DEVELOPING A FRAMEWORK FOR EFFECTIVE CONSERVATION ACCOUNTING AND STEWARDSHIP OF OLD-GROWTH FORESTS ON PRIVATE LAND IN NOVA SCOTIA

by

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ABSTRACT

Developing a Framework for Effective Conservation Accounting and Stewardship of Old-Growth Forests on Private Land in Nova Scotia

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The province of Nova Scotia presents a unique challenge for old-growth forest conservation due to its ownership landscape. With over 63% of land designated as privately owned, it is imperative that the Government of Nova Scotia collaborate with private landowners to ensure these vital ecosystems are properly accounted for, enabling conservation efforts to begin in a manner that is both consensual and approved by the landowners. This thesis highlights the obstacles inherent in private land conservation and builds upon these challenges to present a framework with recommendations for improving the accounting and support of old-growth conservation efforts on private lands. Qualitative data were gathered through semi-structured interviews (n=10) within the forestry, conservation biology, and environmental fields. Participants were asked about the challenges of private land conservation, the role of landowner involvement, and strategies for improving conservation efforts. Research findings suggest that the Government of Nova Scotia should implement a conservation accounting framework that formally recognizes and integrates private land conservation into provincial strategies. Key recommendations include enhancing education and outreach efforts to increase landowner awareness of conservation programs, improving financial incentives to encourage participation, and fostering transparent communication to build trust between landowners and government agencies.

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INTRODUCTION

1.1 Introduction to the Accounting of Old-Growth Conservation on Private Land in Nova Scotia

In a world increasingly defined by climate vulnerability and resource depletion, conserving critical ecosystems, including old-growth forests, is essential to safeguarding against future harm. Conservation efforts in Nova Scotia, Canada, have predominantly focused on Crown land, as the government holds jurisdiction over its research, management, and designation as protected areas. While Crown land conservation is vital for preserving the social and ecological values of old-growth forests, Nova Scotia's unique ownership landscape highlights the critical need for private land conservation. According to the Nova Scotia Department of Natural Resources and Renewables (2022), approximately 63% of forest land in the province is privately owned. This percentage significantly surpasses the amount of public forest land that is owned by the Crown (Nova Scotia Department of Natural Resources, 2022). This majority private ownership restricts the provincial government's ability to directly conserve large portions of forested land. Furthermore, conservation efforts on private lands are difficult for the government to monitor and account for, presenting additional challenges to ensuring the protection of these ecosystems.

Although private ownership presents clear challenges, it is important to acknowledge Nova Scotia's history with private land conservation and to recognize that its ownership landscape must be respected. For conservation efforts to succeed, collaboration between the government and private landowners must be prioritized. The creation of Cape Breton National Park in 1936 highlights the province's past approach to land acquisition, one marked by expropriation and the non-consensual seizure of land (MacEachern, 2001). During the park's

development, landowners were left in the dark, and the government exercised its authority under the Nova Scotia Expropriation Act to forcefully acquire property when owners refused to settle (MacEachern, 2001).

In recent years, however, the Government of Nova Scotia has approached private land conservation in a new light. Significant efforts are being undergone to ensure that conservation efforts occurring on private land are focused on collaboration between the government and the landowner. The Nova Scotia Biodiversity Act (2021) highlights the voluntary nature of private land conservation, stating, 'the Minister may establish a biodiversity management zone on private land with the consent of the owner of the private land by entering into an agreement with the owner' (Biodiversity Act, 2021). The acknowledgment of requiring consent from the private landowner written into legislation demonstrates the Government of Nova Scotia's commitment to ensuring private land conservation efforts are not done so forcefully, rather, are undergone as a result from a mutual desire to protect and conserve the natural ecosystems of Nova Scotia. A delicate balance must be drawn between the government and private landowners to ensure that the future of private land conservation represents and respects the desires of private landowners while supporting the conservation goals of the Government; conservation accounting can serve as a starting place.

Conservation accounting, the act of systematically tracking, measuring, and reporting conservation practices, plays a critical role in bridging the knowledge gap between private landowners and the Nova Scotia Government (Feger, 2019). By establishing clear methodologies, conservation accounting can help to ensure that private landowners' efforts are recognized, incentivized, and aligned with provincial conservation strategies. In the context of old-growth forests, conservation accounting is particularly important. Without a provincial

mechanism to account for conservation practices on private lands, these efforts risk remaining unquantified, leading to misalignments in conservation planning and resource allocation throughout the province.

In Nova Scotia, existing mechanisms for private land conservation include the transfer of land to the Crown in exchange for compensation or the use of conservation easements. Conservation easements are legally binding agreements between a landowner and a conservation organization (such as a land trust) or a government conservation agency (The Nova Scotia Nature Trust, 2020). These agreements attach to the title of the land, allowing the land to remain private property while restricting future uses to protect its ecological value (The Nova Scotia Nature Trust, 2020). Conservation easements are strictly voluntary, but once established, they ensure long-term protection of the land's conservation values.

While these methods are valuable and contribute to the protection of important ecosystems, they do not fully address the broader need for a mechanism to account for conservation practices on private lands. This need is particularly significant for landowners who may not wish to transfer ownership or be constrained by government easements. Developing a framework to account for conservation efforts on privately-owned lands, regardless of formal agreements, is essential to support inclusive and effective conservation planning.

The Nova Scotia Department of Natural Resources has highlighted the need for such a provincial framework in their policy, *An Old-Growth Policy for Nova Scotia*. Section 6.0 of the policy specifically addresses the private ownership of forested land across the province. Among the outlined commitments is section (g), which states the intention to "develop a framework and criteria for accounting for effective conservation and stewardship of old-growth forest areas on private land" (Nova Scotia Department of Natural Resources, 2022, p. 11). This thesis will seek

to explore this section of the policy, drawing on existing literature and provincial conservation frameworks to develop a tailored structural plan for ecosystem conservation accounting in Nova Scotia, filling the current void in this area.

As old-growth forests located on private land in the province of Nova Scotia have important social, ecological, and economic values to the province beyond those provided by old growth forest areas on Crown lands, it is imperative that a mechanism is established to support private landowners in conserving the portions of their forest property (Nova Scotia Department of Natural Resources, 2022). Through adherence to a private land conservation accounting mechanism, private landowners have the potential to contribute significantly to the preservation of Nova Scotia's Old-Growth while also reaping the benefits of old-growth forest management practices. As stewards of these valuable ecosystems, private landowners play a crucial role in ensuring the long-term sustainability and resilience of Nova Scotia's old-growth forests for the benefit of future generations.

Given the unique challenge of accounting for the conservation of old-growth forests in Nova Scotia, conducting this research is imperative. Doing so will strengthen efforts to preserve the important social, ecological, and economic values of old-growth forests to the province, ensuring their continued significance for future generations.

1.2 Research Questions and Objectives

The overarching question this research seeks to explore is: How can the development and implementation of a framework for accounting and measuring conservation efforts on private land in Nova Scotia contribute to the provincial government's conservation of old-growth across the province while maintaining private landowners' rights? To address this question, the following research objectives will serve as guides:

1. Conduct a comprehensive jurisdictional review of existing conservation frameworks across Canada to identify best practices and lessons applicable to Nova Scotia.
2. Gain a deeper understanding of stakeholders' current challenges and barriers to private land conservation, as well as their suggestions for improving old-growth forest (OGF) conservation accounting in Nova Scotia.
3. Develop a tailored framework for conservation accounting in Nova Scotia, building upon pre-existing frameworks while considering the province's unique private land ownership landscape.
4. Propose strategies for the effective adoption and implementation of the framework by the provincial government, outlining a set of criteria to ensure the conservation and stewardship of old-growth forest areas on private land.

By achieving these objectives, this research aims to provide a structured, actionable framework that balances ecological preservation with the rights and interests of private landowners, ultimately supporting long-term old-growth conservation accounting efforts in Nova Scotia.

CHAPTER 2

LITERATURE REVIEW

The following literature review will examine the significance of old-growth forest ecosystems in academic research and compare existing jurisdictional mechanisms for private land conservation across Canada. Additionally, it will explore existing conservation accounting strategies in scholarly work. This review will begin by defining old-growth forests and their characteristics in Nova Scotia, highlighting the ecological, economic, and social significance of these ecosystems.

2.1 Definition, Characteristics, and Classification of Old-Growth Forests in Nova Scotia

Old-growth forests can be defined as 'relatively old and relatively undisturbed by humans' (Hunter, 1989). However, the definition of old-growth varies across regions, leading to confusion about what qualifies as an old-growth stand, as there is no universally accepted or applicable definition (Hunter, 1989). Mosseler et al. (2003a) explores the attributes of late successional old-growth forest types through the development of the 'old-growthness' index, created to assist in defining old-growth forests. Such old-growth attributes include structural features, such as age, presence of standing deadwood and coarse woody debris, as well as process features including natural and human disturbance. Recognizing the importance of geographical context, this thesis will define old-growth based on the attributes present across Nova Scotia.

Old-growth forests are late successional forest ecosystems that evolve through long periods of forest development (Nova Scotia Department of Natural Resources and Renewables, 2022). Old-growth forests occur and develop when large forest areas experience fluctuating levels of low to moderate disturbance followed by significant periods of ecological continuity —

defined as a long uninterrupted presence (Nova Scotia Department of Natural Resources and Renewables, 2022). Alongside being characterized by minimal recent human disturbance, these ecosystems are predominantly large forests, often consisting of interior forest. While such characteristics are ideal, the provincial government also considers forests of all sizes when determining old-growth status, including those as small as 1.0 hectare.

According to the Nova Scotia Department of Natural Resources (2022), a provincial Forest Ecosystem Classification (FEC) system, focusing on late-successional vegetation types, is used to guide the government in managing the diverse types of old-growth forests across forest regions. The FEC system has been instrumental in defining and characterizing old-growth forests located on protected areas and Crown land throughout the province.

Old-growth Forest areas are defined as those where 20% or more of the basal area—a measurement of the cross-sectional area of trees at breast height—consists of trees that are at or exceed the reference age for that forest type, as outlined in the classification system. Using this system, the Nova Scotia Department of Natural Resources (2022) identifies restoration opportunities on both protected areas and Crown land to ensure strong representation of old-growth forests across all ecodistricts. These areas typically meet the vegetation type criteria for old-growth forests. However, the government may also include younger mid- or early-successional forests to create larger protected areas. Such forests may also be included as they developed old-growth characteristics and show potential to become old-growth forests over time (Nova Scotia Department of Natural Resources, 2022).

While the FEC system has greatly benefited the conservation of these critical ecosystems on Crown land, a significant gap remains in addressing old-growth on privately owned land. Many private landowners lack access to the necessary resources and expertise to identify or

manage old-growth forests on their properties. Furthermore, low awareness and literacy in the FEC system among landowners hinders their ability to recognize the presence of old-growth on their land, leaving these ecosystems vulnerable to degradation.

2.2 Environmental Significance of Old-Growth Forests

Old-growth forests are vital ecosystems that must be preserved for a multitude of reasons, including their unique ecological significance. Such ecosystems support biodiversity by providing habitat for a diverse range of plant and animal species and play a critical role in carbon storage, sequestering large amounts of carbon dioxide (Weber, 2015). This, in turn, helps mitigate the effects of climate change by reducing air temperatures and stabilizing local climates (Weber, 2015). Given their ecological importance, there is an urgent need to identify and protect the remaining old-growth forests in Nova Scotia.

Weber (2015) highlights the critical role of old-growth forests in conserving biodiversity, particularly for rare and endangered species. The structural characteristics of these ecosystems, such as the presence of deadwood, habitat continuity, and substrate stability, support the growth and dispersal of species that are especially sensitive to forest management practices.

The loss of foundational species, those that define and sustain entire ecological communities through their structural and functional attributes, poses a significant challenge, as their decline alters the environment that countless other species depend upon (Ellison et al., 2005). For example, Ellison et al. (2005) discuss the Eastern Hemlock and its profound influence on its surrounding ecosystem. Hemlocks create a unique microclimate with their dense shade and acidic, slowly decomposing litter, resulting in cool, damp conditions, slow nitrogen cycling, and nutrient-poor soils. Additionally, in summer months, hemlocks transpire approximately 50% of the total water released by deciduous trees.

