase of larger state control over common shared resources, there has been less influence from private investment corporations. While private practices have been granted rights to use forest land through certain agreements, forest land is owned by the state and managed by the government. Forest resources may be harvested, but only in accordance with sustainable management practices.

6 Policy Recommendations

It is not possible to create a policy that can be applied as a "one size fits all" solution for countries to regulate their forests and it is argued that this would be counterproductive. However, there are general adjustments that can be made to forest regulations that can shift the ideas from a reactive protection of forests to a more proactive sustainability-oriented policy.

The issue in current forest regulation policy is not regarding a lack of regulation, in fact, the forest sector is closer to over-regulation than under-regulation, yet the regulatory approaches are missing the mark (Smyle, 2016). There needs to be an emphasis on the quality of forest regulations rather than an attempt to incorporate as much regulation as possible. This includes forest policy being up to pace with rapid global change; foreseeing future developments over a 10+ year span; addressing key societal issues within a broad and long-term national development agenda; and having all of this based on sound information (Kissinger, 2010).

There is also a concern about utilizing too many or not enough regulatory instruments in the regulation process. An important factor to avoid in forest policy is smorgasbordism which refers to using all regulatory tools rather than the minimum required to achieve success (Swatuk, 2023). There must be a complementary instrument mix that can combine two or more regulatory instruments to shape policy.

Information strategies should be the first instrument applied to achieve SFM as this will incorporate education and training on SFM to the relevant actors in the sector. Governments, the private sector, NGOs, and Indigenous communities should all be on the same page and educated on the why and how of achieving SFM. After this is established, the main governing instrument of command-and-control will be better respected and understood. It is important that respect for command-and-control regulations are improved as there has been a diminished respect for law, judicial systems, and forest sector institutions (Smyle, 2016). Lastly, this complementary instrument mix is rounded out by the economic instrument bringing more enforceability to the regulation. Complexity and a lack of enforceability are two factors that are highlighted for failure of forest regulation (Smyle, 2016), and the integration of information strategies can serve to clear up confusion while economic instruments can improve enforceability.

There are a number of emerging approaches and principles that should be applied to forest regulation to progress towards proactive SFM. Firstly, the regulations must be built through meaningful, effective citizen and stakeholder collaboration (Smyle, 2016). This is something that Canada does well and should be implemented more in China and Brazil. By doing this, the regulations are more likely to resist being undermined by other forces and provide more transparency to hold all parties, including the government, account-

able (Smyle, 2016). Additionally, a focus on the quality of regulation must be based on focusing on the most important public outcomes; this clarity on what the most important and prioritized issues are will allow regulatory efforts to be more focused, less complex, less expensive, and thus, more effective (Smyle, 2016). Lastly, an approach that needs to be placed on forest regulation moving forward is to acknowledge and account for a need to continuously adapt the regulation (Smyle, 2016). A long-term dependable framework must be dynamic and adaptive which means that there must be a system for both performance monitoring and stimulating learning (Smyle, 2016). If done in a transparent, systematic, and continuous manner, allowing regulations to adapt can produce many benefits; it can improve understanding between key actors, reduce conflict and legal challenges, and facilitate collective identification and support for adaptations.

Implementing any of these recommendations will not be easy and there are many questions that will still need to be addressed. Each country would have to implement these changes in their own context and at the input of their own citizens and stakeholders. One question that each country will need to consider is whether barriers are more significant in some places than others. Research depicts that deforestation slowed and afforestation rose between 1990-2015 in wealthier countries, but in contrast, forest loss has continued in poorer countries and the tropics which has considerably reduced the goods and services they can provide (Smyle, 2016). The economic potential that deforestation threats such as logging can provide is obvious and there will always be the challenge of economic versus environment, especially with poorer countries more desperate for income. Which is why it is important to keep that point of view in mind when proposing regulations and an effort needs to be made to propose a utilitarian strategy that can benefit economically but also protect the sustainability of forests. However, the challenge is finding a balance of economic and environmental focus in regulation because regulatory failures are prone to occur when the real purpose of the regulation is to raise revenue (Smyle, 2016).