These characteristics make hemlock-dominated forests particularly important for sustaining unique species. Streams flowing through hemlock stands support salamanders, fish, and freshwater invertebrates that are intolerant of seasonal drying (Ellison et al., 2005). Additionally, hemlock forests provide shelter for deer and other wildlife, highlighting their role as a keystone species within these ecosystems. Preserving old-growth species like the Eastern Hemlock is therefore essential to maintaining the biodiversity of these forests.

Barton (2018) highlights the critical role of old-growth forests in mitigating climate change by reducing carbon dioxide emissions through carbon sequestration. Sequestered carbon, absorbed from the atmosphere by trees during photosynthesis, stored within their biomass, and eventually released back into the atmosphere through respiration and decomposition, is stored at exceptionally high levels in old-growth forests (Barton, 2018). If these forests were cleared or poorly managed, this stored carbon would otherwise be released back into the atmosphere, contributing to greenhouse gas emissions. Due to their low levels of disturbance and abundance of coarse woody debris, old-growth forests function as effective carbon sinks, meaning they absorb and retain significant amounts of carbon over long periods, helping to stabilize the global carbon cycle and reduce the impacts of climate change (Barton, 2018).

2.3 Economic and Social Impacts of Private-land Conservation

2.3.1 Social Impacts

Private land conservation is inherently political in its approach as it has significant impacts on the social and economic fabrics of a given society. Expanding beyond the province of Nova Scotia, private land conservation efforts have the potential to complement those occurring on Crown land by bridging gaps in government initiatives, contributing to the protection of old-growth forests. However, this approach raises important questions about equity, access, and the

role of private landowners in managing resources that hold ecological and cultural values. Effective private land conservation requires balancing environmental goals with the needs of private landowners, ensuring that conservation efforts are inclusive, transparent, and considerate of societal interests.

To achieve such a balance, it is essential to first recognize the diverse values that old-growth forests represent. Moyer and Owen (2022) propose a framework for understanding the multiple dimensions through which people relate to and associate value to old-growth. They did this by organizing these values into six broad categories: ecological, economic, recreational, aesthetic, spiritual, and ethical (Moyer and Owen, 2022). This multidimensional perspective emphasizes that old-growth forest conservation is not solely a matter of protecting forests for the material values, but is deeply tied to identity, tradition, and community.

Davis and Fly (2020) further expand on the importance of understanding the values associated with forests and how such perceptions shape the dynamics of private land conservation. By examining conservation through the lens of private landowners, the authors discovered a correlation between the amount of privately owned forestland and the amount of well-managed privately owned forest land and factors such as time, financial resources, and knowledge required to manage private forests. At the root of the disconnect between private landowners and government forestry bodies lies a significant lack of trust. Many private landowners perceive government foresters as imposing regulations that hinder their economic interests, creating financial and time burdens that feel misaligned with their priorities and capacities (Davis and Fly, 2020). Davis and Fly (2020) sought to understand the rationale and diverse ways private landowners conceptualize the management of their forestland, with the aim of helping government bodies tailor management practices to better align with landowners'

needs. Their findings revealed that many landowners felt a conflict between managing their land for ecological purposes and pursuing economic gain. The most common conceptualization of forest management among landowners was ‘enhancing forest habitat,’ followed closely by ‘making money’ as the second most popular perspective (Davis and Fly, 2020). As these two methods of forest management run parallel without intersecting, there lies a need for a multifaceted approach to forest management that integrates the social needs of the landowner with their economic desires.

Across North America, conservation easements are the most predominant proposed management approach for private land conservation, designed to balance the social and economic needs of landowners in alignment with government conservation goals. However, despite their potential to support environmental objectives, these easements can also have adverse effects on the social fabric of private landowners. Horton et al (2017) sought to discover how conservation easements have impacted landowners’ livelihoods and well-being in Colorado, United States. While many landowners reported that their motivation to participate in such easements was driven by a desire to conserve their land and its resources, they faced numerous challenges that diminished their enthusiasm for participation.

The most significant challenges associated with conservation easements fell into the category of legal and procedural issues. Landowners expressed frustrations with the conservation easement completion process referring to the amount of time and paperwork involved, the inconvenience of monitoring and enforcing the conservation values of the easement and acquiring permission to make changes to the property or amending the easement (Horton et al, 2017). In general, inaccessibility is a hinderance to the success of conservation easements, as private landowners are not adequately educated on the purpose, benefits, and long-term

implications, nor are they provided with sufficient resources to navigate the legal and procedural complexities involved in participating (Horton et al, 2017).

There lies a need to expand beyond conservation easements and address the root causes of the misalignment between governing bodies and private woodlot owners. Finley and Kittredge (2006) suggest the key to increasing landowner participation in forest management programs is to recognize the differences within the target population, and tailor the program to meet segment specific needs and desires. Finley and Kittredge (2006) use the metaphorical figures of Thoreau, Muir, and Jane Doe to represent different types of private forest landowners: those driven by conservation ethics, those focused on forest preservation, and those with utilitarian goals. Finley and Kittredge (2006) highlight the need for customized forest management strategies that address the specific needs, preferences, and values of landowners. They suggest that private landowners, falling into the category of 'John Muir Members,' are more devoted to letting nature take its course, and protecting the environment. As a result, programs requiring timber management may pose a challenge, as such woodlot owners are opposed to harvesting. Conversely, landowners identifying as 'Jane Doe' are not opposed to harvesting if it does not interfere with their ability to sell or develop their land (Finley and Kittredge, 2006).

Understanding the intentions and motivations of private woodlot owners is imperative to keeping the delicate balance of social framework of a given society. Private land conservation must not feel as though the governing body is imposing programs and methods upon the landowner, rather it should be a working relationship between the two, where private landowners are transparent about their needs and motivations.

2.3.2 Economic Impacts

The social framework of private land conservation is inherently linked to that of the economy, as there is a reliance on financial mechanisms to support landowners in preserving old-growth forest areas. The Nova Scotia Department of Natural Resources and Renewables (2022b) prescribes the use of various incentive-based strategies for private land conservation. These mechanisms, such as conservation easements, tax incentives, or direct land purchases, aim to balance the demands of environmental protection and economic opportunity (Nova Scotia Department of Natural Resources and Renewables, 2022).

For many private landowners, incentive-based strategies are morally conflicting and decisions to participate are often made with careful consideration. Although incentivizing landowners through payments for ecosystem services or other financial tools benefits the environment, conservation efforts can lead to potential economic losses at the hand of promoting stewardship. Conservation easements or restrictions on private land can limit the potential for residential, commercial, or industrial development, potentially reducing economic gain. Landowners who participate in conservation programs may lose revenue from activities including timber harvesting and other resource-based industries. Additionally, many conservation efforts rely on government subsidies, grants, or tax incentives, which may strain public budgets or redirect funds from other economic priorities.

Newburn et al. (2005) discusses incentive-based strategies such as conservation easements and short-term management agreements used for conserving biodiversity on private lands and their effects on the economy. Newburn et al. (2005) proposes a strategy which aims to minimize the expected loss in biological benefit due to future land-use conversion while considering the full or partial costs of land acquisition. Newburn et al. (2005) states that billions

of dollars are spent by United States state and local governments and private conservation organizations to support land conservation. Newburn et al. (2005) proposes that government bodies and conservation organizations evaluate the economics of private land conservation through four key frameworks: benefits-only targeting, which focuses on maximizing ecological gains; benefit-cost targeting, which considers ecological benefits relative to financial costs; benefit-loss targeting, which accounts for potential losses if conservation measures are not implemented; and benefit-loss-cost targeting, a comprehensive strategy that incorporates all three factors.

These approaches help prioritize investments in conservation efforts by ensuring resources are directed toward projects with the greatest ecological and economic value. The study highlights the potential of these strategies to improve the efficiency and effectiveness of land conservation initiatives. For example, benefit-cost targeting ensures that limited conservation funds are allocated to projects that produce the highest ecological return for the investment. Similarly, benefit-loss targeting can guide decisions toward protecting lands most at risk of degradation or conversion to other uses. Adopting such an economic framework could significantly benefit governing bodies seeking to maximize the impact of their conservation budgets, enabling more strategic and efficient use of resources.

2.4 Existing Mechanisms for Private-land conservation Across Canada

2.4.1 Nova Scotia

Canada has increasingly emphasized the need for private land conservation as provinces across the country recognize the environmental benefits of protecting and preserving privately owned land. Provincial governing bodies have begun developing frameworks and mechanisms to outline their methods and goals for private land conservation, aiming to balance ecological

priorities with the needs of private landowners. These efforts focus on fostering collaboration, providing incentives, and implementing policies that support sustainable land management practices. As the importance of private land conservation grows, understanding its challenges and opportunities becomes critical to achieving long-term environmental and social benefits.

The Nova Scotia Department of Natural Resources and Renewables (2022) has outlined its existing private land conservation mechanisms, dividing them into three categories. Category A includes landowners who wish to retain ownership of their property or continue residing on it, while Category B encompasses landowners who aim to benefit financially or gain assets from their old-growth forests. Lastly, Category C pertains to landowners willing to donate their old-growth forests without expecting any financial return (The Nova Scotia Department of Natural Resources and Renewables, 2022).

Category A encompasses a range of conservation mechanisms beyond traditional conservation easements (The Nova Scotia Department of Natural Resources and Renewables, 2022). One option is the Right of First Refusal, which allows landowners to conserve their old-growth forests by granting a conservation partner the first opportunity to purchase the property if they decide to sell in the future. Another mechanism, the Donation of Remainder Interest with Reserved Life Estates, enables landowners to donate their forests while retaining the right to live on the property for their lifetimes, after which full ownership transfers to the conservation partner. Stewardship Agreements provide a voluntary framework where landowners undertake conservation practices in exchange for financial compensation or technical assistance, fostering active land stewardship. Additionally, Restrictive Covenants legally bind landowners to limit activities that could harm their old-growth forests, ensuring long-term ecological protection through agreements with conservation organizations.

Mechanisms under Category B include land purchases, private-to-Crown land exchanges, and split-receipt sales, all designed for landowners seeking financial or asset-based benefits from their old-growth forests (The Nova Scotia Department of Natural Resources and Renewables, 2022). Land purchases involve the purchase of land with old-growth forests from landowners. Private-to-Crown land exchanges enable the Department of Natural Resources to consolidate land boundaries and improve land management by allowing landowners to trade their private land for suitable Crown land. Split-receipt sales occur when land is sold at a reduced price, with the remaining value offset by a tax benefit, offering financial incentives to landowners. In contrast, Category C involves the donation of private land, with no reserved rights, to the government or conservation partner organizations, reflecting the landowner's willingness to contribute to conservation efforts without expecting financial compensation (The Nova Scotia Department of Natural Resources and Renewables, 2022).

2.4.2 New Brunswick

In the province of New Brunswick, many remaining natural areas that have not been managed or developed are located on private land. These areas provide critical wildlife habitats, regulate water flow, and serve as benchmarks for scientific research. Recognizing the ecological importance of these lands, the provincial government has placed significant emphasis on promoting private land conservation. The Government of New Brunswick (n.d) discusses existing mechanisms for private land conservation to retain New Brunswick's natural areas. These mechanisms fall into several categories: verbal, written, and management agreements, as well as property leases, sales, donations, and conservation easements.

Verbal agreements are often referred to as 'handshake' agreements between a landowner and the conservation agency whereby the landowner agrees to maintain the habitat to the best of

their ability (The Government of New Brunswick, n.d). These agreements are not legally binding. A written agreement is a signed version of a verbal agreement and does not require additional commitment from the landowner. A Management agreement, however, is a formal contract between the landowner and the conservation agency, specifying how the land is to be managed, often including stewardship assistance for a set period. These agreements are particularly beneficial for landowners seeking short-term conservation support.

Leases are legal agreements that provide a conservation agency the legal right to manage the property for a defined term. This flexible option allows modifications to the agreement with the consent of both parties (The Government of New Brunswick, n.d). If a landowner desires to sell their ecologically significant land rather than lease it, there are several sale options. An outright sale transfers all rights to a conservation agency in exchange for monetary compensation. A bargain sale allows landowners to sell their property below market value, offering both financial compensation and an income tax deduction. Lastly, an installment sale allows for payment over time, providing a gradual financial return for the landowner (The Government of New Brunswick, n.d).

Land donations offer another avenue for conservation in New Brunswick while providing tax benefits. An outright donation transfers full ownership to a conservation agency, with the donor receiving a tax receipt for the land's market value. A donation by devise involves gifting the land through a will, allowing the landowner to maintain stewardship during their lifetime. A life estate enables the landowner to donate the property while retaining the right to live on or use the land during their lifetime. Recent updates to the Federal Income Tax Act further incentivize donations, allowing donors to receive a tax credit of up to 100% of their net income for

contributing ecologically significant lands to qualified agencies. This credit can be applied in the year of donation or carried forward for up to five years.

Lastly, New Brunswick has introduced conservation easements as flexible mechanisms for land conservation. A conservation easement is a legal document that places restrictions on the use and development of land to preserve its natural features (The Government of New Brunswick, n.d). These agreements can be customized to include specific land uses agreed upon by the owner and the easement holder, such as farming, hunting, or limited development. Conservation easements ensure that both current and future owners adhere to the conservation goals set forth, safeguarding the land's ecological value.

2.4.3 British Columbia

The government of Canada with the province of British Columbia (1996) outlined their stewardship mechanisms for private landowners in British Columbia. Many of the frameworks align with the provinces of Nova Scotia and New Brunswick including verbal and management agreements, conservation covenants, sales and donations. The interesting component of this document was how they outlined how to research, retain, and restore natural features and habitats as a private landowner in British Columbia (The Government of British Columbia, 1996). Although only 6% of the province is privately owned, this small portion of land coincides with the richest region of biodiversity. As a result, the Government of British Columbia seeks to work with landowners to conserve private lands and in turn, protect species and ecosystems at risk.

The Government of British Columbia (1996) outlines three general stewardship techniques for private landowners, referring to such as the three R's: research, retain and restore. These techniques emphasize understanding the land's ecological characteristics through research, preserving its existing natural features through retention, and taking active measures to

rehabilitate degraded areas through restoration. By adopting these practices, private landowners can contribute significantly to biodiversity conservation and the maintenance of healthy ecosystems.

Research involves studying the unique ecological attributes of a property, including soil types, vegetation, and wildlife habitats. The Government of British Columbia (1996) encourages private landowners to research their land and explore their local region by visiting regional parks or wildlife management areas. It is also recommended that landowners learn to recognize native species and identify the different habitats and features that make up their region. Additionally, speaking with long-time residents of the area can provide valuable insights into the land's history and ecological changes. Landowners are encouraged to learn about the First Nations of the region and their traditional use of the land, as Indigenous knowledge can offer important perspectives on sustainable land management practices. By engaging in these research activities, landowners can make informed decisions about managing their property. This ecological knowledge will help protect the land, while supporting long-term sustainability, and fostering biodiversity.

Retaining refers to the protection of native species and natural landscapes to prevent further degradation. The Government of British Columbia (1996) outlines that an essential component of land stewardship is often doing nothing. As human beings are a busy species that struggle to leave things undisturbed, few natural areas remain untouched. The Government of British Columbia (1996) discusses natural areas as 'generally hard to improve on' as they evolved that way for a good reason. Consequently, the Government of British Columbia (1996) emphasizes the principle that preserving a natural area is more valuable than attempting to restore it. It is always preferable to retain habitat rather than trying to create it. This principle is

particularly relevant for private landowners interested in conserving their property. By prioritizing retention, landowners can protect ecosystems that have developed over time, ensuring that the balance of environmental factors are maintained. This may involve limiting development, controlling invasive species, and promoting natural regeneration processes.

Lastly, restoring focuses on activities such as planting native vegetation or managing invasive species to rejuvenate the land's ecological balance. The Government of British Columbia's (1996) rule of doing nothing has exceptions; if an area is degraded beyond its ability to recover on its own, human intervention may benefit its restoration. While restoring their land, ecologists suggest that landowners should subscribe to adaptive management, meaning the act of doing something, watching the results, and from that, adapting your next steps to what you have observed. The Government of British Columbia's (1996) outlines restoration and enhancement tasks that landowners can participate in such as planting native species, purchasing nursery grown native plants, and removing exotic and invasive species. Such restoration activities are essential for landowners, as they help maintain ecological health and contribute to the broader goal of environmental conservation.

Although Nova Scotia, New Brunswick, and British Columbia are distinct provincial entities, they share a common commitment to conserving private lands to protect their ecosystems and mitigate climate change. The legal and financial stewardship options available to landowners in each province reflect a shared recognition of the essential role private landowners play in addressing environmental challenges. By providing mechanisms such as conservation easements, stewardship programs, and financial incentives, these provinces display their dedication to collaborating with landowners to ensure the conservation and preservation of their

lands. Such private land conservation mechanisms are imperative to empowering individual landowners to contribute to climate change mitigation efforts and environmental stewardship.

2.5 Mechanisms for Old-Growth Accounting

To effectively evaluate and understand the extent and impact of conservation efforts on private land, the government must implement mechanisms to support landowners. However, these efforts should go further by developing a framework for conservation accounting, the tracking, measuring, and reporting of conservation practices. Such a framework would offer a comprehensive understanding of private landowners' contributions, enabling governmental entities to make informed policy decisions and allocate resources effectively to protect and conserve private lands. Given the scarcity of frameworks pertaining to the accounting of old-growth forest conservation efforts, a review of relevant literature focused on protected lands, conservation areas, and private lands when applicable, will be conducted.

Feger et al. (2019) speaks of conservation accounting as instrumental to the field of conservation and outlines priorities for the development of accounting for ecosystem management. Conservation accounting, referring to the studying of ecosystem-centered accountabilities, is the first priority mentioned by Feger et al. (2019). It is imperative to understand how stakeholders could use ecological and related social, health, economic, and financial information to manage commitments to environmental targets (Feger et al., 2019). Such an understanding would assist governments in answering questions such as 'what commitments have been, are being, or should be negotiated among stakeholders and private landowners; who is accountable to whom and who is not, regarding management of ecosystem quality; and how should information be framed and exchanged to organize these accountabilities effectively?' Accounting can showcase how different ways of structuring and representing environmental

information can lead to creation of ecosystem-centered management to achieve conservation goals.

King et al. (2023) explores the use of the System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) framework to systematically account for protected areas. This framework was adopted as a set of international statistical standards and recommendations in 2021 (United Nations et al., 2021). The SEEA EA provides accounting principles, classifications and measurement boundaries for organizing data on ecosystems, including protected areas (PAs). Such a framework can provide an influx of consistent information on the state, trends and even benefits from PAs (e.g., ecosystem services, climate change mitigation, contributions to economic activity and human well-being).

Through the use of case studies, King et al. (2023) explores three protected area accounting mechanisms and their objectives. First, PAs as Accounting Entities, includes tracking the extent or coverage of PAs over accounting periods. Second, PAs as Ecosystem Accounting Areas (EAAs) entails applying SEEA EA principles to analyze ecosystem types, their condition, and the services they supply. Third, Accounting for PAs in Landscapes and Seascapes, which evaluates trade-offs between biodiversity, ecosystem services, and economic activities at broader scales to guide land-use planning.

To manage PAs effectively and plan the necessary expansion of PA networks, government bodies will need clear and regular information on PAs and the benefits they provide that is consistent over space and time. The three aforementioned methods of accounting would encourage the government to consider benefits, trade-offs and opportunity costs associated with PAs and their expansion in the context of wider development objectives such as policy development and implementation.

Williamson et al. (2020) addresses challenges in evaluating private land conservation by proposing methods to account for incomplete reporting. Identifying locations where private landowners are likely to participate in conservation initiatives can clarify trade-offs between ecological benefits and sociopolitical costs. Conservation accounting is an emerging tool for identifying future conservation opportunities. However, most data on private land conservation are voluntarily reported and incomplete, which complicates these assessments. Williamson et al. (2020) seeks to improve the analyses of conservation on private lands by adapting the widely used occupancy-modeling framework for use in situations where information on participation is incomplete.

The occupancy-modeling framework used throughout the study allows for better estimation of conservation activities even when reporting is incomplete. Williamson et al. (2020) used conservation easements as the basis of the modeling study. Conservation Easements, a prevalent global land protection strategy, were chosen for their widespread use and availability in the National Conservation Easement Database (NCED). The voluntary nature of NCED reporting introduces data gaps, making it an ideal test case for their methods.

Using modeling techniques, Williamson et al. (2020) successfully generated predictions identifying locations where landowners are more likely to engage in conservation efforts. This method advances understanding of the conditions that foster conservation activities. It also provides statistical predictions and enhances the alignment of conservation priorities with actionable outcomes, offering an approach to bridge gaps in data and improve conservation planning.

Conservation accounting is critical for understanding and enhancing conservation efforts on both public and private lands. Studies like those of Feger et al. (2019), King et al. (2023), and

Williamson et al. (2020) illustrate the importance of accounting frameworks and methodologies tailored to address data gaps, track ecological outcomes, and balance ecological goals with economic and social considerations. Such mechanisms have the potential to enable stakeholders and governmental bodies to allocate resources effectively and align conservation priorities with action. By improving data quality and fostering ecosystem-centered management, conservation accounting becomes an essential strategy for sustainable land-use planning and policy development.

2.6 Conclusion

Within academia, old-growth forests are recognized for their significant ecological value. When coupled with academia's support for private land conservation and the social and economic implications, it becomes clear that conserving old-growth forests on private lands is highly desirable. In analyzing the existing mechanisms for private land conservation in Nova Scotia, British Columbia, and New Brunswick, it is important to note that while tools such as conservation easements and financial incentives represent a strong starting point for increasing landowner engagement and expanding conserved land, challenges remain in bridging the gap between government and landowners. As the field of private land conservation continues to evolve, especially in light of our growing focus on ecological sustainability in an era of climate uncertainty, the need for effective conservation accounting will undoubtedly increase. The existing conservation accounting mechanisms mentioned in the literature are important starting points. Further research on this topic will continue to provide valuable insights into the importance of systematically tracking, measuring, and reporting conservation practices.

CHAPTER 3

STUDY AREA AND METHODS

3.1 Study Area

3.1.1 Nova Scotia, Canada

Nova Scotia is a province located in Eastern Canada. According to the 2021 census by Statistics Canada, Nova Scotia has a population of 939,383 people, and the province's land area is 52,824 km2 (Statistics Canada, 2022). Nova Scotia's unique forest composition, combined with the province's diverse ownership landscape, highlights the need for the creation of a framework for conservation accounting. A clear gap in information has become evident, making Nova Scotia an ideal study area for exploring the effectiveness of conservation accounting in promoting sustainable land management.

Figure 1. Geographic Overview of Nova Scotia. This map provides a geographic overview of Nova Scotia. The inset offers a closer look at the highlighted region, while the background map shows Nova Scotia's location within Canada. Map Created by the author (2025).

3.1.2 Forest Types Present Within Nova Scotia

Within the province of Nova Scotia, there are two recognized forest regions: Acadian and Maritime boreal. According to (Mosseler et al., 2003b), Acadian old-growth forests are characterized by attributes including a patchy, multi-layered, multi-species canopy with trees of several age classes dominated by relatively large trees, occasional large snags, and the presence of abundant large woody material on the ground at different stages of decay (Mosseler et al., 2003b). Conversely, Maritime boreal old-growth forests are characterized by attributes including a patchy canopy with trees of two or more age classes, frequent snags, and the presence of abundant woody material at numerous stages of decay (Neily et al, 2022). Maritime boreal old-growth forest areas are dominated by late-successional, species such as black spruce, balsam fir, and white spruce; species that have a naturally short longevity, typically less than 125 years, and are generally more susceptible to natural disturbances (Neily et al, 2022). The presence of late-successional tree species makes Nova Scotia ecologically significant as these species are critical to maintaining biodiversity and ecosystem stability. Given the ecological values of old-growth forests, their conservation in Nova Scotia is vital for preserving biodiversity and sustaining the long-term health of forest ecosystems.