7 Conclusion

The success of a nation's forest regulation is difficult to gauge but an overarching method to define it with is Sustainable Development Goal 15. This goal refers to the sustainable management of forests, combat desertification, halt and reverse land degradation, and halt biodiversity loss (SDG, 2023). Indicator 15.1.1 aims to have forest area as a proportion of total land area, of which out of the three countries focused on in this paper, Brazil ranks highest with 59.4% of its land covered in forest, Canada second with 38.7%, and China last with 23.4% (SDG, 2023).

However, the context of each tells a different story with respect to regulation as Canada's forest area has remained constant since 1990, Brazil's has steadily decreased from 70.5% in 1990, and China's has steadily increased from 16.7% in 1990 (SDG, 2023). Remaining level would suggest that Canada has the most sustainable forest management out of the three because they are able to benefit economically from their forests while still maintaining the area.

This theory had been confirmed considering that Canada's regulatory framework appears most consistent with the policy recommendations. Canada's forestry laws are based on a comprehensive regulatory framework that encompasses federal, provincial, and territorial laws and regulations. Additionally, Canada emphasizes a large stakeholder involvement which causes the regulations to be more likely to resist being undermined by other forces and provide more transparency to hold all parties, including the government, accountable (Smyle, 2016). Furthermore, a lack of enforceability is not something Canada appears to struggle with thanks to penalties for non-compliance such as fines, license suspensions, and legal action.

Brazil have had a 11.1% decrease in forest area, however, despite this still have the 36th largest percentage of forest area in the world (SDG, 2023). From that perspective, Brazil do still satisfy the SDG 15.1.1 indicator and their forest regulation could be justified considering that. However, Brazil must consider the long-term framework for their forests because they cannot prioritize economic development over their environmental protection forever. Even if their forest area is meant to decrease for economic gain, there must be a more stringent long term sustainable forest management plan developed, one that does not consist of loose historical and economic pressure. Brazil seems like an example of regulatory failure due to the real purpose of the regulation being to raise revenue.

China is moving in the opposite direction of Brazil due to increased government control and this may be in efforts to right some historical wrongs. Considering China had been steadily declining in forest area its entire history until 1990 (SDG, 2023), it appears that they may be attempting to recover the forest area they have lost. In 1700 the forest area China had was 30.8% of its total area, which then plummeted to 16.7% in 1990, and is now at 23.4% (SDG, 2023). If China's goal is to increase forest area, then their regulation is succeeding, but they will still need to consider what their plan is when they have completed recouping their forest area. This is an example of the need for regulation frameworks to foresee future developments over a 10+ year span and address key societal issues within a broad and long-term national development agenda (Kissinger, 2010).

Lastly, the long-term regulation of forestry should have the potential to extend beyond the borders as countries should explore supporting other countries forestry initiatives. Considering wealthier countries have experienced forestry increase while poorer coun-

tries experience a decrease (Smyle, 2016), there should be some scope for countries to support each other's afforestation goals while effectively managing their own deforestation regulations. True sustainability cannot be managed without this distribution of support as sustainable forest management is a worldwide effort.

Bibliography

Abessa, D., Famá, A., and Buruaem, L. (2019). The systematic dismantling of Brazilian environmental laws risks losses on all fronts. Nat. Ecol. Evol. 3, 510–511. doi: 10.1038/s41559-019-0855-9

Barreto, P., Ia Pereira, R., Brandão, A., Com, B., De, C., Marianno, B., et al. (2017). Os Frigoríficos Vão Ajudar a Zerar o Desmatamento da Amazônia?. Available online at: www.imazon.org.br (accessed March 24, 2021)

Baumgartner, R. J. (2019). Sustainable Development Goals and the Forest Sector—a Complex Relationship. Forests, 10(2), 152. https://doi.org/10.3390/f10020152

Benini, R. (2019, March 16). Roots for growth: Why protecting and restoring forests is one of the best things any government can do for its people. Retrieved April 20, 2023, from https://www.nature.org/en-us/what-we-do/our-insights/perspectives/protecting-restoring-mantiqueira-forest-brazil/

Binswanger, H. P. (2002, July 10). Brazilian policies that encourage deforestation in the Amazon.