3.1.3 Analysis of Private Land and Crown Land Ownership

The province of Nova Scotia was chosen as the desired research area due to its unique ownership landscape. With over 63% of land in Nova Scotia held in private hands—and a high number of small woodlot owners, many of whom own only small parcels—it is essential that private landowners collaborate with the provincial government to identify and account for old-growth forests across the province. Figure 2. illustrates the forms of land ownership across Nova

Scotia. Currently, the province lacks precise data on the percentage of old-growth forest privately owned in comparison to those on crown land. This information would be highly valuable to the province, as it would allow the government to identify ecologically significant areas and, where possible, collaborate with landowners to ensure the conservation of old-growth forests for the benefit of the environment.

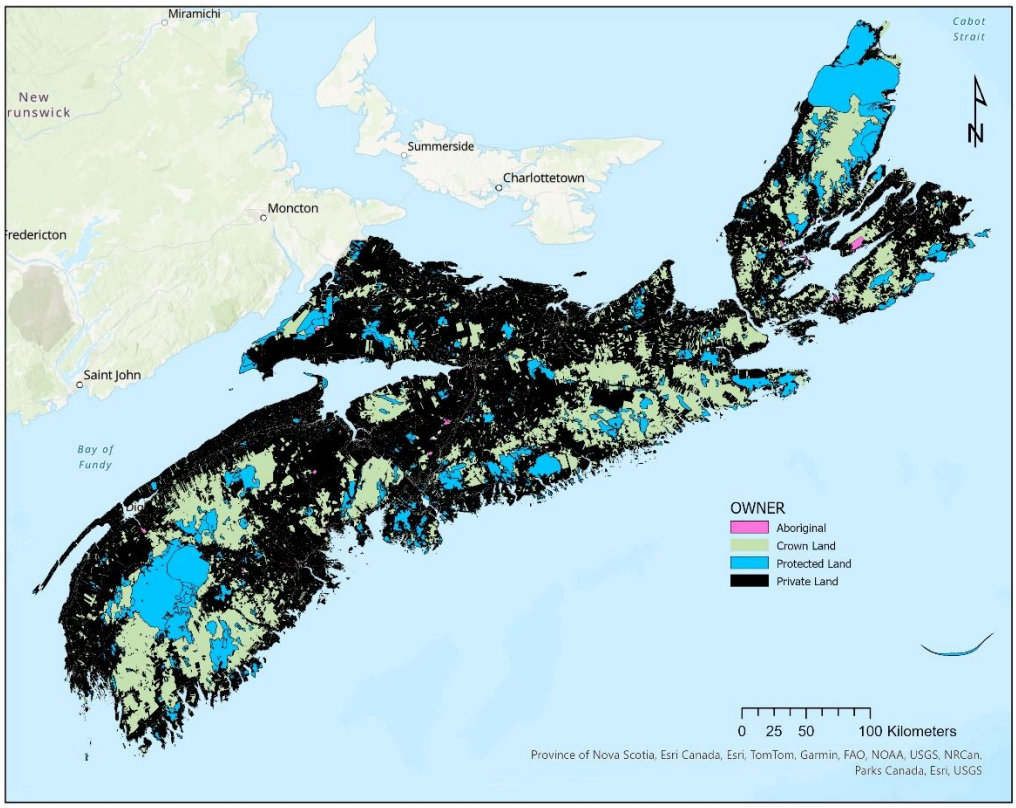

Figure 2. Map of Land Ownership in Nova Scotia. Reproduced from: Nova Scotia Department of Natural Resources & Renewables (2024).

3.2 Methods

A qualitative research approach was used to achieve the objectives of my thesis. This methodology aimed to identify the barriers to old-growth forest conservation on private lands in Nova Scotia and gather recommendations from experts on how to structure and implement a framework for old-growth conservation accounting on private lands. By employing qualitative

methods, various stakeholder's perspectives were captured, including government employees and those working within forest conservation related fields.

3.2.1 Data collection

Qualitative data were collected by conducting semi-structured interviews with key stakeholders and private land associations. The purpose of these interviews is to assess the suitability and applicability of the developed conservation frameworks for Nova Scotia. By understanding the concerns of experts regarding the accounting of Old-Growth conservation efforts, the proposed strategies and criteria for the conservation and stewardship of old-growth forest areas on private land will be refined.

A diverse selection of interviewees was imperative to my research it was desirable to capture a wide range of perspectives and experiences relevant to old-growth conservation accounting in Nova Scotia. By including individuals from diverse backgrounds and professions within the forestry, conservation biology, and environmental fields, the study aimed to ensure that findings would not be limited to a narrow subset of opinions. Rather, the study desired to identify a broad range of concerns and highlight new ideas from citizens of the Province of Nova Scotia, particularly those working in old-growth conservation and related fields. The intentions behind conducting interviews were to identify gaps in the accounting of old-growth forests across the province and seek expert guidance on how the Government of Nova Scotia can address these issues to close the gaps and respond to the concerns raised.

To participate in an interview, individuals had to be 18 years of age or older. Aside from this, Interview candidates were not required to meet specific educational characteristics to be eligible for participation. However, it was preferred that candidates possess an understanding of old-growth conservation and forestry. This knowledge could stem from professional experience

in the field or from possessing private land. To recruit participants, candidates were recommended by thesis supervisor, Dr. Bush, and were contacted directly via email to request their participation. Following the initial recommendation of interviewees, snowball sampling was used to find additional interviewees. This entailed asking initial participants to recommend others who could contribute valuable insights about old-growth forest conservation accounting.

The target sample size for interviews was ten-fifteen. This number was chosen as hearing from people of varying backgrounds, while minimizing the amount of repetition in responses was desired. Interview candidates were contacted via email invitation, which included a detailed explanation of the research, the purpose of the interview, and the expectations for participation (e.g., a 30-minute interview, voluntary participation). To comply with Research Ethics standards, the invitation included essential ethics information, such as the file number and the voluntary nature of the interviews. Upon agreeing to participate, participants were required to provide informed consent in the form of a signature.

Interview data collected between December 3, 2024, following the approval of this research by the Saint Mary's University Research Ethics Board (REB), and February 6, 2025. Interviews were 30 minutes in length and conducted via Microsoft Teams. Before starting each interview, verbal consent was obtained to begin and record the conversation. Interviewees were informed that they could end the interview at any time without penalty, and that their recording would be destroyed if they chose to discontinue. Interviews were recorded using the Voice Memos application and, following their completion, were uploaded to a password-protected USB drive, which was securely held by the principal investigator. A total of ten interviews were conducted between December and February.

3.2.2 Data Analysis

Following the collection of qualitative data from interviews, responses were transcribed and analyzed using the Voice Memos application. To identify key themes, interview transcripts were downloaded from this application and carefully reviewed. Following this, Excel was used to organize responses, categorize recurring themes, and generate graphs that visually represent relationships within the data. The data analysis process for this thesis began in February and concluded in March of 2025. Thematic analysis was employed to identify themes in participants' perspectives, focusing on recurring concerns such as financial barriers, policy gaps, and the role of private woodlot owners in conservation efforts.

3.2.3 Limitations

The interviews conducted were not intended to gather a representative sample of all private woodlot owners across Nova Scotia. Instead, experts in the fields of forestry, environmental management, and conservation biology were interviewed for their valuable insights into the current challenges of conservation and their recommendations for navigating them. It must also be noted that the majority of interview participants are affiliated with private land organizations across Nova Scotia, many of which collaborate with the Department of Natural Resources. Conducting interviews with private woodlot owners was desired, however, due to time constraints, interviews of this type were not completed. While this research does not capture the perspectives of all private landowners in the province, the data collected remains valuable and reflective of a broader phenomenon occurring in Nova Scotia. Additionally, as the majority of interviewees work in forest conservation, many of which holding ties with the Department of Natural Resources, there is an inherent bias in both the methodology and results, leading to responses that are heavily focused on environmental conservation. Most interviewees

expressed strong views on the importance of private woodlot owner involvement in old-growth conservation efforts, emphasizing that their participation is crucial to maintaining the ecological health of old-growth forests in Nova Scotia.

Despite these limitations, the research contributes to a deeper understanding of the challenges and opportunities in private land conservation in Nova Scotia. They highlight the need for policy mechanisms that balance ecological conservation with the economic concerns of woodlot owners, which is the primary objective of this thesis.

CHAPTER 4

RESULTS

4.1 Interviews

In total, ten individuals participated in a semi-structured interview. All ten interview participants work within the fields of forestry, environmental management, or conservation biology. The majority of participants are affiliated with private land organizations across Nova Scotia, and their knowledge of forestry and environmental management has been shaped by their involvement with private land. Participants will be referred to by the chronological order of their interview. For example, 'Participant 1' was the first interview conducted, while 'Participant 10' was the last. Of the participants, three are female and seven are male. Participant 1 works in forest conservation, holding the title of Registered Professional Forester. Participant 2 has experience in various forest conservation roles and currently serves as a project coordinator at the Nova Scotia Community College. Participant 3 works as a Forest Stewardship Coordinator within the forestry field. Participant 4 is involved in forestry management and planning for the Government of Nova Scotia. Participant 5 works in ecological conservation, focusing on program and project management. Participant 6, a Registered Professional Forester, is employed by a private woodlot organization in Nova Scotia. Participant 7 holds the position of Forest Program Manager at an environmental organization. Participant 8 is a Registered Professional Forester. Participant 9 works in the forestry field as an Executive Director. Lastly, Participant 10 works as a manger for a forest co-operative in Nova Scotia.

The following sections summarize the participants' responses to each interview question:

What do you see as the biggest challenges in conserving old-growth forests on private land in Nova Scotia?

Common themes appeared following asking participants their views on the biggest challenge in conserving old-growth forests located on private lands in Nova Scotia. The largest challenge presented was a lack of education on old-growth ecosystems and engagement from woodlot owners to conserve old-growth on private land, as mentioned by six of ten participants. Participant 1 expressed concern regarding private woodlot owner engagement, stating, "there are numerous private woodlot groups in Nova Scotia. I think the actual participation within those groups is 10% of all woodlot owners. It is a very disengaged demographic." The second largest barrier to conservation on private-land was identified as a lack of government regulation, with five of ten participants highlighting this as a challenge. Participant 9 offered insight into the complexities of government regulation on private lands:

> There is a ton of old-growth on private [lands], but the government can't go in and say 'we are going to do this' [enact conservation efforts without consent]. We have to go in with some sort of mechanism that allows them to sign up voluntarily, but if they sign up voluntarily, there needs to be a benefit to the woodlot owner.

Of the ten interview participants, four highlighted financial barriers and a lack of incentives as challenges to old-growth conservation on private land. Participant 8 expressed concern about the financial barriers woodlot owners face, stating, "A lot of large landowners… their land has been in their families for generations. I think the biggest thing in trying to conserve these areas is that a lot of landowners almost cannot afford to let this stuff [their properties] go." Participant 7 identified a gap in government incentives for woodlot owners, stating, "Even if landowners are interested, the mechanisms or the dollars to conserve it are weak. Conservation easements are fine from a policy perspective, but they are not really effective."

Notably, participant 7 highlighted two unique challenges to conservation; a lack of certified individuals, capable of properly assessing old-growth forests located on private lands, and the occurrence of fragmentation within privately owned old-growth forest stands. Participant

7 stated, “There just aren’t the technical staff out there, especially ones that are trained and have the, you know, the motivation to be out there identifying and quantifying it [old-growth] on private land.” When discussing fragmentation, participant 7 stated:

> Fragmentation of old-growth on private land is probably a huge concern as far as how effective it is, even if it’s identified… connectivity between it and other old-growth, or just the nature of how land gets harvested on private land creates risks to that old forest from, you know, introduction of invasive species to windthrow and other events like that.

The lack of support for identifying old-growth forests on private lands was a challenge highlighted by two participants. Participant 6 stated, “I think identifying it and educating people about it, it’s that simple.” This challenge is closely tied to a lack of education and awareness, as participants noted that many woodlot owners are often unaware of what old-growth forests look like. As a result, they may struggle to identify these forests on their land without government assistance.

The ownership landscape of Nova Scotia presents a challenge for conservation efforts due to the high number of small woodlot owners, many of whom own only small parcels of land. Participants highlighted that the fragmented ownership structure within Nova Scotia makes conservation more difficult to navigate compared to the presence of fewer large woodlot owners, who control significant portions of land. Regulating and engaging numerous small landowners poses a greater challenge than working with a smaller number of large landowners.

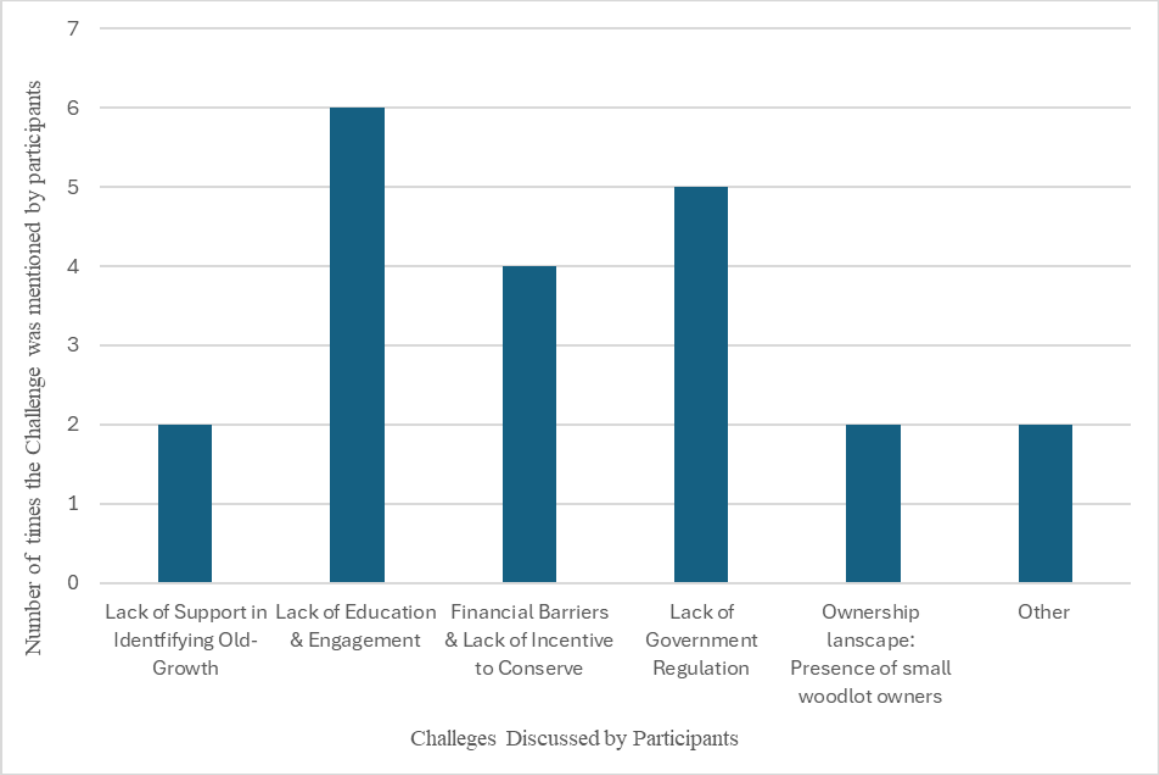

Figure 3. Interviewees' Beliefs of Largest Challenges Associated with Old-Growth Conservation In Nova Scotia. Bar graph depicting interviewees' responses to the question, "What do you see as the biggest challenges in conserving old-growth forests on private land in Nova Scotia?" The Y-axis represents the number of times each recommendation occurred, and the X-axis shows the challenges discussed by participants.

What role do you believe private landowners play in the conservation of old-growth forests compared to public lands?

Participants expressed varying perspectives on the role of private landowners in old-growth forest conservation compared to public lands. The majority recognized the significant potential for private landowners to contribute to conservation efforts but noted that this role remains largely unrealized. Participant 3 remarked:

> I think that they do play an important role that we don't have a value for yet. We don't know how much old-growth forest they are conserving, or at least in my experience, I don't think we do. So, I think there is potentially a really huge contribution on private land, to our known old-growth forests.

Similarly, participant 1 stated, “I think they play an understated role. There is a lot of effort for crown land conservation because it’s easy to implement policies on crown land. It’s not as easy to implement policies and regulations on private land. I think there could be tremendous potential.”

Many participants emphasized the critical need for increased private landowner engagement, urging landowners to take action, as their involvement is essential to old-growth conservation. Participant highlighted Nova Scotia’s ownership landscape as a key factor in engaging private woodlot owners in conservation efforts, stating:

> I think they have to play and contribute the most because the proportional size of private land in Nova Scotia is 63—close to 70%. It is a huge amount of the land…the challenge is if we don’t play the game of old-growth on private land, we really have to find the old-growth potential on crown land or public lands, but the public lands may not support the amount of old-growth that we want in the province as a whole, so private lands are very important just because of the dominating ratio of our province.

Participant 2 discussed the role of the private woodlot owner as significant to old-growth forest conservation and connectivity. They highlighted the potential impact of strategic landowner engagement in maintaining ecological corridors and preventing habitat fragmentation:

> I think they have a role to play in terms of like, if you can identify priority areas or pinch points and target those landowners, I think they could play a really important part. If there is an area of private land between two protected areas, for example, and it’s important for connectivity and you know there is old forest on the private land…I think they play a really important part. They play an important part everywhere, but sometimes because the parcels are so small, it’s harder for them to play as important roles as the larger tracts of land that you would find on crown land.

Participant 8 uniquely emphasized that the role of private landowners in old-growth conservation depends on increased education and improved communication between the public sector and private landowners:

> I think it is really important that information is communicated to the private landowners side….So I think there is a role to play for the public sphere to educate the

> private sphere on the value of these old trees and old forests, but then I think there's quite a bit of onus on the private side of things to, once they do understand what they are holding, to provide them some incentives to protect them.

Participant 5 identified that the role of the private landowner is increasingly important due to the rare value of old growth forests, stating, "Well, I mean, old-growth forests are a bit different than all the other sorts of non-timber values because they are so rare. So, I personally would think there is a bit more onus to manage for it if you have it." Similarly, Participant 9 discussed the ecological significance of old-growth forests on private land, noting the presence of ecologically important sites. They recognized the opportunities for private landowner involvement while also acknowledging the challenges that may arise: "I believe private land has more opportunities because, in general, that is where all of your good sites are…. I think we have a huge opportunity, but it is politically sensitive."

Are you familiar with the "Old-Growth Policy for Nova Scotia" and its commitments regarding private land? If so, what are your thoughts on these commitments?

The majority of participants expressed familiarity with the Old-Growth Policy for Nova Scotia and its commitments regarding private land. Out of the ten participants, six participants were aware of the policy in a general capacity, while four indicated that they were unaware of the policy. Many of the participants aware of the policy highlighted it as a "good starting point," while expressing concerns regarding the current state of the work being done to see through these commitments into fruition. For instance, Participant 2 stated: "In terms of follow up, I know that things are still outstanding… it is great to have these things in policy, but it is hard to action them." The majority of participants familiar with the policy, expressed overall satisfaction "I thought it was really interesting to see those commitments, in particular, some of the

objectives…potential, you know, government support to help expand recognition on private land. I think that's great to see in writing."

For those who responded that they were unfamiliar with the policy, a common concern was the lack of awareness and education regarding the policy and its private land commitments. Participant 9 expressed their concern, stating:

> I've probably read the policy. I'm sure I've read the policy, but would I be able to recall it? You know, I'm not sure I could do that. So that just goes to show you that if I haven't done that, you talk to a woodlot owner, I can almost guarantee you that they will have no idea. There's going to be very few woodlot owners that are going to be aware of that policy.

As understood, section 6.0 of the policy outlines the need for developing a framework and criteria for old-growth forest conservation accounting on private land. How do you think this framework should be structured?

The recommendations for the framework's structure varied among participants; however, several common themes emerged. The majority— seven out of ten participants—suggested that the framework should be grounded in scientific research and spatial sampling, with an emphasis on using LiDAR mapping and ArcGIS for surveys of potential old-growth stands on private lands. For instance, participant 2 highlighted this, stating:

> First of all, having a better awareness of where the old forest is using existing resources and checking your priority sites… a bit like what we are doing on Crown land, looking at GIS layers and the FRI [Forest Resources Inventory] and then trying to find stands and then ground treating them to see if what you think is there is actually old.

Participant 5 emphasized the importance of using GIS analysis within the framework to enhance accessibility and engagement, stating:

> Get to a fairly robust point with desktop analysis and then… make it publicly accessible, so some bubbly maps of, you know, where we expect to find older forests, maybe go as far as to overlay the cadastral layer on that to show, so that when landowners are looking at such a map, they could say, 'oh, that's my back 40' [property].

While GIS was the most discussed recommendation, four participants highlighted a need for increased engagement through the use of incentives prior to conducting land surveying and GIS analysis. Participant 2 expanded on the importance of this approach, stating:

> Have a structure or a methodology for… once you have found those plots, how you will reach out to the landowners themselves, that's not always easy. How are you going to engage… because you can push landowners away, so having a clear strategy for that. Have some kind of incentive or some way of encouraging them [private landowners] to become engaged.

Among half of the participants, the need to develop the framework around increased education emerged as a recurring theme. Participants discussed education in various ways. Some emphasized that increasing education among woodlot owners is essential for the successful implementation of conservation efforts, as many landowners may lack the knowledge needed to identify old-growth forests. Conversely, one participant highlighted the importance of educating those responsible for training and conducting old-growth assessments.

A need for the framework to be structured surrounding the implementation of policy and regulation was highlighted by three participants. Participants identified the importance of aligning old-growth conservation efforts with broader provincial protection goals. Participant 4 suggested incorporating old-growth conservation into the Government of Nova Scotia's 20% by 2030 protected areas strategy, stating:

> In protecting 20% by 2030… old growth is a piece of that protection. We are starting to build a framework for the entire 20% protection. I don't know how to build the framework for the old growth, but I just think it's got to fit—we've got to tie all that together and make sure it fits in there.

Participant 8 recommended that the framework's structure should resemble "a 1-2 page [policy brief], including a clear definition of what it [old-growth] is, maybe include pictures of what you see it as being, so people can visualize it." A clearly defined definition of old-growth within the

context of private land was identified as a strong starting point for the framework to ensure that all private woodlot owners and stakeholders are operating under the same premise.

Community and stakeholder engagement was a recommendation highlighted by four participants. Participant 1 emphasized the importance of strengthening collaboration and communication between landowner organizations and individual landowners as a central goal of the framework's structure. Participant 3 discussed the potential for building a large old-growth forest conservation community where land stewards are connected surrounding the shared recognition of old-forests. Additionally, the inclusion of woodlot owners and stakeholders in the measuring and cataloging old-growth forests on private lands was highlighted by participants to increase woodlot owners' knowledge of old-growth identification as well as to increase overall engagement.

Of the then participants, two offered unique recommendations for the framework's structure. Participant 2 emphasized the importance of clearly defining the framework's objectives:

> Have a clear idea of what you are trying to achieve in finding those [old-growth forests on private lands], whether it is the quality of the old forest… underrepresented types of old forests in certain ecodistricts, whether you are looking for areas that are important for connectivity, or species at risk that are using those areas. I think having a really clear list of priorities would be part of the framework. As there are 30,000 private landowners… you're going to have to hone in on the ones [priorities] that you really want."

Participant 3 recommended that the structure of the framework should include the accounting of co-benefits such as ecosystem services, carbon sequestration, stating: "If we are talking about a larger tract of land, under some kind of voluntary stewardship agreement or conservation easement, just to get into the permanence or longer-term stewardship intention."