Busch, J., and Ferretti-Gallon, K. (2017). What drives deforestation and what stops it? A meta-analysis. Rev. Environ. Econ. Policy 11, 3–23. doi: 10.1093/reep/rew013

Brito, B., Barreto, P., Brandao, A., Baima, S., and Gomes, P. H. (2019). Stimulus for land grabbing and deforestation in the Brazilian Amazon. Environ. Res. Lett. 14:064018. doi: 10.1088/1748-9326/ab1e24

Brockerhoff, E. G., Barbaro, L., Castagneyrol, B., Forrester, D. I., Gardiner, B., González-Olabarria, J. R., Lyver, P. O., Meurisse, N., Oxbrough, A., Taki, H., Thompson, I. M., Van Der Plas, F., Jactel, H. (2017). Forest biodiversity, ecosystem functioning and the provision of ecosystem services. Biodiversity and Conservation, 26(13), 3005–3035. https://doi.org/10.1007/s10531-017-1453-2

Bullock, R., Jastremski, K., Reed, M. G. (2017). Canada's Model Forests 20 years on: towards forest and community sustainability? Natural Resources Forum, 41(3), 156–166. https://doi.org/10.1111/1477-8947.12129

Carvalho, W. D., Mustin, K., Hilário, R. R., Vasconcelos, I. M., Eilers, V., and Fearnside, P. M. (2019). Deforestation control in the Brazilian Amazon: a conservation struggle being lost as agreements and regulations are subverted and bypassed. Perspect. Ecol. Conserv. 17, 122–130. doi: 10.1016/j.pecon.2019.06.002

Cashore, B. W., McDermott, C. (2004). Global environmental forest policies: Canada as a constant case comparison of select forest practice regulations. Victoria, Canada: International Forest Resources.

Chen, B., Nakama, Y. (2013). Thirty years of forest tourism in China. Journal of Forest Research, 18(4), 285–292. https://doi.org/10.1007/s10310-012-0365-y

Christy, L. C. (2007). Forest law and sustainable development: addressing contemporary challenges through legal reform. World Bank Publications.

Coglianese, C. (2020). Environmental Soft Law as a Governance Strategy. https://papers.ssrn.com/sol3/papers.cfm?abstract$_id = 3775088$

Dai, L., Wang, Y., Su, D., Zhou, L., Yu, D., Lewis, B., Qi, L. (2011). Major Forest Types and the Evolution of Sustainable Forestry in China. Environmental Management, 48(6), 1066–1078. https://doi.org/10.1007/s00267-011-9706-4

Dobrynin, D. (2021, October 21). The Forest Environmental Frontier in Russia: Between Sustainable Forest Management Discourses and 'wood mining' practice - ambio. Retrieved April 20, 2023, from https://link.springer.com/article/10.1007/s13280-021-01643-6

Drummond, J. A., and Barros-Platiau, A. F. (2006). Brazilian environmental laws and policies, 1934-2002: a critical overview. Law Policy 28, 83–108. doi: 10.1111/j.1467-9930.2005.00218.x

Earthworm. (2023). Regenerating forests and fighting deforestation - earthworm - earthworm.

Enters, T., Durst, P. B., Applegate, G. B., Kho, P. (2002). Applying reduced impact loggin to advance sustainable forest management.

Escobar, H. (2018). Scientists, environmentalists brace for Brazil's right turn. Science 362, 273–274. doi: 10.1126/science.362.6412.273

Fearnside, P. M. (2018). Challenges for sustainable development in Brazilian Amazonia. Sustain. Dev. 26, 141–149. doi: 10.1002/sd.1725

Fearnside, P. (2017, September 26). Deforestation of the Brazilian Amazon.

Food and Agriculture Organization of the United Nations. (2020). Global Forest Resources Assessment 2020.