Overall, participants provided insightful recommendations on structuring the framework to effectively account for old-growth conservation efforts on private lands in Nova Scotia. The themes that emerged from the interviews emphasize the need for the framework to be multifaceted and inclusive of diverse perspectives while maintaining a clear and well-defined purpose.

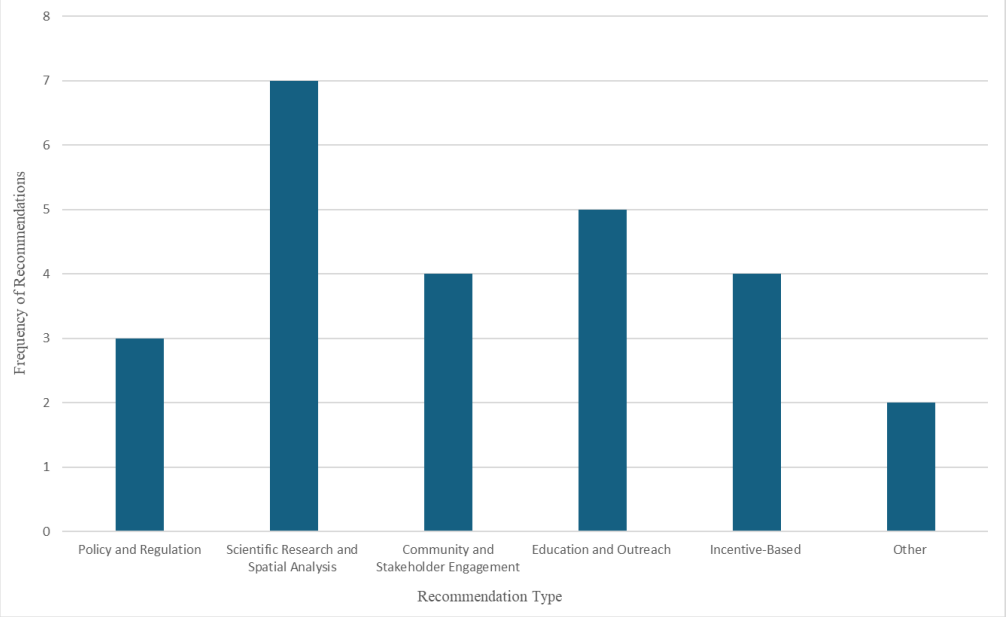

Figure 4. Interviewees' Recommendations for Structuring the Old-Growth Forest Conservation Framework. Bar graph depicting interviewees' responses to the question, "Section 6.0 of the policy outlines the need for developing a framework and criteria for old-growth forest conservation accounting on private land. How should this framework be structured?" The Y-axis represents the number of times each recommendation occurred, and the X-axis shows the grouped recommendations.

What criteria do you believe are essential for accounting for effective conservation and stewardship of old-growth forest areas on private land?

Despite participants being forthcoming with their responses to all questions, many found this particular question challenging due to its theoretical and open-ended nature. Due to time constraints, only seven of the ten participants were asked this question. Of those seven, two provided empirical recommendations for accounting for conservation efforts on private lands in

Nova Scotia. Participant 2 discussed carbon sequestration and the potential for an area to possess ecological significance and old-growth attributes as two essential criteria for accounting, stating:

> We should account for ones that store more carbon, because that might be something that can support the whole thing…One's that score the most highly, one's that are truly old forests. But also because it is private land, there is real scope to add more. So if there are ones that show great potential, I would say those [should be accounted]. I would say the landscape connectivity pinch points would be an area. The ones to count, and this is a really hard one, are the ones that have the most potential for not falling out of the system. So if you have got landowners that are more keen to sign a legal easement, you know, I think if you can protect them that's your highest level of old forest conservation…Some form of commitment.

Conversely, participant 4 identified an area-based accounting system, stating:

> The hard, quantifiable measurement to me, is area based. So hectares going in as old-growth and are monitored overtime to ensure that hectares are maintained and the activities that are not allowed are not occurring. So that could be on the group, satellite, change detection, whatever, someway to verify that that activity is properly being managed. So I think that is one easy way to measure. The hard one is managing potential old growth coming in.

Three participants highlighted the need to revise the age requirements and methodology of conservation accounting to better accommodate private landowners. Participant 4 stated:

> But when I looked at late successional or old growth in the past on private land, [the criteria] was, age, lack of harvest, just like the old-growth policy, lack of harvesting in x number of years in the past, so, you know, it's, you know, in the last 15 or 20 years, there was no harvest there. Now you can qualify for late successional or old-growth. Maybe it doesn't have to be that. Maybe someone wants to have potential, and we can tighten those numbers up a little bit.

Similarly, Participant 5 expressed frustration with the rigid qualifications for conservation in the province and emphasized the need to lower the criteria so that existing conservation efforts can be recognized:

> If we are nickel and diming on what qualifies as stewardship or conservation, then I think we are missing the point a little bit. And so I get frustrated when, for example, a tool that is used to account for conservation filters out some valuable applicants because they have missed a particular criteria by four percent, or whatever. And so that's what I will say at the very high level that that's where I am coming from is that

> we need to relax some of these criteria a little bit so that we can start accounting for the good work and the conservation that private landowners are doing…Maybe relax the age requirements.

Participant 5 additionally expressed concern about modifying the criteria, emphasizing the importance of measuring age:

> I don't know I'm thinking about I'm thinking of a conservation of biodiversity here and I don't know what never have a good way to measure biodiversity, but I think if you don't measure age, I'm not sure what else, like, age is a key criteria is about offer all growth, right? And we've got thresholds for old growth in a province. So I'd have a hard time thinking about age to be kicked out and then long term measurement of that spatial area that doesn't get changed, right, maintain that natural disturbance or a natural pattern.

In response to this question, Participant 7 identified that there is a need for better identification and mapping of potential old forests on private land in Nova Scotia using permanent sample plot system (PSPs) and more effective strategies for engaging private landowners in conservation efforts, stating:

> It would be interesting and I'm sure maybe somebody has run through the exercise of identifying uh through either the permanent sample plot system or through LiDAR based on mapping of potential old forest on private land as well as crown land, Crownland definitely been done. but uh but private land, I'm not sure where that stands right now and… maybe you could fill me in a little bit later on that, but uh um you know, that that would be a good step and then having that information available do they guide landowners, but even just I don't think the traditional mechanisms of field days and um you know, pamphlets and stuff like that that doesn't seem to be effective in reaching more than the seven or eight percent of landowners that are already really engaged in knowing more about their forest land, you know, you've got lots of absentee landowners. We've got, you know, industrial private users of forest land. We've got people that are investment groups from around the world that are investing in private forest land in Nova Scotia that have no clue about old forest attributes or other societal values. So getting that sort of information to them, I think takes a little bit more direct effort than that and providing them with that direct business case of why they should care about old forest on their land in Nova Scotia as compared to, you know, that investment in timber first or carbon credits or whatever the reason that they're purchasing that land in the first place, development or off grid homesteads.

When asked to further consider conservation accounting on private lands as a systematic way to measure old-growth forest conservation efforts, Participant 7 expanded on their previous statement, stating:

> Yeah, I appreciate the idea around that [conservation accounting] and it probably, you know, is very similar to the Indigenous concern around traditional uses and things like that…I'm often an advocate of…the traditional hands-off type [of] conservation…in Old forest and, you know, similar sorts of systems. So, you know, we walk away from or we say, this is hands off, we've protected it. Well, is that really useful to future generations or is that the right thing to be doing in the face of significant climate change threats, whether that be windthrow or whether it be invasive species, Hemlock Woolly Adelgid, things like that. Like, um, those are all perfectly valid reasons for intervening in old forests that should also be recognized on private and crown land. So um, as restoration opportunities.

Participant 10 uniquely identified the need for a centralized management plan to facilitate conservation accounting and described how such a system could be implemented:

> I've always thought if we had some sort of centralized management plan that actually inventories what they have, but you would have to be careful who sees that because you have a lot of people that would be reluctant to share their inventory data if everyone could see it…you know,[for example, you] have a company coming in and say, oh, look at all the mature wood they have here, [I] will go approach them about it or something. But so if we had a way to, you know, have restricted access so that you could account for it somehow. [But] it would need to be in some sort of management plan that was signed off by then. So, you know, do you account for old growth attributes? … If the woodlot owner says yes, then okay, sign them up and we can account for it, and then maybe we make estimates for other people.

Overall, participants identified various criteria for accounting for conservation and stewardship of old-growth forests on private land. Some emphasized ecological factors such as carbon sequestration, and old-growth attributes, while others highlighted the need for an area-based accounting system to track conservation over time. Several participants expressed concerns about rigid age requirements, advocating for more flexible criteria to better support private landowners. Others stressed the importance of mapping and inventorying potential old

forests, with one participant proposing a centralized management plan with restricted access to protect sensitive landowner data.

What incentives or support mechanisms do you think would be most effective in promoting old-growth forest management practices among private landowners?

The majority of participants expressed that financial incentives would be the most effective approach to promoting old-growth forest management practices among private woodlot owners. Before discussing incentives, two participants acknowledged the diverse motivations of private woodlot owners, ranging from financial considerations to environmental stewardship, and emphasized that incentives and support mechanisms should align with these motivations. For instance, participant 4 stated, "Some people are going to do it [conserve their land] because they want to do it and then the other half are very all financial. So they want to see some incentives to do it." Additionally, participant 4 expanded on this, stating, "When it comes to small landowners, what we hear is tax breaks or financial incentives, money. If I have a small piece of property, I have it for a reason, I have it for when my daughter graduates, or for retiring."

As previously noted, A clear theme of the need for financial incentives was identified by participants. Participant 8 highlighted tax breaks as a method of acknowledgment for the landowners work to conserve their land, stating:

> I think a tax incentive of some sort…that's what we've talked about in our groups, some sort of a pat on the back, right? Because for forest to get to this stage, the landowners have obviously done something right. So, I don't know if it's a tax break, perhaps, or financial recognition, or I'm not sure exactly what you call it. I don't know if you go as far as going through silviculture, if we selection harvest an area, and we get compensated for it. Well, maybe it's something like that where you have an old-growth stand, you send in a shape file and there is a certain amount of area that you get paid for to keep it and conserve it."

Participant 10 expanded on the discussion of tax breaks as incentives, stating, "Access to the Carbon Market would be one [an incentive], but I realize that is difficult… Maybe,

potentially, some municipal tax breaks. I know if you're a registered firm, your tax rate is zero. Forestry is 25 cents an acre. So perhaps if you have a zero tax rate, you know, it's not a lot, but it would at least be recognized."

Participant 10 additionally identified capital gain tax exemptions as a potential incentive for private woodlot owners, stating:

> I always bring up the issue of capital gains exemptions. That is a federal government issue, but, you know, I see farmers can have up to a million dollars of capital gains exemptions when they sell property and all that kind of stuff, but I think if you are willing to conserve a part of your woodlot in old-growth and follow some rules, then maybe you should get some benefit elsewhere. Say, in an area that you're doing some high production forestry and you are harvesting, how about you have a capital gains exemption on the harvest? If you are willing to contribute some [land] to the protected area or conservation…if you can have some sort of financial incentive, I know that's top. Old-growth provides so many other ecological benefits, but if you can somehow monetize it a little bit…

Two participants discussed alternative financial incentives. Participant 1 identified the potential for the increase in acquisition as an incentive for landowners, stating:

> Acquisition is an option if some landowners are interested in selling their property, does it need to go back to the Crown? Maybe it's better if it is held by a trust, that could be another type of incentive. Another thing is most of the land trusts have access to the federal ecological gifts program, which is when you place an easement on your property, you then get a tax receipt for the amount that the property value has been reduced by because you've made these commitments that have restrictions.

Participant 5 discussed acquisition as a well as the introduction of carbon offset programs as a method to incentivize, stating, "The existing ones [incentives] would typically be some kind of nature conservancy, someone's found the money to pay to buy your woodlot and you want to protect it…So that's one option people have. Another option is people can try and get into carbon offset schemes and get aid for not cutting wood and managing it to a carbon offset program."

Many participants also identified the importance of support mechanisms catered to increasing landowner awareness as effective. Participant 2 stated:

> I'd say one raising awareness, uh making them actually think about old forests and knowing what old forests are and recognizing them if they have them so that they can tell us, [be]cause it's hard to reach everybody ourselves. And as a part of that, increasing the level of pride of owning a patch of old forest instead of seeing it as an impediment, um and encouraging them to leave it as a tip for nature.

This participant identified a unique concept —a 'tip for nature'—suggesting that preserving old-growth forests is a form of giving back to the environment. For example, if a landowner owns 100 acres that include old forest, they might choose to leave that portion untouched rather than harvesting it, much like leaving a tip at a restaurant.

Participant 7 highlighted the potential desire for an increase in education on old-growth as an incentive for woodlot owners to conserve their lands:

> There is probably all kinds of people amongst the conservation groups… and Indigenous groups in the province that would love to have old-growth training and some staff funding to take some of the onus and burden off of NSDNR or other people that are trying to identify and conserve old forests on private land.

Similarly, Participant 5 emphasized a shift away from financial incentives, towards providing management plans and guidance for landowners, stating: "I think, like not paying a landowner, but [rather] giving them the management, basically. And then helping them make better decisions."

Participant 3 expressed concerns regarding the effectiveness of incentives while identifying the importance of landowner engagement, stating, "I don't know if anything is terribly effective right now. I think the one-on-one engagement and confirming for landowners that what they've suspected is true [their stand is valuable by the provincial standard], that seems to be a really effective approach."

Some participants suggested that incentives should go beyond traditional financial options or education and instead focus on encouragement, celebration, and recognition. For instance, participant 5 stated:

> I think these people will want some financial incentives through their taxes, but I think there is something to be said for celebration. I think some kind of award, or some kind or like categories of each level of protection, you know, X, Y, & Z [has been] done and sort of celebrating that publicly would be another good attempt or good incentive. I think people want to protect the environment. I really think they do. I think they want to be thanked for it, and I think they want to be paid for it.

Overall, participants identified a range of incentives and support mechanisms that could encourage private landowners to conserve old-growth forests. While financial incentives, such as tax breaks, capital gains exemptions, and carbon offset programs, were most discussed, participants also highlighted the importance of alternative approaches. These included land acquisition programs, management support, and increased access to education and training.

How do you envision the role of private landowners in the future of old-growth forest conservation in the province?

All participants expressed optimistic statements regarding the role of private landowners in the future of old-growth conservation. Many participants expressed the importance of private land conservation, while using verbiage such as ‘huge’ and ‘instrumental.’ For instance, participant 1 stated, “I think they have a huge role to play. As we kind of eat up a lot of the Crown land within the triad and it’s getting zoned, you know, there is going to be a need to amass private woodlots to help contribute to protected area goals.” Participant 3 expressed appreciation for private woodlot owners and their potential increased role in conservation stating, “I think communities have a lot to give really, [there is] a lot of concern and care for the land by private landowners. So I think that they could have a large role to play in conserving those ecosystems.” Similarly, Participant 5 stated:

> I think these types of private landowners who have old growth or older trees on their property are going to be instrumental in protecting biodiversity in Nova Scotia. There's more land in their lands than in the public [Crown Land], they for the most part, have generations and generations of appreciation for their land. They know how to manage it. They want to be recognized. Yeah, I think these woodlot owners are huge.

A common theme identified by two participants is an expected dependence on private woodlot owners to achieve conservation goals. For example, participant 9 strongly stated, "I think we're going to have to rely on them." Similarly, Participant 1 emphasized the importance of supporting adaptive management strategies on private lands, particularly in response to the threat of Hemlock Woolly Adelgid (HWA):

> I think the support for adaptive management related to HWA [Hemlock Woolly Adelgid] is extremely important on private lands over the next 10 years because if we don't support more efforts to conserve Hemlock forests, we are not going to have much old-growth left on private [land].

This reliance on private woodlot owners highlights the need to shift conservation efforts across Nova Scotia, as a significant portion of old-growth and ecologically valuable forests exist outside of Crown land and protected areas. Whether addressing the spread of HWA or ensuring long-term forest conservation, participants emphasized the need for greater reliance on private landowners through increased engagement in conservation efforts.

Three participants identified the role of private landowners in conservation efforts is dependent on government action and the creation of supports to increase their engagement. Participant 2 expressed the necessity for government guidance, stating, "It [the role of private landowners] depends on what we do. I think, you know, they could do a lot or they could do nothing depending on what the government and woodlot owner management organizations do." Participant 8 highlighted the need for increased clarity of what old-growth is amongst the government and private woodlot owners as their role in old-growth conservation increases.

Stating, “I think it’s huge. Because there are so many private landowners…. But I truly believe that landowners need a definition [of Old-growth].” Participant 7 identified the need for flexibility when government agencies are working with private woodlot owners, stating, “We just have to maintain some flexibility overall on how we implement and how we identify and conserve it on private land.” Participants overall, identified that the future role of private woodlot owners is instrumental to conservation efforts; however, it is dependent on government guidance.

CHAPTER 5

DISCUSSION

This section will explore overarching themes in the research results that highlight gaps in the accounting of old-growth forests across the province and provide recommendations to address these issues, close the gaps, and respond to the concerns raised. Additionally, this section will explore further recommendations for the creation and implementation of a framework to effectively account for old-growth conservation efforts on private lands in Nova Scotia.

Challenges and Opportunities in Private Land Conservation

A central focus of this research was understanding how a structured framework for tracking conservation efforts on private land could improve the province's old-growth records while supporting both ecological conservation and private landowner rights. The results from the interviews suggest that significant barriers to old-growth conservation on private lands stem from the province's ownership landscape, having 63% of land owned privately. Specifically, the predominance of private land ownership has contributed to a lack of engagement in conservation efforts and limited awareness among landowners regarding the ecological value of old-growth forests.

Participants highlighted the fragmented ownership landscape as a significant challenge to conservation efforts, noting the prevalence of numerous small woodlot owners, each holding parcels of land smaller than 100 acres, compared to larger woodlot owners in the province. They emphasized the difficulty of engaging a diverse group of landowners with varying needs and priorities, identifying this lack of consensus as a fundamental obstacle to advancing conservation efforts.

Landowner engagement across Nova Scotia was identified as a significant barrier to conservation, as efforts cannot be successful without the willingness of landowners to participate. Participants described private woodlot owners as ‘disengaged’ in terms of their involvement with conservation organizations, such as woodland trusts. Many attributed this lack of engagement to a broader issue of limited education and awareness about conservation programs and their benefits. Interview findings indicate that many private landowners are unaware of available conservation programs as well as hesitant to participate due to concerns over regulatory restrictions, financial implications, and potential limitations on land use. The absence of clear incentives or support mechanisms further discourages voluntary conservation efforts.

As a result of the social implications of private land ownership across the province, participants highlighted the lack of government regulation on private lands as a persistent challenge. The combined influence of the fragmented ownership landscape, limited education, and low engagement among landowners creates significant barriers to government intervention and collaboration. Participants noted that because the government cannot act on land that is not owned by the Crown, there is reduced awareness and, consequently, limited education on conservation issues. This creates a cycle in which a lack of knowledge and engagement perpetuates inaction, hindering progress in conservation efforts on private land.

The results from the interviews, outlining private land conservation barriers, indicate the potential opportunity to bridge the gap between private woodlot owners and the government and private land organizations. Participants identified policy changes, increased education and awareness, and financial incentives as essential mechanisms for fostering collaboration and

landowner engagement. By implementing these strategies, the government can work more effectively with landowners to account for and support conservation efforts on private land.

Results suggest that prior to taking action, private landowner motivations must be considered. This finding supports previous research on the complexities of private land ownership and the importance of considering their motivations for their participation in conservation efforts. For example, Finley and Kittredge's (2006) study explored how private forest landowners conceptualize and practice forest management, highlighting the diverse perspectives and approaches that shape decision-making and involvement within management plans. The understanding of each different type of landowner was critical to their understanding to the barriers of entry to the chapter 61 current-use tax program, as through understanding the difference in landowners, they could understand why people who valued the environment over financials did not desire in harvesting, while others motivated by the appreciative values of their forest are not receptive as they believe the program limits their privacy.

Participants identified the importance of understanding landowner motivations as this knowledge will serve as a guide to address the feasibility and how much the incentives and support mechanisms will actually assist in the government accounting for conservation efforts occurring on private lands in Nova Scotia. Financial incentives were widely recognized by participants as the most effective method for engaging landowners in conservation efforts, as they provide direct economic support, unlike other mechanisms such as awards. It is important to note that the main reasoning behind financial incentives as effective mechanisms is due to the financial barriers private landowners face in Nova Scotia. Many participants expressed that landowners are hesitant to engage in conservation efforts as their land supports them economically. Many landowners fear that if the government were to identify old-growth forests

on their property, strict regulations could limit their ability to generate income from the land. To address these concerns, participants highlighted financial mechanisms such as tax breaks, capital gains exemptions, and carbon credits as potential strategies to increase landowner engagement while mitigating financial risks.

Some participants noted that while financial benefits may initially attract interest, long-term engagement requires additional governmental support, such as assistance in identification of old-growth, access to forestry professionals, and clear education regarding the ecological significance of old-growth, current policies, and conservation programs across Nova Scotia. The results suggest that land acquisition programs, management support, and increased access to education and training would be effective mechanisms to increase private landowners' engagement with conservation efforts.

Participants identified education as a necessary component to increasing landowner engagement in conservation efforts. It was identified that many landowners lack the knowledge needed to identify old-growth forests on their land, and there is a broader gap in understanding the ecological significance of these ecosystems. Even when landowners recognize the value of conservation and desire to manage their land sustainably, they often face barriers such as limited access to resources and difficulty navigating existing conservation programs. Participants emphasized the need for a clear and adaptable definition of old-growth that aligns with private land conservation. Additionally, access to forestry professionals or government workers with expertise in land surveying and old-growth identification was highlighted as a critical support mechanism. Many landowners simply do not have the knowledge or resources to conduct these surveys independently. Providing guidance and assistance help landowners in identifying old-growth located on their properties and increasing their willingness to participate in conservation

initiatives, while supporting government initiatives of systematically accounting the amount of old-growth located on private lands.

Implications of the Results

The research for this thesis provides insights into conservation accounting on private lands, as a systematic way to measure the amount of old-growth that is in Nova Scotia. The results suggest that there is a clear need for a framework to account for old-growth conservation occurring on private-lands in Nova Scotia. It has been made apparent that significant gaps persist between private landowners and the provincial government, contributing both to the government's lack of knowledge regarding the extent of old-growth forests in Nova Scotia and to landowners' distrust or reluctance toward conservation efforts. These gaps stem from unclear communication, limited government outreach, and a lack of incentives or support mechanisms that align with landowners' values and economic realities.

After hearing directly from working professionals within the fields of forestry, environmental management, and conservation biology across Nova Scotia, and hearing of clear obstacles and gaps as well as recommendations for their resolution, it is evident that more research in this field is imperative. Participants highlighted the potential of private land conservation not only to support ecological goals but also to foster stronger collaboration between the Crown and private landowners. The emerging nature of private land conservation in Nova Scotia presents an opportunity for further research, particularly in understanding landowner motivations, the effectiveness of incentives, and the long-term sustainability of private land conservation efforts.

Future research within the field of conservation accounting should focus on the ways in which conservation policies can encapsulate landowner motivations and economic

considerations, and the provincial government's ecological priorities. Strengthening partnerships between policymakers, conservation organizations, and private landowners through ongoing discussion and trust-building initiatives will be essential to bridging the existing gaps and ensuring the accounting of old-growth forests in Nova Scotia.

CHAPTER 6

FRAMEWORK RECOMENDATIONS

This section of the discussion will outline my recommendations for a conservation accounting framework designed to help the government systematically measure the amount of old-growth forest in Nova Scotia while also addressing the needs and interests of private landowners.

Purpose & Objectives

This framework seeks to provide the government with recommendations regarding the systematic measurement of the extent of old-growth that exists within Nova Scotia to implement conservation efforts to reach conservation and protection goals. Additionally, it aims to bridge the gap between the government and private landowners while increasing private landowner's awareness of the ecological importance of private land conservation.