Gibbs, H. K., Rausch, L., Munger, J., Schelly, I., Morton, D. C., Noojipady, P., et al. (2015). Brazil's soy moratorium. Science 347, 377–378. doi: 10.1126/science.aaa0181

Golden Kroner, R. E., Qin, S., Cook, C. N., Krithivasan, R., Pack, S. M., Bonilla, O. D., et al. (2019). The uncertain future of protected lands and waters. Science 364, 881–886. doi: 10.1126/science.aau5525

Goal 15: Life on land - SDG tracker. Our World in Data. (2023). Retrieved April 21, 2023, from https://sdg-tracker.org/biodiversitytargets

Government of Canada. (2020, May 20). Government of Canada. Retrieved April 20, 2023, from

https://www.canada.ca/en/services/environment/natural-resources/forests/deforestation.html

Government of Canada. (2023, January 24). Legality and sustainability. https://natural-resources.canada.ca/our-natural-resources/forests/sustainable-forest-management/canadas-forest-laws/legality-and-sustainability/13303

Guariguata, M. R., Brancalion, P. H. S. (2014). Current Challenges and Perspectives for Governing Forest Restoration. Forests, 5(12), 3022–3030. https://doi.org/10.3390/f5123022

Gunningham, N., Holley, C. (2016). Next-Generation Environmental Regulation: Law, Regulation, and Governance. Annual Review of Law and Social Science, 12(1), 273–293. https://doi.org/10.1146/annurev-lawsocsci-110615-084651

Gunningham, N., Kagan, R. A., Thornton, D. (2003). Shades of green: business, regulation, and environment. Stanford University Press.

Hickey, G. M., Innes, J. L. (2003). The battle of Evermore? Global lessons from hard versus soft laws for monitoring forestry. In XXI World Forestry Congress Proceedings (3), Edited by Anonymous (p. 283).

Kaimowitz, D. (2012). Forest law enforcement and rural livelihoods. In Illegal logging (pp. 126-154). Routledge.

KPMG. (1996). Canadian Management Survey. Toronto: KPMG

Kemp-Benedict, E., de Jong, W., Pacheco, P. (2014). Forest futures: Linking global paths to local conditions. Forests under pressure: Local responses to global issues, 539.

Kirton, J. J., Trebilcock, M. J. (2017). Hard choices, soft law: Voluntary standards in global trade, environment and social governance. Routledge.

Kissinger, H. (2010). Developing effective forest policy: A Guide. Developing effective forest policy - A guide. Retrieved April 21, 2023, from https://www.fao.org/3/i1679e/i1679e00.htm

Larson, A. M., Pulhin, J. M. (2012). Enhancing forest tenure reforms through more responsive regulations. Conservation and Society, 10(2), 103-113.

Lawrence, A. (2013, September 18). Is the private forest sector adapting to climate change? A study of forest managers in North Wales - Annals of Forest Science. Retrieved April 20, 2023, from https://link.springer.com/article/10.1007/s13595-013-0326-4

Levi-Faur, D. (2010). Jerusalem papers in regulation governance.

Lipschutz, R. D. (2000). Why is there no international forestry law: an examination of international forestry regulation, both public and private. UCLA J. Envtl. L. Pol'y, 19, 153.

May, P. M. (2005). Regulation and Compliance Motivations: Examining Different Approaches. Public Administration Review, 65(1), 31–44. https://doi.org/10.1111/j.1540-6210.2005.00428.x

McManus, P. (2020). Environmental regulation.

Mendoza, M. A. (2015, March 3). Reinsurance as Governance: Governmental Risk Management Pools as a Case Study in the Governance Role Played by Reinsurance Institutions. https://papers.ssrn.com/sol3/papers.cfm?abstract$_id = 2573253$

Mitchell, W. (2021). Beyond politics: markets, welfare, and the failure of bureaucracy. Routledge.