The objectives of this framework are to:

- Re-define old-growth forests to encompass private land conservation.
- Pose recommendations for the identification and accounting old-growth forests on private lands.
- Encourage private landowner participation in conservation efforts.
- Strengthen collaboration between private landowners and the provincial government.
- Provide financial, technical, and educational support to landowners engaging in conservation.

Establish a Definition of Old-Growth that encapsulates Private Land

As previously mentioned, In Nova Scotia, the Department of Natural Resources and Renewables defines old-growth forests as late-successional forest ecosystems that develop over long periods of time (Nova Scotia Department of Natural Resources and Renewables, 2022). In

addition to meeting age requirements, old-growth forests must be characterized by low to moderate disturbance, followed by significant periods of ecological continuity—defined as an extended, uninterrupted presence of natural forest dynamics (Nova Scotia Department of Natural Resources and Renewables, 2022).

While the current definition has proved sufficient for the conservation of old-growth ecosystems on Crown lands, its rigid age requirements and prohibition on harvesting present challenges for private woodlot owners who wish to conserve old-growth without forfeiting all economic gain. As demand for private land conservation grows, the definition of old-growth must be expanded to include private landowners. Strict age requirements exclude ecosystems with the potential to develop into old-growth. The definition should recognize these ecosystems as candidates for protection, as they will later provide ecological benefits.

Additionally, many landowners rely on their forests for economic sustainability. A complete ban on harvesting prohibits conservation efforts, as identifying old-growth on private land currently necessitates stopping all harvesting. The revised definition should incorporate selection silviculture, a method that allows for selective harvesting while maintaining and enhancing old-growth forest elements in managed stands.

Establish a Conservation Accounting System:

The results suggest that establishing a clear definition of what is to be ‘accounted for’ is essential to ensure that both the government and private landowners share a unified understanding of conservation accounting. First, forests that meet or are close to meeting the age requirements for old-growth classification must be identified, ensuring that both existing and emerging old-growth forests are properly recognized. Trees falling below age-requirements should not be overlooked, as they still provide significant ecological value. Results highlighted

that carbon storage potential is also crucial for accounting, with a focus on high-biomass tree species known for significant carbon sequestration, such as red spruce, white pine, and hemlock. Finally, results suggested an area-based method of accounting, measuring old-growth conservation in hectares, should be implemented as the most straightforward method for tracking conservation efforts over time. This criteria for accounting will provide both the government and private landowners with a clear definition of what is classified as old-growth or ecologically significant on private lands. Once outlined, these ecosystems can be systematically tracked, ensuring that landowner actions align with the broader goals of government-led conservation programs.

Data Collection and Monitoring

Results suggest that conservation accounting identification must be conducted through a voluntary process, where private landowners can report old-growth to the government for further identification and mapping. From there, the government can use remote sensing technologies, such as satellite imagery and LiDAR mapping, alongside on-the-ground surveys conducted by forestry professionals from the Nova Scotia Department of Natural Resources. Results suggest the use of GIS mapping to highlight where older forests are expected to be found and overlay the cadastral layer to show that old-growth persists across various private lands.

Landowner involvement in Data collection

It is imperative that private landowners are involved in data collection and old-growth identification on their lands. Increased education on old-growth identification would serve private landowners in being able to personally recognize old-growth characteristics on their property. Government-led workshops or training programs focused on old-growth identification would not only increase land-owner engagement in conservation efforts, it would also allow the

government to educate private landowners on the ecological importance of old-growth on private lands. A landowner-run self-reporting system for old-growth identification could be an interesting and effective method for the government to increase awareness. A digital platform, such as a website, where landowners can self-report and receive management guidance for their properties would reduce the amount of direct interaction between private landowners and the government, which could be a barrier for some landowners.

Develop Incentives to Encourage Participation

For the success of a conservation accounting framework, incentives and mechanisms to increase private landowner engagement are essential. This framework is dependent on a combination of financial, technical, and educational incentives to encourage private landowner participation and engage with conservation efforts.

Financial

As results indicated the effectiveness of financial incentives in increasing private landowner engagement, their use in the implication of conservation accounting efforts would be essential. Tax reductions, capital gains exemptions, and carbon offset programs were financial incentives identified by participants. In terms of conservation accounting, the largest issue is engagement and landowners who allow the government to survey their property for old-growth. As a result, to encourage private landowner participation in conservation efforts, it is recommended that landowners be compensated for allowing the government (or trusted ENGOs) to conduct old-growth surveys on their property. Additionally, if old-growth is identified on their land, the government could provide further incentives, such as an old-growth tax reduction. The tax reduction could be based on the size of the old-growth area, its carbon sequestration potential, or the length of time the forest has been maintained as old-growth. The creation of an

old-growth tax reduction would incentivize landowners who have identified old-growth on their property to actively conserve it and protect their ecological value.

Recognition

Results indicated that there was a need to use recognition as an incentive to increase private landowner engagement in conservation accounting efforts. When paired with financial incentives, such as monetary awards, recognizing landowners for their contributions to old-growth conservation could generate a ripple effect, encouraging others to seek similar recognition and engage more actively with conservation organizations like land trusts and the provincial government. For example, a monetary or non-monetary award for an 'Old-Growth Woodlot Owner of the Year' could motivate landowners to protect their old-growth forests for their ecological value, while also offering both recognition and financial support for their stewardship efforts.

The basis of this award would be to recognize and celebrate private landowners who are actively working towards conserving and protecting old-growth forests on their properties. Landowners would be categorized based on property size to ensure fair recognition is given. This award would be chosen by a selection committee of stakeholders, including representatives from the provincial government, conservation organizations, and forestry experts. Public input could also be incorporated through a nomination form to highlight private landowners' actions.

There could be a dedicated category within the award to recognize landowners who are actively implementing strategies to mitigate threats like Hemlock Woolly Adelgid (HWA). These efforts may include monitoring and treatment, public education, and collaboration with researchers or land trusts to support protection of old-growth hemlock stands.

Moving forward, recognition is imperative to incentivize private landowners to engage in old-growth conservation accounting efforts. Acknowledging the time and resources that landowners invest in stewardship validates their efforts and encourages other landowners to follow suit. Celebrating conservation through awards encourages environmental responsibility and instills pride in land stewardship. When combined with financial incentives and support from conservation organizations, recognition becomes a powerful incentive to driving long-term conservation accounting on private lands.

Technical and Educational Support

While financial incentives and recognition are essential to conservation accounting efforts, a need for technical and educational support has been identified. An increase in education is imperative. Educational initiatives could include government-led workshops, webinars, and field training sessions to teach landowners how to identify old-growth characteristics and understand their role in preserving these ecosystems. Additionally, creating resources such as guides, videos, and infographics on online social media platforms could assist landowners in navigating conservation programs and available incentives.

Technical support should also be offered, such as access to Department of Natural Resources forestry professionals who can assist with land surveys, old-growth assessments, and the development of management plans. Additionally, this research identifies the need for a more formal structure around old-growth forest field training workshops. Delivered by third-party organizations across Nova Scotia, workshops would strengthen conservation accounting practices by providing hands-on training to private landowners. By equipping landowners with the knowledge they need, the government can increase private woodlot owner participation and engagement.

Improving Government-Landowner Trust & Communication

An essential component of the success of conservation accounting is an increase in trust between the government and private landowners. This is needed throughout all steps of the implementation process. It is recommended that the Nova Scotia Department of Natural Resources,' Private Lands, Stewardship and Outreach Division place greater emphasis on enhancing existing outreach efforts and conservation frameworks for old-growth forests. This would entail expanding educational initiatives, strengthening partnerships with private landowners, increasing public awareness, and refining conservation frameworks to better protect and manage old-growth forests. Additionally, transparent, and flexible government policies are needed. The government can not be intensely rigid when working with private landowners to achieve conservation goals. It is imperative that landowners have opportunities to participate in conservation policy development and flexible conservation agreements are offered so that landowners maintain land-use rights.

Conclusion

This framework provides recommendations for structuring and implementing old-growth conservation accounting efforts across Nova Scotia, with the goal of balancing ecological preservation with the needs of private landowners. The recommendations emphasize the necessity for the government to redefine old-growth to include private land conservation, in order to increase the potential for old-growth areas to be conserved. The framework stresses the importance of involving private landowners in the identification, data collection, and management of old-growth forests.

Through a combination of financial incentives, such as tax reductions and carbon offset programs, along with technical and educational support, landowners will be incentivized to

contribute to conservation efforts. Additionally, establishing clear and consistent communication between landowners and the government, with dedicated support roles and flexible policies, is essential for building trust and long-term engagement in conservation efforts across Nova Scotia.

CHAPTER 7

CONCLUSION

This section will summarize research findings and discuss their implications for conservation accounting of old-growth forest ecosystems in Nova Scotia. It will reinforce the significance of interview findings, including gaps in conservation efforts and recommendations for future research and policy improvements.

Summary of Research

The goals of this research were to develop a deeper understanding of the current challenges associated with private land conservation accounting, to explore potential opportunities to address these barriers, and to create a framework for accounting and measuring conservation efforts on private land in Nova Scotia. The aim of this framework was to contribute to the provincial government's record of old-growth across the province and promote ecological conservation while maintaining private landowners' rights. This framework can serve as a preliminary document identifying the barriers of private land conservation, while highlighting for future research, the opportunities and importance of private land conservation to achieve provincial ecological targets.

The interviews identified both barriers to private land conservation as well as recommendations for increasing private landowners' engagement. Participants identified barriers including limited engagement, education, financial incentives, and a lack of trust between landowners and the government. Additionally, participants provided insights into strategies for overcoming these barriers and fostering stronger collaboration. Recommendations included expanding education and outreach efforts to increase awareness of conservation programs, enhancing financial incentives to make conservation more financially viable for landowners, and

establishing transparent communication to build trust between the government and private landowners. This research aimed to provide an understanding of existing challenges and opportunities regarding conservation accounting on private lands. It sought to underscore the ecological importance of private land conservation while emphasizing the need to strengthen relationships between landowners, the government, and conservation organizations to support effective long-term conservation efforts.

Final Conclusions

This research supports the idea that conservation accounting plays a critical role in bridging the knowledge gap between private landowners and the Nova Scotia Government and that a conservation accounting framework is imperative to the future of conservation efforts. Research findings reveal barriers to private land conservation in Nova Scotia. Addressing these challenges requires a deeper understanding of landowner motivations to identify their root causes. The research highlights opportunities for the government to collaborate with private landowners, ensuring their conservation accounting efforts are recognized, incentivized, and integrated into provincial strategies. Some opportunities for government involvement are relatively straightforward, requiring financial support for initiatives such as education and awareness campaigns, technical training, and volunteer-based accounting. Other opportunities, such as implementing tax incentives, will require more time and greater financial investment from the government to be successfully implemented.

As private land conservation becomes increasingly vital to achieving ecological goals, the need for a formal conservation accounting framework grows. Without a provincial mechanism to account for old-growth forests, these critical ecosystems risk being overlooked, leading to misaligned conservation planning and resource allocation across the province.

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APPENDIX

Interview Questions

1. Can you provide an overview of your experience with old-growth forest conservation in Nova Scotia?

[Follow-up question]:

2. What do you see as the biggest challenges in conserving old-growth forests on private land in Nova Scotia?
3. What role do you believe private landowners play in the conservation of old-growth forests compared to public lands?
4. Are you familiar with the "Old-Growth Policy for Nova Scotia" and its commitments regarding private land? If so, what are your thoughts on these commitments?
5. [Follow-up question, if familiar]:
6. As understood, section 6.0 of the policy outlines the need for developing a framework and criteria for old-growth forest conservation accounting on private land. How do you think this framework should be structured?
7. What criteria do you believe are essential for accounting for effective conservation and stewardship of old-growth forest areas on private land?
8. What incentives or support mechanisms do you think would be most effective in promoting old-growth forest management practices among private landowners?
9. How do you envision the role of private landowners in the future of old-growth forest conservation in the province?