Moutinho, P., Guerra, R., and Azevedo-Ramos, C. (2016). Achieving zero deforestation in the Brazilian Amazon: what is missing? Elementa 4:000125. doi: 10.12952/journal.elementa.000125

Orbach, B. (2012, September 7). What Is Regulation? https://papers.ssrn.com/sol3/papers.cfm?abstract$_id = 2143385$

Pereira, E. J. A. L., Ribeiro, L. C. S., Freitas, L. F. S., and Pereira, H. B. B. (2020). Brazilian policy and agribusiness damage the Amazon rainforest. Land Use Policy 92:104491. doi: 10.1016/j.landusepol.2020.104491

Pinotti, P. (2012). Trust, Regulation and Market Failures. The Review of Economics and Statistics, 94(3), 650–658. https://doi.org/10.1162/rest$_{a0}0209$

Rajão, R., del Giudice, R., van der Hoff, R., and de Carvalho, E. B. (2021). Uma Breve História da Legislação Florestal Brasileira: contém a Lei no 12.651, de 2012, com comentários críticos acerca da aplicação de seus artigos. 1a edição. Florianópolis: Expressão.

Ritchie, H., Roser, M. (2021, February 9). Forests and Deforestation. Our World in Data. https://ourworldindata.org/forest-area

Rothkopf, D. (2018). Brazil's new president adds to global threat to science. Nature 563, 5–6. doi: 10.1038/d41586-018-07236-w

Sikor, T., Stahl, J. (Eds.). (2012). Forests and people: property, governance, and human rights. Routledge.

Siry, J. P., Cubbage, F. W., Ahmed, M. R. (2005). Sustainable forest management: global trends and opportunities. Forest policy and Economics, 7(4), 551-561.

SFB (2020). Cadastro Nacional de Florestas Públicas – Atualização 2019. Available online at: http://www.florestal.gov.br/cadastro-nacional-de-florestas-publicas/127-informacoes-florestais/cadastro-nacional-de-florestas-publicas-cnfp/1894-cadastro-nacional-de-florestas-publicas-atualizacao-2019

Smyle, J., Collins, S., Biason, C. (2016). RETHINKING FOREST REGULATIONS. Rights and Resources Initiative's. https://rightsandresources.org/wp-content/uploads/2016/04/Rethinking-Forest-Regulations$_R RI_A pril - 2016.pdf$

Soares-Filho, B., Rajão, R., Macedo, M. N., Carneiro, A. M. P., Costa, W. R. S., Coe, M. D.,

Rodrigues, H., Alencar, A. (2014). Cracking Brazil's Forest Code. Science, 344(6182), 363–364. https://doi.org/10.1126/science.1246663

Sterner, T., Barbier, E. B., Bateman, I. J., Van Den Bijgaart, I., Crépin, A., Edenhofer, O., Fischer, C., Habla, W., Hassler, J., Johansson-Stenman, O., Lange, A., Polasky, S., Rockström, J., Smith, H. G., Steffen, W., Wagner, G., Wilen, J. E., Alpízar, F., Azar, C., . . . Robinson, A. L. (2019). Policy design for the Anthropocene. Nature Sustainability, 2(1), 14–21. https://doi.org/10.1038/s41893-018-0194-x

The Nature Conservancy. (2021, January 08). Our priorities: Tackle climate change.

Tollefson, J. (2012). President prunes forest reforms. Nature 486:13. doi: 10.1038/486013a

UN Environ. Progr. (UNEP). 2012. Global Environment Outlook 5: Environment for the Future We Want.

Von Gadow, K., Pukkala, T., Tomé, M. (Eds.). (2001). Sustainable forest management (Vol. 1). Springer Science Business Media.

Wenhua, L. (2004). Degradation and restoration of forest ecosystems in China. Forest Ecology and Management, 201(1), 33–41. https://doi.org/10.1016/j.foreco.2004.06.010

Zhiyanski, M., Glushkova, M., Dodev, Y., Bozhilova, M., Yaneva, R., Hristova, D., Semerdzhieva, L. (2021). Role of the cultural ecosystem services provided by natural heritage in forest territories for sustainable regional development. Journal of the Bulgarian Geographical Society, 45, 61–66. https://doi.org/10.3897/jbgs.e72766